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Demand-driven sales and operations planning: a framework proposal

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**Planejamento de vendas e operações dirigido pela demanda: proposta
para estruturação**

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DANIEL FERNANDO BOZUTTI

Demand-driven sales and operations planning: a framework proposal

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DANIEL FERNANDO BOZUTTI

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estruturação**

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*I dedicate this Ph.D. Thesis to my family
that has always been by my side.*

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*“The two most important days in your life
are the day you are born and the day you
find out why.”*

Mark Twain

ABSTRACT

BOZUTTI, D. F. **Demand-driven sales and operations planning: a framework proposal.** 339 p. Thesis (Ph.D.). University of São Paulo at São Carlos School of Engineering, São Carlos, 2020.

In a period of great technological advances and social and economic changes, the competitive environment is challenging for companies, which requires them to take actions towards flexibility, collaboration, integration, agility, velocity, traceability and cost-effective operations and supply chains. Both scholars and practitioners are employing the term Demand-Driven (DD) to characterize companies able to respond to these dynamic characteristics. Additionally, a critical process which has the aim of matching the supply with the demand is the Sales and Operations Planning (S&OP) and this process requires an updated understanding and the necessity of changes considering the new competitiveness environment, which also requires customer centricity and being driven by demand. Based on this, this thesis had the objective of proposing a framework for the Demand-Driven Sales and Operations Planning (DDS&OP). To achieve this objective two systematics literature (SLR) reviews were conducted, one for DD phenomenon and other for S&OP process. Based on both SLRs, the framework for the DDS&OP was proposed and it was modelled in BPMN. The framework considered three perspectives (strategic, tactical and operational) and the governance of the process. The framework was validated with 17 experts from different areas (scholars and practitioners from different industries) through the Fuzzy-Delphi Method. The main result of the thesis was a framework for the DDS&OP proposed upon a robust theoretical method and validated by experts. Other results were: a common definition for the DD phenomenon presented, a structuring and unifying conceptual framework for the DD phenomenon, the necessity of expansion of both vertical and horizontal consistencies for the S&OP and a list of 20 approaches that should be considered in the S&OP process for the new competitiveness environment.

Keywords: Sales and Operations Planning. Demand-Driven. Supply Chain Management. Fuzzy-Delphi Method. Production Planning and Control.

RESUMO

BOZUTTI, D. F. **Planejamento de vendas e operações dirigido pela demanda: proposta para estruturação.** 339 p. Tese (Doutorado). Escola de Engenharia de São Carlos – Universidade de São Paulo, São Carlos, 2020.

Em um período de grandes avanços tecnológicos e mudanças econômicas e sociais, o ambiente competitivo está mudando para as empresas, o qual gera a necessidade de tomada de decisões que considerem flexibilidade, colaboração, integração, agilidade, velocidade, rastreabilidade e eficiência em custos nas operações e em cadeias de suprimentos. Tanto os acadêmicos como os praticantes estão utilizando o termo Dirigido pela Demanda (*Demand-Driven* – DD) para caracterizar as empresas que estão aptas a responder a essas características dinâmicas. Adicionalmente, um processo crítico que tem o objetivo de casar o suprimento com a demanda é o Planejamento de Vendas e Operações (*Sales and Operations Planning* – S&OP) e esse processo necessita de um entendimento atualizado e a necessidade de mudanças considerando o novo ambiente competitivo, que inclusive exige foco no cliente e ser dirigido pela demanda. Baseado nessa apresentação, essa tese teve o objetivo de propor um modelo estruturante para o Planejamento de Vendas e Operações Dirigido pela Demanda (*Demand-Driven Sales and Operations Planning* – DDS&OP). Para atingir esse objetivo duas revisões bibliográficas sistemáticas foram conduzidas, uma para o fenômeno DD e outra para o processo de S&OP. Com base em ambas as revisões bibliográficas sistemáticas, foi proposto um modelo estruturante para o DDS&OP, sendo ele modelado em BPMN. O modelo estruturante considerou três perspectivas (estratégica, tática e operacional) e a governança do processo. O modelo estruturante, então, foi validado por 17 especialistas de diferentes áreas (acadêmicos e praticantes de diferentes indústrias) através do método Fuzzy-Delphi. O principal resultado da tese foi um modelo estruturante para o S&OP validado por especialista, considerando um método robusto. Outros resultados foram: uma definição comum para o fenômeno DD, um modelo conceitual estruturante para o fenômeno DD, a necessidade de expansão das consistências vertical e horizontal do S&OP e uma lista de 20 abordagens que devem ser consideradas no processo de S&OP para o novo ambiente competitivo.

Palavras-chave: Planejamento de Vendas e Operações. *Demand-Driven*. Gestão da Cadeia de Suprimentos. Método *Fuzzy-Delphi*. Planejamento e Controle da Produção.

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Abbreviations and Acronyms List

3PL – third-party logistics
4PL – fourth-party logistics
ADC – average demand consumption
AHP – analytic hierarchy process
AI – artificial intelligence
APICS - American production and inventory control society
APP – aggregated production planning
APS – advanced planning and scheduling
ARP – automatic replenishment program
BI – business intelligence
BPMN – business process model and notation
CAD – computer-aided design
CAM – computer-assisted manufacturing
CPFR – collaborative planning, forecasting and replenishment
CRM – customer relationship management
CTP – capable-to-promise
DBA – dynamic buffer adjustment
DD – demand-driven
DDI – demand driven institute
DDMRP – demand-driven material requirement planning
DDS&OP – demand-driven sales and operations planning
DRP – distribution requirement planning
e-CRM – electronic customer relationship management
EAI – enterprise application integration
ECR – efficient customer response
EDI – electronic data interchange
EPCIS – electronic product code information system
ERP – enterprise resource planning
ESI – early supplier involvement
FCS – finite capacity scheduling
FMCG – fast-moving consumer goods
GSCF – global supply chain forum

Abbreviations and Acronyms List

IoT – internet of things
IT – information technology
KPI – key performance indicators
MES – manufacturing execution system
MRP – materials requirement planning
MRP-II – manufacturing resources planning
MTO – make-to-order
MTS – make-to-stock
POS – point-of-sale
PTX – private trading exchange
QR – quick response
RFId – radio frequency identification
ROI – return on investments
RQ1 – research question 1
RQ2 – research question 2
RQ3 – research question 3
RQ4 – research question 4
S&OP – sales and operations planning
SAP – a worldwide ERP provider
SCOR – supply chain operations reference
SOA – service-oriented architecture
SRM – supply relationship management
TOC – theory of constraints
VMI – vendor-managed inventory

SUMMARY

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This chapter has the aim of contextualizing the research theme, presenting the research questions and objectives, elucidating the research value and contributions and presenting the thesis' structure. Thus, this chapter is organized in five sections: Section 1.1 presenting the contextualization and research theme, Section 1.2 presenting the research questions and objective, Section 1.3 presenting the research value and contributions, Section 1.4 presenting a methodological release and, finally, Section 1.5 presenting the thesis' structure.

1.1 Contextualization

In the new business environment comprising several technological advances (e.g., Industry 4.0 and Artificial Intelligence (AI) advances) and social and economic changes all around the world, requires that companies be adaptative to a dynamic context. The traditional approaches to plan and control operations may not fit to this new market reality; today it is necessary to be closer to the customer by understanding deeply their needs and responding effectively to them, from the companies' strategy definition to operations, in an integrated and coherent way (BURROWS III, 2012). This integration becomes even more important in supply chains (MENDES; LEAL; THOMÉ, 2016) and it is an essential prerequisite to survive and to be competitive in the market (DREYER et al., 2010).

In this context, a new approach emerges in the literature: the Demand-Driven (DD) phenomenon. For DD companies, managers should develop and follow patterns of responses (CHATZOPOULOS et al., 2012) with the aim of fulfilling customers' orders and requirements in a timely manner, with quality, competitive price, at the required place and in the right ordered quantity (MENDES; LEAL; THOMÉ, 2016).

Gollamudi (2013, p.3) cites some characteristics of the DD environment, such as: (i) volatile market environments and fluctuating demand; (ii) specialized products; (iii) competition from low-cost production facilities; and (iv) external focus.

Some elements must be integrated and considered to understand the costumer and achieve the market goals in this new supply chain environment (AMBE; BADENHORST-WEISS, 2011; BJARTNES et al., 2008; DREYER et al., 2010; VERDOUW et al., 2010):

- ✓ Control processes defined;
- ✓ Integrated decision support tools and methods integrated;
- ✓ Roles clear and defined;

- ✓ Collaboration models applied;
- ✓ Performance measurement;
- ✓ Enabled information and communication technology.

In this sense, the DD phenomenon requires DD supply chains, which can be defined as “a system of coordinated technologies and processes that senses and reacts to real-time demand signals across a network of customers, suppliers and employees” (BUDD; KNIZEK; TEVELSON, 2012, p.3).

The DD phenomenon requires companies to be flexible. Hadaya and Cassivi (2007) consider five types of flexibility necessities for this new environment:

- ✓ **Volume flexibility:** ability to adjust production to capacity;
- ✓ **Launch flexibility:** ability to introduce new products in a rapid and effective manner;
- ✓ **Access flexibility:** ability to cover the distribution network;
- ✓ **Product flexibility:** ability to produce different products with different characteristics; and
- ✓ **Responsiveness to target market(s):** ability to respond the needs of the target markets.

Budd, Knizek and Tevelson (2012) consider the importance of the information flow in the DD phenomenon, thus, they define a DD supply chain as the supply chain that has the capacity to share real-time information with the supply chain’s participants. This ability creates to the supply chain’s participants the capacity of reacting rapidly and effectively to unexpected changes.

Thus, the processes should be developed and should be able to respond effectively to this new phenomenon. One critical process that matches the demand with supply is the Sales and Operations Planning (S&OP). This process has the aim of balancing demand, production, distribution, procurement and finance to ensure the plans and performance are aligned to support the business strategic plan (APICS, 2016; FENG; D’AMOURS; BEAUREGARD, 2008). APICS (2016, p.164), defines S&OP as “a process to develop tactical plans that provide management the ability to strategically direct its business to achieve competitive advantage on a continuous basis by integrating customer-focused marketing plans for new and existing products with the management of 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”. The S&OP process is traditionally divided in five steps (APICS, 2006;

SCHNEIDER, 2013a; WALLACE; STAHL, 2008): (i) run sales forecasts reports, (ii) demand planning, (iii) supply planning, (iv) pre S&OP meeting, and (v) executive S&OP meeting. The S&OP should provide vertical and horizontal integration; vertical integration is related to the alignment among strategic, tactical and operational perspectives and horizontal integration is related to the cross-functional integration among the company's areas (KATHURIA; JOSHI; PORTH, 2007).

With the aim of improving this traditional process, that has its origins in the 1950's (SINGHAL; SINGHAL, 2007), many studies have been conducted to understand how S&OP can support this new scenario and its necessities (this will be detailed in Chapter 3). Such studies considered the S&OP process itself, information system assessment, influences on performance, organizational issues and the relationship with the supply chain management. Nonetheless, by the two systematic literature reviews conducted in this research, it was perceived a necessity to formalize a framework to the new S&OP trends, that is named as Demand-Driven Sales and Operations Planning (DDS&OP).

1.2 Research Problems and Objectives

To define the research problems and objectives, two systematic literature reviews were carried out: one for the DD phenomenon and other for the S&OP. The results and procedures adopted in each systematic literature review are presented in Chapter 2 and Chapter 3, i.e., Chapter 2 presenting the DD phenomenon and Chapter 3 presenting the S&OP findings.

Considering the systematic literature review for the DD phenomenon, it was perceived a lack of a systematic literature review for this phenomenon and a lack of an organizing conceptual framework to map the state of the art and to create a common language in this field. In this sense, two first research questions of this thesis were defined:

Research Question 1 (RQ1): What are the main characteristics (definition, processes, technologies and systems and approaches) of the DD phenomenon?

Research Question 2 (RQ2): How can the concepts of the DD phenomenon be organized in a conceptual framework?

On the other hand, considering the systematic literature review conducted for S&OP, it was perceived that many studies have been performed to understand how S&OP can support the new competitive scenario (complex, turbulent and volatile) and its necessities. Such studies

considered the S&OP process itself, information system assessment, influences on performance, organizational issues and the relationship with the supply chain management, as it will be detailed in the Chapter 3. Nonetheless, there is a lack of an updated systematic literature review that provides a holistic view of the necessities for the S&OP in this new turbulent, complex and volatile competitiveness environment. The latest systematic literature review about S&OP, with similar objectives, was conducted by Thomé et al. (2012); a more recent literature review was provided by Kristensen and Jonsson (2018), notwithstanding a future research agenda was provided, the paper was focused on a context-based analysis and not in the process itself. In this sense, one more research question for this thesis was defined:

Research Question 3 (RQ3): What are the characteristics, approaches, frameworks and models for the Sales and Operations Planning considering the new business environment requirements of flexibility, responsivity, adaptability, visibility, velocity, agility, demand variability, demand variety and customer centricity?

By comparing and analysing the two systematic literature reviews conducted, it was concluded that the new characteristics for the S&OP match with the characteristics of the DD phenomenon. Thus, the new S&OP can be named as DDS&OP (Demand-Driven Sales and Operations Planning). In this sense, the last research question for this thesis was defined:

Research Question 4 (RQ4): How can the concepts of the DD phenomenon and new characteristics and requirements for the S&OP be organized in a DDS&OP framework?

By considering these research questions and to answer them, the general objective of this thesis was:

To propose a framework for the Demand-Driven Sales and Operations Planning.

This general objective can be decoupled in the following specific objectives:

- ✓ Characterize and discuss the DD phenomenon, considering technologies, processes, research problems and future researches;

- ✓ Identify and compare how scholars and practitioners deal with the DD phenomenon;
- ✓ Propose an organizing conceptual framework for the DD phenomenon;
- ✓ Identify and discuss new necessities for the S&OP process based on competitiveness dimensions defined in the RQ3 and provide conceptual directions for the S&OP process improvement;
- ✓ Find the agreement level of DDS&OP framework among the experts (scholars and practitioners), considering the Fuzzy-Delphi method.

1.3 Research Value and Contributions

Considering the DD phenomenon systematic literature review conducted, it was found an increased interest about the theme by both scholars and practitioners, as can be analysed in Graphs 2.4 and 2.5 (in Chapter 2). The same was perceived with the results of the systematic literature review for the S&OP, as can be analysed in Graph 3.1 (in Chapter 3). Thus, the first contribution of this thesis is to provide new insights and updated data for these increased research trends.

Another contribution can be inferred by Graph 3.3 (in Chapter 3). In spite of the increased interest of the S&OP research theme, there is a great possibility of research considering the new competitive requirements. Thus, the research described and developed for this thesis comes to contribute with this research gap.

By analysing the proposed future researches for the DD phenomenon, detailed in Chart 2.12 (in Chapter 2), the research developed in this thesis is aligned with them. For instance, Hilletofth, Ericsson and Christopher (2009) consider the necessity to develop a framework that includes Product Development process for the DD environment, Bozutti and Esposto (2019) considered the necessity of a framework development for the S&OP process in the DD environment and Brown (2012), Jones and Clarke (2002), Li and Zuo (2011), Hao, Wu and Li (2012), Laksham (2013), Tinhnam (2006), Lo et al. (2005) and Ayers (2006) considered the necessity of empirical and practical findings to validate the explored concepts (that was reached by this thesis with the Fuzzy-Delphi method). Bvuchete, Grobbelaar and Van Eeden (2018), Asare, Brashear-Alejandro and Kang (2016) and Mohammadi and Mukhtar (2012) pointed the necessity of surveys to validate concepts of the DD phenomenon; in the case of

this thesis, it was not conducted a survey by its essence, but, with the Fuzzy-Delphi method, opinions of experts were collected, contributing partially with this gap.

By analysing the proposed future researches for the S&OP process, detailed in Chart 3.7 (in Chapter 3), the research developed in this thesis is also alligned with them. For instance, Tuomikangas and Kaipia (2014) pointed the necessity of expansion of the papers and research bases considered in their literature review (it was covered by this research). Noroozi and Wikner (2017), Kaipia et al. (2017), Swaim et al. (2016), Boone Ganesan and Hicks (2015), Ivert et al. (2015a), Lapide (2014a), Chase (2013), Walters (2008), Lapide (2005a) and Lapide (2005b) considered the necessity of empirical studies (the thesis contributed with the Fuzzy-Delphi method) and to understand about how data sharing can be shared in the S&OP meetings in order to improve the supply chain flexibility (the thesis contributed with the DDS&OP framework). Godsell, Birtwistle and Van Hoek (2010) and Wilson and Raman (2017) considered the necessity of surveys to improve the knowlodge of S&OP (partially contributed with this thesis) and to understand how financial planning and product development process can be considered in the S&OP process to obtain a more strategic allingment (contributed with the DDS&OP framework). Esper et al. (2010) considered the necessity to deep understand the participation of supply chain partners in the S&OP process, and this was convered in the proposed DDS&OP framework. Bozutti and Esposto (2019), Burrows III (2007), Burrows III (2012), Cecere (2012), Cecere, Barrett and Mooraj (2009), Gollamudi (2013), Kohler and Pukkila (2016), Li, Shakya and Owusu (2018), Payne (2015), Ptak and Smith (2018), Bower (2018), Kruse (2004), Lapide (2016), Lee (2013) and Suurmond (2016) considered the necessity to develop models and frameworks for the S&OP, and this necessity was covered by the proposed DDS&OP framework.

Beside these described contributions, this thesis provided two systematic literature reviews, making available the state-of-the-art of the theme.

Finally, it was proposed an organizing conceptual framework for the DD phenomenon and a framework for the DDS&OP (this last, validated by scholars' and practitioners' experts). Both frameworks were not found in the academic literature, thereby concluding the contributions of this thesis.

1.4 Methodological Release

Marconi and Lakatos (2017) cite that without the use of scientific methods, there is not science. Thus, the same authors consider the method as a set of systematic activities that

allows the researchers to conduct the research by formalizing the steps, mistakes and considerations. In this sense, the methodology has the aim of differentiating the science from the common sense (MARTINS, 2012a).

The objective of this section is to provide an overview of the methodological approach used to achieve the thesis' objectives. The details of the systematic literature review method used for the DD phenomenon and S&OP are detailed in Sections 2.1 and 3.1, respectively. The details of the Fuzzy-Delphi method are detailed in Section 4.1.

During the systematic literature reviews both qualitative and quantitative approaches were used, i.e, for bibliometric findings, a quantitative approach was considered and for interpretation and analysis of the findings a qualitative approach was considered. To develop the framework, a qualitative approach was considered. In the process to find the agreement level of the framework among the experts, a fuzzy approach was used, characterizing a quantitative approach, and to analyze the agreement level, because many respondents provided an analysis of the framework, a qualitative approach can be considered.

Accordingly to Martins (2012b), the research can adopt three main approaches: (i) quantitative, (ii) qualitative or (iii) mixed (both qualitative and quantitative). It was adopted the mixed approach for this research (as prior described), considering that qualitative researches can contribute to theory building in the field of operations management (BARRATT; CHOI; LI, 2011) and quantitative research (provided by the fuzzy approach) helps to enumerate and to confirm quantitatively the findings. It is important to notice that the qualitative research proposes a dynamic relationship between the real-world and the subject (TURRIONI; MELLO, 2012), contributing and being adherent with the research's objectives. Bryan (1989) apud Martins (2012b, p.53) cites six main characteristics of the qualitative approach: (i) emphasis on the subjective interpretation, (ii) delimitation of research context, (iii) non-structured approach, (iv) importance on the organizational reality, (v) multiple evidences sources, (vi) proximity with the studied phenomenon. Bryan (1989) apud Martins (2012b, p.49) also cites four main characteristics of the quantitative research: (i) measurability, (ii) causality, (iii) generalization and (iv) replication.

Nakano (2012), based on Berto and Nakano (2000) and Filippini (1997), considers seven categories of research methods in production engineering and operations management: (i) survey, (ii) case research, (iii) modeling, (iv) simulation, (v) field research, (vi) experiments, and (vii) theoretical/conceptual.

For this thesis, a multi-method was considered, by the combination of survey and theoretical/conceptual approaches. During the systematic literature reviews and the framework development, the research can be classified as theoretical/conceptual. For the agreement level of the framework, a type of survey was considered, i.e., the Fuzzy-Delphi method. In this method, a small number of participants are considered, but the analysis is deeper than the survey, because it is foreseen the use of the fuzzy approach to check mathematically the adherence of the answers and can happen a closer interaction with the participants.

This research can be classified as exploratory, because it was necessary becoming a problem more explicit and real for scholars and practitioners (considering literature review to find gaps and the opinions of experts to validate the framework) (TURRIONI; MELLO, 2012) and the theory became refined and more adherent with the market reality (VOSS; TSIKRIKTSIS; FROHLICH, 2002).

This research was organized in eight steps, as showed in the Figure 1.1. It is perceived from the Figure 1.1, that two steps were conducted in parallel, i.e., both systematic literature reviews; this approach was important to minimize the total time of the research.

Figure 1.1 – Research Steps

Source: Prepared by the author

Step 1 considered the theme definition. It was conducted an exploratory literature review and the kwon-how of the researcher and the advisor to define the theme.

Two systematic literature reviews were conducted in this thesis. These two systematic literature reviews have had a twofold objective: first to provide the state-of-the-art of both themes and second to provide a clear definition of the gap to be covered. In **step 2**, a systematic literature review of the demand-driven phenomenon was conducted (all details are presented in

Chapter 2). In **step 3**, a systematic literature review of S&OP was conducted (all details are presented in Chapter 3).

The research problem and the objectives were possible to be defined after the systematic literature reviews conduction. In **step 4** was presented the research problems and the thesis objectives (all details are presented in Section 1.2 of this Chapter).

After the systematic literature reviews, a first version of the proposed framework for the S&OP in the demand-driven phenomenon context was proposed. This was the aim of **step 5** and all details are presented in the Chapter 4.

To improve and to obtain the framework refinement and considerations, a Fuzzy-Delphi method was conducted with scholars' and practitioners' experts. The details of **step 6** is presented in Chapter 5, with their results and analyses.

The adoption of the Delphi-method (in specific, Fuzzy-Delphi method) was considered to obtain a better construct for the agreement level of the framework. The Delphi-method has been used in the field of operations management, production planning and control and supply chain fields, as illustrated in Appendix A. For the case of this research, the Fuzzy approach is totally adherent, because the proposed framework is an unprecedented framework, thus uncertainty was involved during the answering process by the experts; fuzzy approach deals accordingly with this uncertainty, obtaining better results compared to the crisp approach. It is important to notice that Appendix A does not have the aim of showing an exhaustive analysis of the Delphi-method adoption, but solely has the aim of illustrating its use and applicability.

It is possible to infer from Appendix A (Chart A.1) that the Delphi-method has been used and the papers have been published in relevant journals. Thus, this method can be used, and it is adherent with the purpose of this thesis. In most of the publications presented in Appendix A, the Delphi-method is combined with other method (Analytical Hierarchical Process (AHP), fuzzy and case researches) to improve the robustness of the research. That's why, this thesis has considered the adoption of a combined version of the Delphi-method, known as Fuzzy-Delphi method.

In **step 7**, based on the results from the Fuzzy-Delphi method, considerations were proposed for developed framework. With these considerations it is expected that the framework be more adherent with the companies' reality.

In **step 8**, final considerations and discussions, limitations of the research and future studies directions were provided, as well as, the main contributions of this thesis were described.

1.5 Thesis Structure

This thesis was structured in six chapters, as detailed in Figure 1.2.

Figure 1.2 – Thesis' Structure

Source: Prepared by the author

C CHAPTER 2

THE DEMAND-DRIVEN (DD) PHENOMENON

This chapter has the aim of presenting, understanding and establishing the Demand-Driven (DD) phenomenon concept, considering definitions, processes and approaches, technologies and systems, and developed researches. Thus, it is organized in four sections: Section 2.1 presenting the method to conduct the systematic literature review, Section 2.2 presenting the scholars' perspective of the DD phenomenon, Section 2.3 presenting the practitioners' perspective of the DD phenomenon and, finally, Section 2.4 presenting a critical analysis and an organizing conceptual framework for the DD phenomenon.

2.1 Adopted Method for the Systematic Literature Review

To obtain a consistent understanding of the DD phenomenon, a systematic literature review was conducted. A systematic literature review allows researchers, considering the interest, to identify, to transparently evaluate and to critically interpret all available and relevant research (KITCHENHAM, 2004; ROUSSEAU; MANNING; DENYER, 2008). To guide the research, the approach suggested by Denyer and Tranfield (2009) was used, as shown in Figure 2.1.

Figure 2.1 – Steps to conduct the systematic literature review

Source: Adapted from Denyer and Tranfield (2009)

It is important to formalize the conducted steps in the systematic literature review in order to make researchers and scholars able to evaluate the current research, to provide improvements and to continue the research by eliminating its gaps (FULMER, 2012). In this sense, the methodological steps are presented.

In **step 1** was formulated the research question, which is:

What are the characteristics of the DD phenomenon for operations management (supply chain and production planning and control), considering definitions, processes and approaches, technologies and systems, and developed researches?”

The question was defined considering a prior scope studying, as suggested by Denyer and Tranfield (2009).

In **step 2** the search terms were defined. An exploratory literature review (pilot-search) was prior performed to define the research strings. The research strings were also validated by other two researchers (these researchers have experience and have already developed researches and/or worked in companies considering the studied theme) , considering an interactive process, i.e., once the results of a group of strings had been found, conjunctly, these results were discussed to modify the strings, until the final group of strings was defined. Thus, the relevant search terms and Boolean operators were defined. The details (strings, filters and relevant information) are shown in Chart 2.1. The period of analysis considered was 20 years, i.e., publications from 1999 to 2019. This period was defined considering a prior scope studying and because of the evidence of the theme during the closer past years; the necessities of agility and visibility proposed by the DD is a current issue, because of that older studies would not contribute with the research.

With the aim of providing a complete understanding of the DD phenomenon, in **step 3** a research was performed considering the following research tools: EBSCO host, Emerald, Scopus, ScienceDirect, Web of Science and ABI/Inform.

The databases were selected based also on an exploratory literature review (considering papers that conducted similar systematic literature reviews with the theme). The number of returned publications by research tool are also presented in Chart 2.1.

To define the strings, the terms with and without the hyphen (i.e. demand-driven and demand driven) were considered to not limit the results. Besides the term demand-driven, based on prior read papers, it was realized the importance to use the terms demand-oriented and change the term “demand” by “market” and “customer”. The terms operations, planning and supply chain (in accordance with Mentzer et al. (2001), the concept of supply chain is broader than logistics, thus supply chain was the term used for the strings) were also included in the strings, because they are related with the research objective. This approach to define the strings was adopted to not limit the search and to have a sufficiently broad scope, leading to desirable

results (COOPER, 2010). The research, without duplications among the research tools and databases, returned 202 papers.

Chart 2.1 – Research's Parameters and relevant information for the DD Phenomenon systematic literature review

Strings	"Demand-driven operations" or "Demand-driven planning" or "DD supply chain" or "Demand driven operations" or "Demand Driven planning" or "Demand driven supply chain" or "Market-driven operations" or "Market-Driven planning" or "Market-driven supply chain" or "Market driven operations" or "Market Driven planning" or "Market driven supply chain" or "Customer-driven operations" or "Customer-Driven planning" or "Customer-driven supply chain" or "Customer driven operations" or "Customer Driven planning" or "Demand driven supply chain" or "Market-driven operations" or "Market-Driven planning" or "Market-driven supply chain" or "Market driven operations" or "Market Driven planning" or "Customer driven supply chain" or "Demand-oriented operations" or "Demand-oriented planning" or "Demand-oriented supply chain" or "Demand oriented operations" or "Demand oriented planning" or "Demand oriented supply chain" or "Market-oriented operations" or "Market-oriented planning" or "Market-oriented supply chain" or "Market oriented operations" or "Market oriented planning" or "Market oriented supply chain" or "Customer-oriented operations" or "Customer-oriented planning" or "Customer-oriented supply chain" or "Customer oriented operations" or "Customer oriented planning" or "Demand oriented supply chain" or "Market-oriented operations" or "Market-oriented planning" or "Market-oriented supply chain" or "Market oriented operations" or "Market oriented planning" or "Customer oriented supply chain"
Considered paper's structures	Title, Abstract and Keywords
EBSCO host	Research date: February of 2019 Research bases: Business Source Complete, Academic Search Complete, Computers & Applied Sciences Complete, EconLit with Full Text, GreenFILE, Library, Information Science & Technology Abstracts, PsycINFO, SocINDEX, SocINDEX with Full Text Research period: from 1999 to 2019 (range of 20 years) Other relevant filters: Scholarly (Peer Reviewed) Journals and Academic Journal Total of publications: 39
Emerald	Research date: February of 2019 Research bases: N/A Research period: from 1999 to 2019 (range of 20 years) Other relevant filters: N/A Total of publications: 7
Scopus	Research date: February of 2019 Research bases: Engineering, Computer Science, Business, Management and Accounting, Social Sciences, Decision Sciences, Phenomenonal Science and Economics, Econometrics and Finance Research period: from 1999 to 2019 (range of 20 years) Other relevant filters: Article, Conference Paper and Review Total of publications: 170
ScienceDirect	Research date: February of 2019 Research bases: N/A Research period: from 1999 to 2019 (range of 20 years) Other relevant filters: Review Articles and Research Articles Total of publications: 45
Web of Science	Research date: February of 2019 Research bases: Engineering, Business Economics, Computer Science and Public Administration Research period: from 1999 to 2019 (range of 20 years) Other relevant filters: Article and Review Total of publications: 21

Chart 2.1 – Research's Parameters and relevant information for the DD Phenomenon systematic literature review
- *Continuation*

ABI/Inform	Research date: February of 2019
	Research bases: N/A
	Research period: from 1999 to 2019 (range of 20 years)
	Other relevant filters: Scholarly Journal, Full Text and Peer Reviewed
Total of papers: 20	

Source: Prepared by the author

It is important to notice that some research's tools limit the number of terms in the strings to perform the research. Based on this, to perform the research in such research's tools, the strings were divided in groups, and carefully and individual researches for these groups was performed.

After a carefully read of the title, abstract and keywords of the publications, 61 publications were selected to compose the literature review. After a full reading of the 61 papers, it was realized that some papers solely presented the term demand-driven (and the equivalents) on the title or abstract. These papers did not discuss the concept; thus, they were not considered in the research, totalizing to the systematic literature review 51 papers. The details of **step 3** are presented in Figure 2.2.

Figure 2.2 – Details of the screening publications process in the Step 3

Source: Prepared by the author

Besides the academic's and scholar's viewpoint of the theme, it was important to consider the practitioners' perspective of the theme. For that, a grey literature with white papers,

reports, online posts, dictionaries and books were also included in the research, considering institutes, associations and consulting companies' productions; 70 publications were considered, and the source of these publications was a research performed in the Google website. Professional publications cannot be disregarded in emerging fields, but prior analyses of the returned publication must be performed in order to verify their validity and real contribution (WEINTRAUB, 2000).

In **step 4**, the academic's perspective was analyzed separately from the practitioner's perspective. This approach was adopted to have a fully understanding of each perspective separately. In order to group and summarize the data in meaningful themes, a thematic analysis was performed by isolating relevant data, tabulating them and aggregating common findings (BRAUN; CLARKE, 2006; COOPER, 2010). The data tabulation and aggregation were also validated by other two researchers with expertise in the studied theme to avoid mistakes and increase the analysis validity. Similarity qualitative analysis was performed using the software Iramuteq® which is supported by the statistical computing and graphics software called R®, which have enriched the findings.

In **step 5**, the research question was answered considering the analyses presented in **step 4**.

2.2 A scholars' perspective of DD phenomenon

In order to analyze the main characteristics of the DD phenomenon, the papers were grouped, as follow:

- ✓ Group 1: papers having a DD definition;
- ✓ Group 2: papers exploring the DD concept, but do not have the DD definition;
- ✓ Group 3: papers with similar concepts to DD (i.e., demand-oriented, customer-driven, etc.).

This grouping approach was considered because it was intended to understand carefully the DD phenomenon. By separating the DD papers between definitions and concepts, makes clear if there is a unique definition apart of the main considered concepts. This approach was not adopted to the related terms, because they solely contribute with the concepts and assumptions about the theme. Chart 2.2 shows a synthesis of the surveyed papers, Graphs 2.1 and 2.3 show the distribution of the publications per year for Groups 2 and 3 (Group 1 did not present trends of increasing or decreasing in the studied period). and Graph 2.3 shows the consolidated publications per year. It was noticed an increase of publication's interests during the years.

Chart 2.2 – Synthesis of DD and related returned papers

Group	Characteristics	Number of Papers	Percentage	Authors
1	DD Definitions	9	18%	Verdouw et al. (2011); Mendes, Leal and Thomé (2016); Grandzol and Grandzol (2018); Ayers, (2006); Verdouw et al. (2010); Mohammadi and Mukhtar (2012); Cassivi et al. (2004); Hadaya and Cassivi (2007); Bozutti and Esposto (2019)
2	DD Concepts	18	35%	Brown (2012); Bvuchete, Grobbelaar and Van Eeden (2018); Cao, Xiao and Sun (2017); Chan and Chung (2004); Cid Yáñez et al. (2009); Davis et al. (2012); Dey, Alam and Bose (2010); Dreyer et al. (2008); Farahani, Akkerman and Wilke (2014); Ganjia, Shah and Coutroubis (2018); Ganjia, Shah and Coutroubis (2017); Hadaya and Cassivi (2009); Hilletoft, Ericsson and Christopher (2009); Laksham (2013); Makatsoris and Chang (2004); Martino et al. (2017); Tinham (2006); Wang and Zhang (2010)
	Customer-Driven	16	31%	Parmar et al. (2010); Asare, Brashear-Alejandro and Kang (2016); He et al. (2012); Ho, Lee and Ho (2009); Jahani et al. (2012); Jones and Clarke (2002); Lau and Lee (2000); Lyons et al. (2005); Martinelli and Tunisini (2018); Mason, Lalwani and Boughton (2007); Sawik (2009a); Sawik (2009b); Sawik (2011); Sawik (2014); Sawik (2018); Singhal et al. (2018)
3	Customer-Oriented	5	10%	Xu et al. (2015); Li and Zuo (2011); Lo et al. (2005); Basaez et al. (2014); Moshref-Javadi and Lee (2016)
	Market-Oriented	2	4%	Qinghua et al. (2010); Waller, Dabholkar and Gentry (2000)
	Demand-Oriented	1	2%	Hao, Wu and Li (2012)

Source: Prepared by the author

Graph 2.1 – DD concepts' papers publications per year

Source: Prepared by the author

Graph 2.2 – DD similar concepts' papers publications per year

Source: Prepared by the author

Graph 2.3 – DD consolidated papers publications per year

Source: Prepared by the author

It is possible to infer, based on Chart 2.2, that 53% of the publications considers the term DD and the other 47% related terms (customer-driven, customer-oriented, market-oriented and demand-oriented). This shows that there is not a prevalence, in the scholars' perspective,

of the term DD. However, the considered concepts and approaches are compatible, as will be discussed later.

Charts 2.3, 2.4 and 2.5 describe the publications' source, within each considered group, and the relative journal impact, if applicable.

Chart 2.3 – DD definitions' papers publications

Source	Number of publications	Journal Impact ¹
Chemical Engineering Progress	1	0,560
Computers and Electronics in Agriculture	1	2,427
Decision Sciences Journal of Innovative Education	1	-
Industrial Management & Data Systems	1	2,948
International Journal of Digital Content Technology and its Applications	1	-
International Journal of Production Economics	1	4,407
International Journal of Production Management and Engineering	1	-
Production Planning and Control	1	2,330
The International Journal of Logistics Management	1	1,776

Source: Prepared by the author

Chart 2.4 – DD concepts' papers publications

Source	Number of publications	Journal Impact ²
2010 International Conference on Management and Service Science, MASS 2010	1	N/A
2017 International Conference on Industrial Engineering, Management Science and Application, ICIMSA 2017	1	N/A
2018 3rd Biennial South African Biomedical Engineering Conference, SAIBMEC 2018	1	N/A
62nd IIE Annual Conference and Expo 2012	1	N/A
Asia Pacific Journal of Marketing and Logistics	1	1,200
Assembly	1	-
Computers and Chemical Engineering	1	3,113

¹ Source: InCites Journal Citations Reports 2018 – Clarivate Analytics. / Journal Data Filtered By: Selected JCR Year: 2017 Selected Editions: SCIE,SSCI Selected Category Scheme: WoS

² Source: InCites Journal Citations Reports 2018 – Clarivate Analytics. / Journal Data Filtered By: Selected JCR Year: 2017 Selected Editions: SCIE,SSCI Selected Category Scheme: WoS

Chart 2.4 – DD concepts' papers publications - *Continuation*

Source	Number of publications	Journal Impact ³
Electronic Markets	1	3,818
IEEE International Conference on Industrial Engineering and Engineering Management	1	N/A
Industrial Management and Data Systems	1	2,948
Innovations in Networks - Proceedings of the APMS 2008 Conference, An Event of the IFIP Working Group 5.7	1	N/A
International Journal of Applied Engineering Research	1	-
International Journal of Computer Integrated Manufacturing	1	1,995
International Journal of Production Research	1	2,623
Journal of Industrial and Production Engineering	1	-
Manufacturing Computer Solutions	1	-
Production Planning and Control	1	2,330
Reviews in Aquaculture	1	7,139

Source: Prepared by the author

Chart 2.5 – DD similar concepts' papers publications

Source	Number of publications	Journal Impact ⁴
International Journal of Production Research	4	2,623
Journal of Business and Industrial Marketing	2	1,833
2012 International Conference on Future Energy, Phenomenon, and Materials	1	N/A
European Journal of Operational Research	1	3,428
IEEE Power and Energy Society General Meeting	1	N/A
International Commerce Review: ECR Journal	1	-
International Conference on Advanced Communication Technology, ICACT	1	N/A
International Conference on Management and Service Science, MASS 2011	1	N/A
International Journal of Logistics Management	1	1,776
International Journal of Logistics: Research and Applications	1	1,820
International Journal of Physical Distribution and Logistics Management	1	4,215
International Journal of Production Economics	1	4,407
International Series in Operations Research and Management Science	1	-
Journal of Business Logistics	1	2,891
Mathematical and Computer Modeling	1	-
Operations Management Research	1	1,524
Proceedings - 2012 International Conference on Information Retrieval and Knowledge Management, CAMP'12	1	N/A

³ Source: InCites Journal Citations Reports 2018 – Clarivate Analytics. / Journal Data Filtered By: Selected JCR Year: 2017 Selected Editions: SCIE,SSCI Selected Category Scheme: WoS

⁴ Source: InCites Journal Citations Reports 2018 – Clarivate Analytics. / Journal Data Filtered By: Selected JCR Year: 2017 Selected Editions: SCIE,SSCI Selected Category Scheme: WoS

Chart 2.5 – DD similar concepts' papers publications - *Continuation*

Source	Number of publications	Journal Impact ⁵
Production and Operations Management	1	1,772
Strategic Change: Briefings in Entrepreneurial Finance	1	-
Supply Chain Management	1	-

Source: Prepared by the author

It is possible to infer from Charts 2.3, 2.4 and 2.5 that the theme has been being published in relevant papers, such as International Journal of Production Economics, Electronic Markets, European Journal of Operational Research and International Journal of Physical Distribution and Logistics Management. Such fact reinforces the scholar's increasing interest about the theme. From Chart 2.5, it is noticed that related terms had the major number publication in journals with high impact. This could be explained by two reasons: firstly, the third group contains a broader number of strings and, secondly, the abstinence of a unique term to define the phenomenon characteristics (this second reason should be tested, and it will be discussed later).

Chart 2.6 summarizes the research methods used in the publications.

Chart 2.6 – Summary of the applied research methods

Research Method	Number of Publications	Percentage	Authors
Case Research	7	14%	Basaez et al. (2014); Bvuchete, Grobbelaar and Van Eeden (2018); Dreyer et al. (2008); Grandzol and Grandzol (2018); Hilletoft, Ericsson and Christopher (2009); Li and Zuo (2011); Mason, Lalwani and Boughton (2007)
Literature Review	12	24%	Ayers (2006); Bozutti and Esposto, (2019); Brown (2012); Dey, Alam and Bose (2010); Ganji, Shah and Coutroubis (2017); Ganji, Shah and Coutroubis (2018); Jones and Clarke (2002); Laksham (2013); Qinghua et al. (2010); Singhal et al. (2018); Tinhani (2006); Waller, Dabholkar and Gentry (2000)
Literature Review and Theoretical Analysis	2	4%	Asare, Brashear-Alejandro and Kang (2016); Martinelli and Tunisini (2018)
Theoretical Analysis	4	8%	Lau and Lee (2000); Makatsoris and Chang (2004); Martino et al. (2017); Mohammadi and Mukhtar (2012)
Theoretical Analysis and Case Research	6	12%	Hao, Wu and Li (2012); Lo et al. (2005); Lyons et al. (2005); Mendes, Leal and Thomé (2016); Verdouw et al. (2010); Verdouw et al. (2011)
Modeling	10	20%	Cao, Xiao and Sun (2017); Chan and Chung (2004); Moshref-Javadi and Lee (2016); Parmar et al. (2010); Sawik (2009b); Sawik (2011); Sawik (2014); Sawik (2018); Wang and Zhang (2010); Xu et al. (2015)
Modeling and Case Research	6	12%	Cid Yáñez et al. (2009); Sawik (2009a); Farahani, Akkerman and Wilke (2014); He et al. (2012); Ho, Lee and Ho (2009); Jahani et al. (2012)
Survey	3	6%	Davis et al. (2012); Hadaya and Cassivi (2007); Hadaya and Cassivi (2009)
Case Research and Survey	1	2%	Cassivi et al. (2004)

Source: Prepared by the author

⁵ Source: InCites Journal Citations Reports 2018 – Clarivate Analytics. / Journal Data Filtered By: Selected JCR Year: 2017 Selected Editions: SCIE,SSCI Selected Category Scheme: WoS

By analyzing Chart 2.6, it was realized that 28 publications (55%) have modeled and or developed a theoretical analysis (with the aim developed frameworks about the DD) scenario. This shows a lack of a unique framework and/or maturity of operations about the DD phenomenon. This absence leads to research opportunities.

It is also realized that 20 (40%) of the publications presents case researches (including the situations in which were adopted case research and modeling/theoretical analysis together). This shows that companies are dealing with the DD phenomenon and needs a theoretical background to support their activities. As cited by Yin (2015), cases researchers support the development of new theories based on practitioners' approaches.

Chart 2.7 presents the industry's sector that each case research was performed. It is possible to realize that food / fruit / beverage / fast-moving consumer goods (FMCG), electronics and automotive are the main industries' sector studied (50% of the case researches), because of the product's and market's characteristics. However, there are other eight sectors studied, demonstrating the wideness application of the current DD phenomenon.

Chart 2.7 – Sectors of the performed case researches

Sector	Number of Publications	Percentage	Authors
Food / Fruit / Beverage / Fast-Moving Consumer Goods	6	30%	Dreyer et al. (2008); Farahani, Akkerman and Wilke (2014); Hao, Wu and Li (2012); Li and Zuo (2011); Mendes, Leal and Thomé (2016); Verdouw et al. (2010)
Electronics / Communication	4	20%	Cassivi et al. (2004); Ho, Lee and Ho (2009); Jahani et al. (2012); Sawik (2009a)
Automotive	2	10%	He et al. (2012); Lyons et al. (2005)
Appliance	1	5%	Hilletoft, Ericsson and Christopher (2009)
Clothing	1	5%	Lo et al. (2005)
Education	1	5%	Grandzol and Grandzol (2018)
Flower	1	5%	Verdouw et al. (2011)
Healthcare	1	5%	Bvuchete, Grobbelaar and Van Eeden (2018)
Road freight transport	1	5%	Mason, Lalwani and Boughton (2007)
Timber	1	5%	Cid Yáñez et al. (2009)
Tire Recycling	1	5%	Basaez et al. (2014)

Source: Prepared by the author

By reading the 51 publications, some authors were concerned about the Information Technology (IT) and Systems that could interfere and/or could bring benefits and/or could be

tendencies for the DD phenomenon. Chart B.1 (in Appendix B) shows the considered technologies and approaches, the authors, number of publications that mentions such technology and the main contributions and/or insights for each technology, considering the DD phenomenon.

By analyzing Chart B.1, the main contribution from the papers is the necessity of visibility enhancement in the DD environment by using the Information Technology and System. Flexibility, velocity and agility are also improved, mainly because of the use of real-time information (supported by cloud-based systems, web-based services and internet of things (IoT)), information from the customers (point-of-sales data) and use of Computer-aided design (CAD), Computer-assisted manufacturing (CAM), prototyping and 3D printing. These approaches support the decision making and integration by focusing on business strengths and by aligning with customer's needs.

Chart B.1 also brings the tendencies of technologies in the DD environment, i.e., point-of-sales (POS) data with the aid of radio frequency identification (RFId), sensor technologies and/or barcode are important to collect data and understand the customer's preferences, one of the essential goals of the DD phenomenon. The companies should be integrated (using enterprise resource planning (ERP) systems) and the information should be available and easily shared, that's why cloud-based systems, web services and internet of things (IoT) and electronic data interchange (EDI) systems are also cited.

Besides technology, processes and their approaches were also analyzed. Chart C.1 (in Appendix C) summarizes the considered processes and approaches, the authors, number of publications that mentions such processes and the main contributions and/or insights for each process, considering the DD phenomenon.

By analyzing Chart C.1, the main contribution that the processes and approaches brings to the DD phenomenon is the possibility of collaboration and integration, either intern or external (among supply chain partners). In accordance with Chart B.1, real-time information is also very important for the processes, in order to allow companies to respond with velocity and agility to the market's and customers' needs. Such velocity and agility, as well as flexibility, should be presented in all areas of the companies and not solely in the manufacturing. That's why, integration is important in the DD phenomenon.

Standards in process modelling is also recommended when defining and formalizing the DD processes. The references considered, as one possibility of modeling language, the Business Process Model and Notation (BPMN). The processes can also be defined considering established supply chain models, such as the Global Supply Chain Forum framework (GSCF)

and/or the Supply Chain Operations Reference (SCOR); independently of the chosen framework and the chosen modeling language, the information sharing must be considered in order to enhance flexibility and responsiveness among the shareholders.

Another key-point, considered in the references, was the product development. Currently, customization becomes essential and, for that, the knowledge of the product is so important as the knowledge of the processes. Thus, marketing has the role to be the bridge between customers and the company. Besides, the product management should consider its whole life and all dimensions involved, i.e., costs, customers' needs, production restrictions and environmental issues.

Changes from traditional management approaches were recommended. Traditional MRP and S&OP should be changed to respond adequately to the DD phenomenon (use of rate-based approach than forecasted-quantity approach), but such changes were just empirically proposed, by practitioners (institutes and consulting). This is a research gap that must be covered. Lean and Six Sigma were cited as convergent with the needs of the DD phenomenon.

The relationship among suppliers and customer is also essential in the DD phenomenon. This is not a new issue, but it cannot be disregarded. Logistics with third-party-logistics (3PL), fourth-party-logistics (4PL), cross-docking, postponement, vendor managed inventory (VMI), collaborative planning, forecasting and replenishment (CPFR) are approaches/tools that can be combined with customer relationship management (CRM) and supplier relationship management (SRM) to improve the relationship and efficiency of processes among the companies in a DD phenomenon.

Chart D.1 (in Appendix D) presents the problems, categories of problems, number of publications in each category, the authors, the main contributions of each category and the percentage of publications in each problem (the percentage considered the total of 51 analyzed papers). Four categories of problems were considered:

- ✓ **Development and/or improvement of an algorithm to improve or optimize a process or situation** (subcategories: Logistics, Transport and Distribution; Supplier Management; Supply Chain Scheduling and Decisions; Bullwhip effect; Production and Planning; and Facility Location);
- ✓ **Framework Development** (subcategories: Information systems and technologies support; DD planning concept; Product Development / Customization; Maturity model; Supplier Management; Order fulfillment;

Visibility improvement; Strategy Development; Logistics, Transport and Distribution; and Risk Assessment);

- ✓ **Critical Analysis** (subcategories: DD implementation; Integration / Collaboration; Marketing / Demand / Market; Information systems and technologies support; Product Development; Lean Production and Six Sigma; Logistics, Transport and Distribution; Big data; Smart Manufacturing; and S&OP); and
- ✓ **Education** (subcategory: Active teaching-learning methodology).

Another important information to be analyzed is the gaps of research cited in the papers. The gaps lead to the problem to be studied and, posteriorly, guideline for future researches. The gaps cited by the authors were grouped as shown:

- ✓ Development or improvement of algorithms for (i) supplier management, (ii) logistics, distribution and inventory management; (iii) manufacturing; (iv) bullwhip effect; (v) planning process; (vi) facility and (vii) supply chain management as a whole system;
- ✓ Analysis of (i) system implementation and technologies; (ii) DD implementation; (iii) concepts; (iv) supply chain management; (v) product development; (vi) logistics and distribution; (vii) supplier and/or customer relationship management; (viii) risk management;
- ✓ Modeling (i) DD supply chain and (ii) manufacturing phenomenon to optimize it;
- ✓ Teaching concepts for active teaching learning in DD concepts with simulation;

Chart 2.8 summarizes the gaps category, gaps subcategory, number of publications, percentage and the authors.

Chart 2.8 – Summary of gaps about DD phenomenon's studies

Gap Category	Gap Subcategory	Number of publications	Percentage	Authors
Algorithms	Supplier Management	4	8%	Jahani et al. (2012); Parmar et al. (2010); Sawik (2018); Sawik (2011)
	Logistics / Distribution and Inventory	4	8%	He et al. (2012); Moshref-Javadi and Lee (2016); Xu et al. (2015); Sawik (2009a)
	Manufacturing	3	6%	Chan and Chung (2004); Sawik (2009b); Davis et al. (2012)
	Bullwhip effect	2	4%	Wang and Zhang (2010); Cao, Xiao and Sun (2017)
	Planning Process	1	2%	Farahani, Akkerman and Wilke (2014)
	Facility Location	1	2%	Ho, Lee and Ho (2009)
	Supply Chain Management	1	2%	Sawik (2014)

Chart 2.8 – Summary of gaps about DD phenomenon's studies - *Continuation*

Gap Category	Gap Subcategory	Number of publications	Percentage	Authors
Analysis	System implementation and technologies	9	18%	Qinghua et al. (2010); Dreyer et al. (2008); Bvuchete, Grobbelaar and Van Eeden (2018); Asare; Brashear-Alejandro and Kang (2016); Singhal et al. (2018); Lau and Lee (2000); Lyons et al. (2005); Mohammadi and Mukhtar, (2012); Basaez et al. (2014)
	DD implementation	8	16%	Laksham (2013); Tinham (2006), Lo et al. (2005); Ayers (2006); Dey, Alam and Bose (2010); Hilletoft, Ericsson and Christopher (2009); Brown (2012); Jones; Clarke (2002)
	Concepts	5	10%	Bozutti and Esposto (2019); Martinelli and Tunisini (2018); Li and Zuo (2011); Hao, Wu and Li (2012); Waller, Dabholkar and Gentry (2000)
	Supply Chain Management (Collaboration / Integration)	2	4%	Cassivi et al. (2004); Hadaya and Cassivi (2007)
	Product Development	2	4%	Ganji, Shah and Coutroubis (2017); Ganji, Shah and Coutroubis (2018)
	Logistics / Distribution	2	4%	Makatsoris and Chang (2004); Mason, Lalwani and Boughton (2007)
	Supplier and/or Customer Relationship Management	1	2%	Hadaya and Cassivi (2009)
	Risk Assessment	1	2%	Martino et al. (2017)
Modeling	DD supply chain	3	6%	Verdouw et al. (2011); Mendes, Leal and Thomé (2016); Verdouw et al. (2010)
	Manufacturing	1	2%	Cid Yáñez et al. (2009)
Teaching	Active teaching-learning methodology	1	2%	Grandzol and Grandzol (2018)

Source: Prepared by the author

It is possible to infer from Chart 2.8 that almost half of publications found gaps related to concepts definition, DD implementation and systems/technologies implementations (44% of the total of publications). This led to research possibilities, such as, framework developments for successful implementation and researches to establish the concepts that appears normally as buzzwords among practitioners.

Chart E.1 shows the details of the cited gaps in each subcategory and summarizes the provided future researches in each subcategory, cited by the authors.

Nevertheless, by analyzing Chart 2.2, the low number of papers that contains a DD definition suggests that there is a lack of a formal and scholar's definition for the DD phenomenon.

In order to figure out the main characteristics of the DD phenomenon from the returned papers and contributing in the direction of a formal definition for the DD phenomenon, it was used the software Iramuteq®, which performs texts qualitative analyses. Iramuteq® is supported by the statistical computing and graphics software named R®. To interpret the results is necessary to check the distance among the nodes (circles), i.e., the closer the circles, the closer the terms are in text (distance among the words). The lines represent the link among the terms, i.e., the thicker the line, more linkages of meaning among the terms were found in the text. Finally, the size of the node means the number of terms found in the paper.

The first analysis was performed within each group, in order to understand the main terms that were explored. These individual analyses were performed initially to avoid interferences among the groups.

Figure 2.3 shows the similarity analysis of Group 1.

Figure 2.3 – Similarity analysis of DD definitions

Group 1 considers papers with DD definitions. It is possible to infer that DD is a term with a high relation with customers; this is important, because it is necessary to fulfill customer's orders in a perfect manner. DD phenomenon is also related to:

- ✓ Have a quick response;
- ✓ Be inserted in the supply chain phenomenon;
- ✓ Have flexibility in a collaborative manner to supply adequately the customers;
- ✓ Have information that needs to be shared, involved with all stakeholders and timely shared;
- ✓ Be linked with the strategy and to have a dynamic process to rule it;
- ✓ Fulfill the demand that is volatile; for that, must be time-precisely and has responsive characteristics to fulfill rapidly this demand that contains customized products.

Figure 2.4 shows the similarity analysis of Group 2, which considers papers that explore the DD concept, but do not have the DD definition. It is also possible to infer that the DD concept is related to customer's orders and fulfillment expectations.

Figure 2.4 – Similarity analysis of DD concepts

Source: Prepared by the author

For that, the DD should consider:

- ✓ The management of costs, inventory and information;
- ✓ The linkage with the company's strategy;
- ✓ The customer's demand, that needs to be planned, to have focus and have a collaborative process to be shaped;
- ✓ The supply chain phenomenon;
- ✓ The customer itself, that requires relationship;
- ✓ Company's capability to satisfy with a valuable product;
- ✓ The visibility to respond adequately to the market.

Figure 2.5 represents the similarity analysis of Group 3, which considers papers with similar concepts to DD.

Figure 2.5 – Similarity analysis of DD similar concepts

Source: Prepared by the author

. It is also possible to infer the importance of the customer-centric approach. In such phenomenon, by looking after the customer desires will guarantee their satisfaction by having focus and responsiveness. Because of the numbers of articles published, the terms customer-oriented and market-oriented did not have been highlighted in Figure 2.5. The term demand-oriented did not appeared because there was solely one published paper. The similar concepts to DD consider:

- ✓ Flexibility and reliability to fulfill customer's expectations;
- ✓ Processes to integrate;
- ✓ To know the market to increase the profit;
- ✓ Service;
- ✓ Focus and responsiveness;
- ✓ Information management.

It is perceived congruency among the groups by analyzing individually the similarity analysis of each one. However, another analysis was performed (also provided by Iramuteq® software) to have a critical analysis among the groups and to figure out the main terms to define the DD phenomenon concept. This analysis is called specificity analysis and returns the frequency of each terms among the groups.

The first specificity analysis was performed between Group 1 and Group 2. The results are shown in Table 2.1.

Table 2.1 – Specificity analysis between Group 1 and Group 2

Term	Absolute Frequency		Sum of Frequencies	Percentage	Cumulative Percentage
	Group 1 - DD Definitions	Group 2 - DD Concepts			
Customer	12	33	45	16%	16%
Demand	21	22	43	15%	31%
Supply	17	11	28	10%	41%
Supply chain	11	10	21	8%	49%
Information	6	9	15	5%	54%
Product	7	8	15	5%	60%
Process	6	7	13	5%	64%
Time	4	8	12	4%	69%
Cost	3	7	10	4%	72%
Inventory	2	8	10	4%	76%
Business	6	3	9	3%	79%
Management	2	7	9	3%	82%
Focus	3	5	8	3%	85%

Table 2.1 – Specificity analysis between Group 1 and Group 2 - *Continuation*

Term	Absolute Frequency		Sum of Frequencies	Percentage	Cumulative Percentage
	Group 1 - DD Definitions	Group 2 - DD Concepts			
Market	1	7	8	3%	88%
Visibility	1	7	8	3%	91%
Flexibility	4	2	6	2%	93%
Service	2	4	6	2%	95%
Collaborative	3	3	6	2%	97%
Change	1	3	4	1%	99%
Integration	2	2	4	1%	100%

Source: Prepared by the author

By analyzing Table 2.1, the term DD is strongly related to customer and demand. Considering the DD definitions and DD concepts, the main terms that appear in both groups are: customer, demand, supply, supply chain, information, product, process, time, cost and inventory (representing 76% of the total terms frequency in both groups). However, terms like visibility, flexibility, collaborative and integration should also be considered to understand the DD concept, because they appeared in both groups, even in low frequency.

By analyzing Table 2.2 (specificity analysis between Group 1 and 3), the term DD is also strongly related to customer and demand. Considering the DD definitions and DD similar concepts, the main terms that appear in both groups are: customer, demand, supply, supply chain, information, product, process, plan, business, flexibility and costs (representing 76% of the total terms frequency in both groups). The terms process, plan and business show a new finding, besides those from Table 2.1, evidencing the importance of the planning activity, establishing process and be integrated with the business. This finding brings a strategical view of the DD phenomenon. As analyzed in Table 2.1, terms like time, market, respond, collaborative, focus, management and visibility should also be considered to understand the DD concept, because it appeared in both groups, even in low frequency.

Table 2.2 – Specificity analysis between Group 1 and Group 3

Term	Absolute Frequency		Sum of Frequencies	Percentage	Cumulative Percentage
	Group 1 - DD Definitions	Group 3 - Customer-Driven, Customer-Oriented; Demand-Oriented, Market-Oriented			
Customer	12	46	58	19%	19%
Demand	21	11	32	10%	29%
Supply	17	12	29	9%	39%

Table 2.2 – Specificity analysis between Group 1 and Group 3 - *Continuation*

Term	Absolute Frequency		Sum of Frequencies	Percentage	Cumulative Percentage
	Group 1 - DD Definitions	Group 3 - Customer-Driven, Customer-Oriented; Demand-Oriented, Market-Oriented			
Supply chain	11	11	22	7%	46%
Information	6	10	16	5%	51%
Product	7	9	16	5%	56%
Process	6	9	15	5%	61%
Plan	5	9	14	5%	66%
Business	6	5	11	4%	69%
Flexibility	4	7	11	4%	73%
Cost	3	7	10	3%	76%
Service	2	7	9	3%	79%
Inventory	2	7	9	3%	82%
Integration	2	7	9	3%	85%
Time	4	5	9	3%	88%
Market	1	7	8	3%	91%
Respond	6	2	8	3%	93%
Collaborative	3	5	8	3%	96%
Focus	3	3	6	2%	98%
Management	2	2	4	1%	99%
Visibility	1	2	3	1%	100%

Source: Prepared by the author

Table 2.3 returns the terms that appear simultaneously in Group 1, Group 2 and Group 3. It is perceived a more regular distribution among the terms, revealing the same importance for them to define and understand the DD concept.

Table 2.3 – Specificity analysis among Groups 1, 2 and 3

Terms	Absolute Frequency			Sum of Freq.	%	Cum. Perc.
	Group 1 - DD Definitions	Group 2 - DD Concepts	Group 3 - Customer-Driven, Customer-Oriented; Demand-Oriented, Market-Oriented			
customer	12	33	46	91	18%	18%
demand	21	22	11	54	11%	29%
supply	17	11	12	40	8%	37%
supply chain	11	10	11	32	6%	43%
information	6	9	10	25	5%	48%

Table 2.3 – Specificity analysis among Groups 1, 2 and 3 - *Continuation*

Terms	Absolute Frequency			Sum of Freq.	%	Cum. Perc.
	Group 1 - DD Definitions	Group 2 - DD Concepts	Group 3 - Customer-Driven, Customer-Oriented; Demand-Oriented, Market-Oriented			
product	7	8	9	24	5%	53%
plan	5	9	9	23	5%	57%
process	6	7	9	22	4%	62%
cost	3	7	7	17	3%	65%
inventory	2	8	7	17	3%	69%
time	4	8	5	17	3%	72%
market	1	7	7	15	3%	75%
business	6	3	5	14	3%	78%
flexibility	4	2	7	13	3%	80%
service	2	4	7	13	3%	83%
focus	3	5	3	11	2%	85%
management	2	7	2	11	2%	87%
system	2	5	4	11	2%	89%
respond	6	3	2	11	2%	92%
integration	2	2	7	11	2%	94%
collaborative	3	3	5	11	2%	96%
change	1	3	6	10	2%	98%
visibility	1	7	2	10	2%	100%

Source: Prepared by the author

The terms are also adherent with the two-prior analysis, evidencing that there is a common understand about the characteristics of the DD phenomenon, which are:

- ✓ It has a **focus** on fulfill the **demand** by understanding the **customers'** expectative;
- ✓ It is inserted in the **supply chain** context, so the importance to align **demand** and **supply**, to fulfill customers' expectations of **product** and **services**;
- ✓ It is necessary to **manage** the **information** and **process** to **respond timely to the market**;
- ✓ **Systems** and **processes** should be **planned** properly to make the whole **business** become **flexible**, **integrated** and **collaborative**, which are requirements from the new market phenomenon;

- ✓ **Changes** in the culture, processes, systems and approaches should be necessary to improve the **visibility** of the demand, improving levels of **inventory** and reducing costs.

2.3 A practitioners' perspective of DD phenomenon

In order to understand the practitioners' perspective of the DD environment, a search was conducted using Google®, with the same strings used in the academic's perspective. To have a more accurate books searching, Googles Books® was used, with the same prior described strings used for the scholar's perspective.

The search returned 70 publications. It is important to notice that publications with a marketing perspective was not included in the analysis, because the focus of this paper was operations management and a prior analyses of the returned publication was also performed in order to verify their validity and real contribution (WEINTRAUB, 2000), because online posts and blogs were considered. The publications were grouped into 4 categories: (i) book, (ii) online post, (iii) white paper and (iv) dictionary. Chart 2.9 shows the category, number of publications in each category, the percentage in each category and the authors of the publication.

Chart 2.9 – DD Practitioners' Publications

Category	Number of publications	Percentage	Authors
Book	18	26%	Burrows (2012); Chase (2013); Davis (2015); Eagles (2017); Hines (2015); Kash and Calhoun (2011); Langabeer and Rose (2003); Langella (2007); Manning and Thorne (2003); Mendes (2011); Mondon (2016); Myerson (2018); Neves (2013); Ptak and Smith (2016); Ptak and Smith (2018); Sharma (2019); Smith and Smith (2014); Walter, Kartsounis and Carosio (2009)
Dictionary	1	1%	APICS (2016)
Online Post	40	57%	Baumbusch, Clothier and Notarangeli (2018); BigBang ERP (2018); Burnon (2019); Caillet, Xiong and Gorken (2017); Capgemini (2013); Clow (2015); Dantas (2016a); Dantas (2016b); Dantas (2016c); Dantas (2016d); Dantas (2016e); Dantas (2017); Davies (2018a); Davies (2018b); Dynasys (2018); Eagle and Packowski (2017); Gartner (2018); Hart (2016); Hochfelder (2017); Inexmoda (2019); Intuiflow (2015); Jabil (2019); Julianelli (2015); Lahy (2016); Lean Axis (2019); Mannila and Nyholm (2015); Marris Consulting (2019); Mckevitt (2017); Mikalsen and Larsen (2018); NTTData (2018); Orchestr8 (2018); Queensland Government (2014); Rouse (2009); Rutherford (2017); Scottsdale (2018); Sirajudeen (2018); Synchrono (2019); Syspro (2019); Team (2018); Technopedia (2019)
White paper	11	16%	Budd, Knizek and Tevelson (2012); Bustamanete (2017); Camelot (2019); Economist Intelligence Unit (2009); KPMG International (2016); SAS (2014); Smith, Ptak and Ling (2017); Smith and Smith (2013a); Smith and Smith (2013b); Smith and Smith (2013c); Synchrono (2018)

Source: Prepared by the author

Graph 2.4 shows the distribution of the aggregate practitioners' publications per year. It is easy to conclude that the interest has been grown during the years, more than from the academic's perspective.

Graph 2.4 – Number of Practitioners' Publications per year

Source: Prepared by the author

Graph 2.5 shows the distribution of the practitioners' publications per year, considering each category. It is notable the increasing of online publication about the theme.

Graph 2.5 – Number of Practitioners' Publications per year, divided per category

Source: Prepared by the author

Because of the increasing number of online publications, Table 2.4 details those are the responsible for the publications. Information Technology Solutions providers companies, consulting companies and supply chain blogs are the main responsible of the online posting

about DD (78%). This information combined with the increasing of publications by practitioners in the last years, reveals the increasing interest of the theme by the practitioners.

Table 2.4 – Detailing of the online posts about DD phenomenon.

Publications responsibility	Total of publications	Percentage
IT Solutions provider	15	38%
Consulting Company	10	25%
Supply Chain Blog	6	15%
IT Blog	2	5%
Research company	2	5%
Fashion Company	1	3%
Industries Alliance	1	3%
Logistics Provider	1	3%
Product Solutions Company	1	3%
Research Institute	1	3%
Total	40	100%

Source: Prepared by the author

Within the group of IT Solutions providers are big ones, such as SAP and Oracle. These companies are providing solutions particularly to the Demand-Driven MRP (DDMRP). Within the group of Consulting Companies are also big ones, like Accenture and Ernst & Young, providing solutions for DD Planning and DD Supply Chain. Gartner, a big research company, is dealing with DD Phenomenon too.

In order to analyze the benefits from the practitioners, the publications (dictionary, online posts and white papers) were classified in seven groups: (i) success factors, (ii) definitions, (iii) technology, (iv) discussion/analysis, (v) metrics, (vi) Lean / Six Sigma / Theory of Constraints and (vii) trends. It was necessary to create different groups compared to the scholar's perspective, because the practitioner's perspective do not have the academic rigor to publish, thus the results became broader. Chart 2.10 shows the category (group), total of publication in each category, percentage (considering the total of 52 publications, once the books are not included) and the authors. The books were not included in this analysis.

The group of Discussion and Analysis was created because some publications solely focused on definitions (APICS, 2016; CAPGEMINI, 2013; GARTNER, 2018; ROUSE, 2009; TECHNOPEdia, 2019), focused solely on success factors (HART, 2016; RUTHERFORD, 2017), focused solely on technology (SCOTTSDALE, 2018) or focused solely on metrics

(SMITH; SMITH, 2013c). The other 43 publications presented a deeper discussion or analysis about the theme.

Chart 2.10 – Practitioners’ Contributions Category

Category	Total of publications	%	Authors
Discussion/Analysis	43	83%	Baumbusch, Clothier and Notarangeli (2018); BigBang ERP (2018); Budd, Knizek and Tevelson (2012); Burnon (2019); Bustamanete (2017); Caillet, Xiong and Gorken (2017); Camelot (2019); Capgemini (2013); Clow (2015); Dantas (2016a); Dantas (2016b); Dantas (2016c); Dantas (2016d); Dantas (2016e); Dantas (2017); Davies (2018a); Davies (2018b); Dynasys (2018); Eagle and Packowski (2017); Economist Intelligence Unit (2009); Hochfelder (2017); Inexmoda (2019); Intuituitflow (2015); Jabil (2019); KPMG International (2016); Lahy (2016); Lean Axis (2019); Liveblog Team (2018); Mannila and Nyholm (2015); Marris Consulting (2019); Mckevitt (2017); Mikalsen and Larsen (2018); NTTdata (2018); Orchestr8 (2018); Queensland Government (2014); SAS (2014); Sirajudeen (2018); Smith, Ptak and Ling (2017); Smith and Smith (2013a); Smith and Smith (2013c); Synchrono (2018); Synchrono (2019); Syspro (2019);
Technology	20	38%	BigBang ERP (2018); Budd, Knizek and Tevelson (2012); Caillet, Xiong and Gorken (2017); Dantas (2016a); Dantas (2016b); Dantas (2016c); Dantas (2016d); Dantas (2016e); Dantas (2017); Davies (2018b); Dynasys (2018); KPMG International (2016); Lean Axis (2019); NTTdata (2018); Orchestr8 (2018); SAS (2014); Scottsdale (2018); Sirajudeen (2018); Synchrono (2018); Synchrono (2019)
Definitions	14	27%	APICS (2016); Budd, Knizek and Tevelson (2012); Capgemini (2013); Davies (2018b); Gartner (2018); Hochfelder (2017); Inexmoda (2019); Rouse (2009); Rutherford (2017); Sirajudeen (2018); Smith, Ptak and Ling (2017); Synchrono (2018); Synchrono (2019); Technopedia (2019)
Metrics	10	19%	Budd, Knizek and Tevelson (2012); Bustamanete (2017); Camelot (2019); KPMG International (2016); McKevitt (2017); Smith, Ptak and Ling (2017); Smith and Smith (2013a); Smith and Smith (2013b); Smith and Smith (2013c); Synchrono (2019)
Lean/Six Sigma/TOC	9	17%	Budd, Knizek and Tevelson (2012); Bustamanete (2017); Camelot (2019); Marris Consulting (2019); Smith, Ptak and Ling (2017); Smith and Smith (2013a); Synchrono (2018); Synchrono (2019); Syspro (2019)
Success Factors	7	13%	Baumbusch, Clothier and Notarangeli (2018); Budd, Knizek and Tevelson (2012); Eagle and Packowski (2017); Economist Intelligence Unit (2009); Hart (2016); Rutherford (2017); Sirajudeen (2018)
Trends	1	2%	Synchrono (2018)

Source: Prepared by the author

Many companies are considering and establishing actions to move forward to the DD phenomenon, for instance, SAP, Oracle, Nestlé, Procter & Gamble, Coca-Cola, PepsiCo, Philip Morris, Unilever, AB Inbev, BAT, L’Oréal, Toyota, Dell, WalMart, Dow Chemical and Nokia (ECONOMIST INTELLIGENCE UNIT, 2009; JULIANELLI, 2015; NTTDATA, 2018). Thus, this a theme that have been considered by big worldwide companies. Empirical studies show the benefits of being DD, such as, sales increases, on-time-delivery increases, lead time reduces, inventory reduces and supply chain costs reduces (BIGBANG ERP, 2018; CAILLET; XIONG; GORKEN, 2017; CAMELOT, 2019; EAGLE; PACKOWSKI, 2017; INEXMODA, 2019; MARRIS CONSULTING, 2019; MCKEVITT, 2017).

DD approach considers a full knowledge of customers preferences and their behavior (which require personalization and customization), which is becoming more challenging (CAILLET; XIONG; GORKEN, 2017; DAVIES, 2018a; MANNILA; NYHOLM, 2015;

QUEENSLAND GOVERNMENT, 2014). Customer should be divided in segments in order to better understand their needs (KPMG INTERNATIONAL, 2016). To become DD companies should accept the complexity of the phenomenon (CAMELOT, 2019; DANTAS, 2016b; PTAK; SMITH, 2018), consider flow instead of volume, establish a DD model and DD processes and use the correct flow-based metrics (SMITH; SMITH, 2013a; SYNCHRONO, 2019). It is important that the metrics be aligned among suppliers, manufactures and customers and should be supported by a coherent strategy development (MCKEVITT, 2017). The functionality of the DD phenomenon is based on demand signals instead of long-range forecasts (INTUIFLOW, 2015; JABIL, 2019; SIRAJUDEEN, 2018; SYNCHRONO, 2018).

KPMG International (2016) completes the previously argument citing that current customers are connected, informed, conscious, empowered, individual and vulnerable. Thus, companies should own the customer experience during the whole product/service life cycle, continuously adjust their operations to customers' requirements, align, integrate and collaborate in the supply chain and improve visibility, agility and flexibility. Nonetheless, senior sponsorship and executive commitment are essential for its implementation (CLOW, 2015; ECONOMIST INTELLIGENCE UNIT, 2009).

By combining the knowledge of Lean Manufacturing, Six Sigma and Theory of Constraints (TOC), companies becomes more DD, because they eliminate wastes, minimizes processes variability and understand flows and constraints in the shop-floor (LEAN AXIS, 2019; MARRIS CONSULTING, 2019; SYNCHRONO, 2019).

Real-time information (ECONOMIST INTELLIGENCE UNIT, 2009; RUTHERFORD, 2017), their availability and accuracy (CAILLET; XIONG; GORKEN, 2017) are the new requirements brought by the DD concept. Instantly and correct information allow companies to gain velocity to fulfill the demand (LEAN AXIS, 2019) by obtaining precise and online market signals (SAS, 2014).

With the right information and effectivity processes based on DD concepts, companies become able to improve their visibility, with transparency, (MCKEVITT, 2017; RUTHERFORD, 2017; SMITH; SMITH, 2013a) and their flexibility (BURNON, 2019; CAILLET; XIONG; GORKEN, 2017) to be protect from market variability (LEAN AXIS, 2019). Collaboration among partners is also important, therefore CPFR, VMI, EDI and POS data are approaches and tools to be used (JULIANELLI, 2015; KPMG INTERNATIONAL, 2016).

Demand forecasting, demand planning and demand sensing (CAILLET; XIONG; GORKEN, 2017; ECONOMIST INTELLIGENCE UNIT, 2009) should be used to understand the volatile demand, the growing risks (CLOW, 2015; DAVIES, 2018b; SIRAJUDEEN, 2018) and the quickly marketing changes (BURNON, 2019). The objective is to minimize inventories and improve service levels (BUDD; KNIZEK; TEVELSON, 2012; DAVIES, 2018b; LIVEBLOG TEAM, 2018).

Innovative and digital technologies are also contributing to the DD phenomenon, i.e., advanced statistical modeling, big data, cloud-based applications, 3D printing, predictive analytics and internet of things (IoT) (CAILLET; XIONG; GORKEN, 2017; CLOW, 2015; JULIANELLI, 2015; SIRAJUDEEN, 2018; SYNCHRONO, 2019). Traditional ERP may be considered a barrier to the DD implementation, but SAP, SabeSoft, LillyWorks, Agilis, Efficient.io, IFS and SPF are moving forward to DDMRP (CAMELOT, 2019; DANTAS, 2016a, 2016b, 2016c, 2016d, 2016e, 2017; DEMAND DRIVEN INSTITUTE, 2019a). Nonetheless, some challenges need to be dealt (MIKALSEN; LARSEN, 2018): (i) defining the network buffer is not so simple; (ii) DDMRP calculations can present risk of poor accuracy; (iii) the link between safety stock and service level is not so clear; (iv) DDMRP assumes the demand to be normal distributed, and sometimes it is not; and (v) DDMRP agree that is not based on forecast, but it relies on average historical sales (simple forecasting method).

Besides ERP, there are also add-ons applications for DDMRP, i.e., Replenishment+, Replenishment+® NS (DDMRP for NetSuite), Flowsoft, Orchestr8 Limited, The One, Bevolta, CAMELOT LEAN Suite, WA Solutions, B2Wis, DDMRP for Dynamics, DDMRP for SYSPRO, DSCP (Demand & Supply Chain Planning), Smart Buffer, Protected Flow Manufacturing™, iSimPlan and OMP Plus (CAMELOT, 2019; DEMAND DRIVEN INSTITUTE, 2019b; DYNASYS, 2018; ORCHESTR8, 2018; SYSPRO, 2019).

The S&OP is assuming an important role in the DD phenomenon. The S&OP in this phenomenon should assume a more company-outside view, aligning and coordinating partner in the supply chain. With this approach companies become more responsive to market changes (NTTDATA, 2018; SAS, 2014; SYNCHRONO, 2018).

DDMRP, an approach of the DD phenomenon, is based on decouple points definitions (LIVEBLOG TEAM, 2018; PTAK; SMITH, 2016a; SMITH; SMITH, 2013a) and put the right quantity of stock where it is needed (EAGLE; PACKOWSKI, 2017).

The concept of DD phenomenon is not applied solely to the manufacturing phenomenon. Lahy (2016) shows an application of such concept in the logistics phenomenon, specifically on distribution and inventory positioning along the supply chain.

By analyzing the definitions of DD phenomenon, seen in the practitioners' publications, is possible to divide them in four groups: (i) DD value network, (ii) DD supply chain, (iii) DD manufacturing and (iv) DD material requirements planning.

The **DD value network** can be considered a business system in the context of a supply chain (TECHNOPEDIA, 2019) that maximizes the value and mitigates the risks among the companies' stakeholder and partners and uses technologies to sense and orchestrate the demand in real-time (GARTNER, 2018).

The **DD supply chain** considers the demand signal to build the management network (BUDD; KNIZEK; TEVELSON, 2012; RUTHERFORD, 2017; SIRAJUDEEN, 2018) with processes and technologies to sense and react in real-time for customers' expectations (BUDD; KNIZEK; TEVELSON, 2012; JULIANELLI, 2015; RUTHERFORD, 2017). For that, it is important to establish the optimum type and level of inventories along the partners, to fulfill the demand even if unexpected changes arise (CAPGEMINI, 2013; HOCHFELDER, 2017). The focus should be always on the customer (CAPGEMINI, 2013). APICS (2016) presents the same concept calling by DD Supply Network, and it completes that it is the customer purchase that causes movement of product through the network.

The **DD manufacturing** is an approach that takes in consideration the actual orders than forecasts (ROUSE, 2009; SYNCHRONO, 2018, 2019). To respond effectively to the customers this practice incorporates the best of the Lean Manufacturing, Theory of Constraints (TOC) and Six Sigma principles (ROUSE, 2009; SYNCHRONO, 2019).

The **DD material requirements planning** (DDMRP) enables companies to build plans more closely to actual markets requirements (APICS, 2016, p.48). “ The DDMRP utilizes strategically determined decoupling point buffers to compress lead times and minimize the distortion to relevant information (transfer and amplification of demand signal distortion) up the supply chain and the distortion to relevant materials (supply continuity variability) down the supply chain” (SMITH; PTAK; LING, 2017, p.13). It makes part of the DD Operating Model that interacts with the DD Sales and Operations Planning. Both makes part of a major model called Demand Driven Adaptive Enterprise (SMITH; PTAK; LING, 2017). This approach minimizes inventory, simplifies forecasting and boosts productivity (DAVIES, 2018b).

It is important to notice that the DDMRP was cited in 17 publications of the 52 (33%) analyzed. It is the most supported by technologies and has a detailed framework developed by Ptak and Smith (2016).

When defining metrics, it is important to create visibility from the phenomenon (MCKEVITT, 2017). In a DD phenomenon, variability, flow (rate at which a system converts material to product), cash velocity and Return on Investments (ROI) (which does not correspond directly and solely to unit cost minimization) are the key metrics (SMITH; PTAK; LING, 2017; SMITH; SMITH, 2013a, 2013b, 2013c). ERP systems may lead to bad metrics measurement and unit costs, legislation and people should be managed when working with metrics (SMITH; SMITH, 2013c). The flow-based metrics are the mind change for the DD phenomenon (SYNCHRONO, 2019) and can be shown in a dashboards to facilitate the understanding (BUSTAMANETE, 2017). Thus, order times, stockouts, production accuracy and cross-functional and aligned related metrics inside the company and among supply chain partners (BUDD; KNIZEK; TEVELSON, 2012; KPMG INTERNATIONAL, 2016; MCKEVITT, 2017) are important approaches for metrics, but solely forecast precision is not (CAMELOT, 2019).

The DD phenomenon, and their related approaches (i.e., DD material requirement planning, DD planning, DD manufacturing, DD supply chain and DD value network), uses the body of knowledge of the Lean Manufacturing, Six Sigma, MRP and Theory of Constrains (TOC) to establish the concepts, tools and approaches to better match with customers' expectations (CAMELOT, 2019; MARRIS CONSULTING, 2019; SMITH; PTAK; LING, 2017; SYNCHRONO, 2018, 2019; SYSPRO, 2019).

By adopting Lean Manufacturing concepts, the companies become able to reduce inventory, lead time and costs and become able to increase service levels (MARRIS CONSULTING, 2019). The focus is on the waste elimination (SYSPRO, 2019), continuous improvement (BUSTAMANETE, 2017) and Kanban can be used (BUDD; KNIZEK; TEVELSON, 2012).

By adopting TOC concepts, the reliability, stability, velocity and system improvement will be improved, once the focus will be on increasing of profitability and protection and improvement of the bottlenecks (SMITH; SMITH, 2013b).

Some success factors were identified to implement and to be inserted in a DD phenomenon:

- ✓ **Coordinated processes and technologies connecting (if necessary, real-time connection) people, suppliers, customers, employees** (RUTHERFORD, 2017). For this, confidence among supply chain partners is essential (HART, 2016). Effectively S&OP can be considered a process that integrate and remove silos within and among organizations, aiding the

coordination and integration necessities, besides being considered from the product development phase (BAUMBUSCH; CLOTHIER; NOTARANGELI, 2018; ECONOMIST INTELLIGENCE UNIT, 2009; MENDES, 2011; SIRAJUDEEN, 2018). It is required, therefore, an organizational change management, with expanding the view of supply chain excellence (more considered tiers in the supply chain), a strong leadership (EAGLE; PACKOWSKI, 2017; MENDES, 2011), focus on processes based on demand sensing and shaping (ECONOMIST INTELLIGENCE UNIT, 2009; HART, 2016), change of employees' behavior (EAGLE; PACKOWSKI, 2017) and rethink of operations (BUDD; KNIZEK; TEVELSON, 2012);

- ✓ **Visibility along the process and supply chain.** Normally to create visibility companies should invest in the right technologies infrastructure (BUDD; KNIZEK; TEVELSON, 2012), define performance indicators and align them with incentives and performance goals (BUDD; KNIZEK; TEVELSON, 2012), know the customers' preferences and identify cost-saving points (BUDD; KNIZEK; TEVELSON, 2012; HART, 2016). To improve visibility, CPFR, VMI and statistical forecast can be used (MENDES, 2011). To be able to receive demand signals (from demand forecast, POS data, or other analytics source, but it has to be accurate and timely) to make anticipatory decisions is also a benefit from visibility (BAUMBUSCH; CLOTHIER; NOTARANGELI, 2018);
- ✓ **Learning functional.** It is important to learn from the past to do not commit the same errors in the future. To adopt tools and approaches that allows to have access to historical data of problems, to have files of "lessons learned" and to improve is essential for DD (BAUMBUSCH; CLOTHIER; NOTARANGELI, 2018). By learning and improving, the company will adapt in the new complex and vulnerable phenomenon (PTAK; SMITH, 2018; SMITH; PTAK; LING, 2017).
- ✓ **Optimization.** A necessity in the DD phenomenon is the optimization of process and technologies (RUTHERFORD, 2017). Advanced data analytics and multi-equation optimization are examples of tools that can be used to

deliver value to the customer (BAUMBUSCH; CLOTHIER; NOTARANGELI, 2018).

DD phenomenon will require the companies to have a transformation from the *status-quo*. Synchrono (2018) bets on top ten trends to the way for be DD:

1. **Transformation through Layered Technology:** manufacturers may take advantage from more flexible cloud technologies. The technologies should be in accordance with the Lean concepts and continuous improvement. The layered technology also supports communication and integration with the extended supply chain;
2. **Manufacturing System of Record:** normally many companies use spreadsheets to manage their largest costs, due to the inflexibility of the standard ERP package. System that does not deal solely with the transactional data, but also deals with the production flow are required to leverage up the ERP. This will allow companies to have more visibility through real-time data;
3. **The Digitized, Connected Shop Floor:** the technology should allow to collect needed data from the shop-floor in order to aid the decisions processes. Important data are collected automatically from the shop-floor and instantly can feedback the personnel about productivity, quality or another desired information / metric;
4. **Enterprise Synchronization Technologies:** the Internet of Things (IoT) applied to the industrial context can synchronize and connect equipment, processes, data and people. With this approach companies will be able to collect data from customers (real-time visibility) and take decisions about production in accordance with the customers' behavior;
5. **Strategic S&OP and Business Process Planning:** S&OP processes can be applied either to make-to-order phenomenon (making companies able to gear up potential orders) or make-to-stock phenomenon (making companies able to check and be ready for forecasts, demand and other variabilities that they may face). In a DD phenomenon the S&OP should consider long-terms planning than the traditional. The goal is to develop and compare scenarios (by using tools and models) to match supply and demand;
6. **Outsourcing:** outsourcing is a tendency of the current management approach (and it is necessary for DD phenomenon) in order to obtain agility and

flexibility, improve cost efficiency, improve operational efficiency, to increase sales, to improve time-to-market or time-to-volume by increasing internal focus capabilities;

7. **Machine Learning:** this approach will make companies able to trigger an order for preventive maintenance by collecting real-time and online data from machines (such as temperature, humidity, run rate, pressure, etc.). This allows to know more about a machine and reduce downtime incidents;
8. **Digital, DD Supply Chain:** “The goal of the Digital DD Supply Chain is to get as close to the demand signal as possible and synchronize all downstream activities and resources” (SYNCHRONO, 2018, p.14). This can be allowed by the collaboration and visibility initiatives and expanded by the cloud computing penetration in manufacturing;
9. **Robotic and Human Interaction:** researches show that in the future robots and human will work together in order to improve productivity. Robots can contribute with dangerous and repetitive work and humans with logical, intelligent and mindful work;
10. **Supply Chain Responsiveness:** supply chain should be more responsive once stock-out, variability in demand and frequent expending are the main challenge of actual supply chains. DD aids supply chains to be more responsible by lowering lead times, improving services levels and providing real-time information.

To end the practitioner’s perspective, a brief analysis of the published books is provided. Graph 2.6 presents the number of DD-related books published per year. It is noticed a constant publication, once again evidencing the interest about the theme.

Graph 2.6 – Books publications per year

Source: Prepared by the author

The main themes considered in each book are presented in the Chart 2.11.

Chart 2.11 – Practitioners’ Published books

Category	Number of Books	Percentage	Authors
DD concepts	13	72%	Chase (2013); Davis (2015); Eagles (2017); Kash and Calhoun (2011); Manning and Thorne (2003); Mendes (2011); Myerson (2018); Neves (2013); Ptak and Smith (2016); Ptak and Smith (2018); Sharma (2019); Smith and Smith (2014); Walter, Kartsounis and Carosio (2009)
S&OP for DD	3	17%	Burrows (2012); Mendes (2011); Ptak and Smith (2018)
DD supply chain	3	17%	Langabeer and Rose (2003); Mendes (2011); Sharma (2019)
DD and lean production	3	17%	Eagles (2017); Mondon (2016); Myerson (2018)
DD metrics	2	11%	Eagles (2017); Smith and Smith (2014)
DD technologies	2	11%	Sharma (2019); Walter, Kartsounis and Carosio (2009)
DD forecasting	1	6%	Chase (2013)
DD strategy	1	6%	Neves (2013)

Source: Prepared by the author

2.4 Critical analysis of the DD phenomenon, a formal definition and an organizing conceptual framework proposal

It was noticed an increasing interest of the DD phenomenon in the past years. Nonetheless, by analyzing Graphs 2.1, 2.2, 2.3 and 2.4 (scholars’ side) and Graphs 2.5 and 2.6 (practitioners’ side), it is possible to conclude that further academics researches are necessary to contribute to the new market reality. Many companies are offering consulting and technologies approaches to support this new requirement, but with an academic support by the theme, certainly successfully implementations and initiatives will increase.

In spite of the necessity of new academic’s researches, there is an alignment between the approaches dealt in the scholars’ and practitioners’ sides, regarding the demand-driven phenomenon.

Chart 2.12 presents a comparison of which technologies were studied and/or cited and or recommended by scholars and practitioners. Fifteen groups of technologies were found in the conducted research. It was perceived 47% of alignment among the technologies, i.e., both academics and scholars have considered the same technologies. The technologies that present alignment are related to collaboration, visibility, optimization, real-time information and Industry 4.0-supported approaches.

Chart 2.12 – Technologies approaches – Scholars and Practitioners

Technology	Scholars	Practitioners
3D printing	✓	✓
Advanced Planning Systems (APS)	✓	✓
Advanced Statistical Modeling / Predictive Analysis		✓
BI / Data Mining	✓	✓
Cloud-based Systems, Big Data, Internet of Things (IoT), Internet and Web-bases and Smart Manufacturing	✓	✓
Computer-aided design (CAD) / Computer-assisted manufacturing (CAM) and prototyping	✓	
DD MRP software		✓
Development Languages / (Service-Oriented Architecture) SOA	✓	
Distribution Requirements Planning (DRP)	✓	
Electronic Data Interchange (EDI) / PTX (private trading exchange) / EAI (enterprise application integration)	✓	✓
Electronic Kanban	✓	
Enterprise Resource Planning (ERP) / SAP	✓	✓
Event Management Software (EMS)	✓	
Manufacturing Execution Systems (MES)	✓	
Point-of-Sales (POS) data		
Radio Frequency Identification (RFId)		
Sensor Technologies / Electronic Product Code Information Systems (EPCIS)	✓	✓
Barcode		

Source: Prepared by the author

Chart 2.13 presents a comparison of which processes and approaches were studied and/or cited and or recommended by scholars and practitioners. Thirty groups of processes and approaches were found in the conducted research. It was perceived 53% of alignment among the processes and approaches (16 groups of processes and approaches), i.e., both academics and scholars have considered the same processes and approaches. The process and approaches that present alignment are related to demand management, capacity and buffer analysis, collaboration, integrated plans, product development, market familiarity, lean and six-sigma approaches and Industry 4.0-supported approaches.

Chart 2.13 – Processes, tools and approaches – Scholars and Practitioners

Processes and Approaches	Scholars	Practitioners
Business Process Model and Notation (BPMN)	✓	
Capable-to-Promise (CTP) and Finite Capacity Scheduling (FCS)	✓	✓
Collaborative Planning, Forecast and Replenishment (CPFR)	✓	✓
Customer Relationship Management (CRM)	✓	
Customer Segmentation	✓	✓
Demand Sensing	✓	✓
Demand Shaping	✓	✓
DD Maintenance approach		✓
DD planning and forecasting		✓

Chart 2.13 – Processes, tools and approaches – Scholars and Practitioners - *Continuation*

Processes and Approaches	Scholars	Practitioners
Dynamic Buffer Adjustment (DBA)	✓	✓
E-commerce		✓
Earlier Supplier Involvement (ESI)	✓	
Efficient Consumer Response (ECR)	✓	
Forecast value added (FVA)		✓
Global Supply Chain Forum (GSCF) Framework	✓	
Integrated Business Planning (IBP)	✓	✓
ISO standards		✓
Lean Manufacturing and Six Sigma Approaches	✓	✓
Logistics – third party-logistics (3PL), fourth party-logistics (4PL) and cross-docking	✓	✓
Manufacturing Intelligence	✓	✓
Marketing Planning	✓	✓
Material Requirements Planning (MRP)	✓	✓
Postponement	✓	✓
Product Life Cycle Management, Product Segmentation and Product Development	✓	✓
Quick Response (QR) and Automated Replenishment Programs (ARP)	✓	
Sales and Operations Planning (S&OP)	✓	✓
Supplier Relationship Management (SRM)	✓	
Supply Chain Operations Reference (SCOR)	✓	
Theory of Constraints (TOC)	✓	✓
Vendor-Managed Inventory (VMI)	✓	

Source: Prepared by the author

Besides the future research proposals presented in Chart E.1, this analysis reveals a great opportunity for future researches. Understanding the reasons of some technologies, processes and approaches are not cited simultaneously by both sides shows gaps and opportunities to be covered.

One gap to be covered is the abstinence of a unique and formal definition for the DD phenomenon. The research until this point contributed by presenting the main characteristics, approaches and considerations by scholars and practitioners. Thus, Chart 2.14 presents the definitions considered by scholars and practitioners. With the definitions presented side-by-side and with the main characteristics already cited, a proposal of a formal and unique definition was be provided.

By analyzing the scholars' definitions, the DD phenomenon should be responsive and sensitive to demand (which is more and more variable), thus it is necessary to know the end-consumption to provide customized responses. The response must be timely, rapid and cost-effective, for that visibility is essential, being achieved by the use technologies and business processes. The responsiveness, reduced inventory and flexibility is also achieved by a closer relationship and collaboration among the supply chain partners.

Chart 2.14 – Scholars' and Practitioners' DD Phenomenon Definitions

Scholars' Definitions	Practitioners' Definitions
<p>“...DD chain can be defined as a supply chain in which all actors involved are sensitive and responsive to demand information of the end customer and meet those varied and variable demands in a timely and cost-effective manner...” (VERDOUW et al., 2011, p. 365)</p> <p>“...a DD supply network as a system of technologies and business processes that sense and respond to demand signals in real-time, through a network of customers, suppliers, and employees.” (FRISCIA et al., 2009 apud MENDES; LEAL; THOMÉ, 2016, p. 154)</p> <p>“The DD model focuses on responsiveness and flexibility realized by small quantities, flexible equipment and labor pools...” (GRANDZOL; GRANDZOL, 2018, p.6), “...DD characteristics to respond to changes in the market...” (GRANDZOL; GRANDZOL, 2018, p.7) “...DD phenomenon requires examining issues that constrain this reaction time.” (GRANDZOL; GRANDZOL, 2018, p.7)</p> <p>DD is “the use of end-consumption to make supply-chain decisions.” (AYERS, 2006, p.21)</p> <p>“In a DD supply chain, all actors involved are sensitive and responsive to demand information of the ultimate consumer and meet those varied and variable demands in a timely and cost-effective manner.” (VERDOUW et al., 2010, p.174)</p> <p>“The ... DD Supply Chain (DDSC) ... is to realize rapid and customized response to customer demand.” (MOHAMMADI; MUKHTAR, 2012, p.21)</p> <p>“DD strategies rely on fast turnover cycles, low inventories and quick response of the supply network, as well as real visibility across the supply chain”. (CASSIVI et al., 2004, p.92)</p> <p>DD is about “encouraging the development of close relationships between partners, a supply network makes sure that only products and services corresponding to customers’ demands will be produced”. (HADAYA; CASSIVI, 2007, p.954)</p> <p>“The DD phenomenon requires companies to be flexible and DD supply chain is the supply chain that has the capacity to share real-time information with the supply chain’s participants” (BOZUTTI; ESPOSTO, 2019, p.30, 31)</p>	<p>DD is “...a system of coordinated processes and technologies that senses and reacts to real-time demand signals across a network of suppliers, employees and patients”. (RUTHERFORD, 2017, n.p.)</p> <p>The “DD material requirement planning is a method for planning material needs that enables a company to build more closely to actual market requirements.” (APICS, 2016, p. 48)</p> <p>The “DD supply network is a situation in which a customer purchase initiates real-time information flow through the supply chain that consequently cause movement of product through the network.” (APICS, 2016, p. 48).</p> <p>DD MRP “is a model which helps increase the competitive advantage for companies in the manufacturing sector by managing both the production and the time it takes items to reach the customer.” (DAVIES, 2018b, n.p.)</p> <p>“The DD supply network is a system of technology and processes that allows to capture and react, in real-time, to demand through a relationship network among employees, customers and suppliers.” (JULIANELLI, 2015, n.p.)</p> <p>“DD manufacturing (DDM) is an approach to manufacturing where production is based on actual orders rather than forecasts. DDM is also referred to as flow-driven manufacturing (FDM) or just-in-time (JIT) manufacturing.” (ROUSE, 2009, n.p.)</p> <p>“Create a pull supply chain driven by consumer demand. A DD Supply Chain enables a “pull” business model where all supply chain activities are focused around consumer or shopper demand. With this approach, retailers and consumer products companies can better read and react to actual customer purchases, thereby achieving more accuracy in assortments, more control.” (CAPGEMINI, 2013, n.p.)</p> <p>“DD value network (DDVN) is a business phenomenon holistically designed to maximize value of and optimize risk across the set of extended supply chain processes and technologies that senses and orchestrates demand based on a near-zero-latency demand signal across multiple networks of corporate stakeholders and trading partners.” (GARTNER, 2018, n.p.)</p> <p>“A DD value network (DDVN) is a business system that directs the overall activities of a supply chain in context or one that offers ultra-efficient sourcing for an enterprise.” (TECHNOPEDIA, 2019, n.p.)</p> <p>“A DD value network (DDVN) is a business system that directs the overall activities of a supply chain in context or one that offers ultra-efficient sourcing for an enterprise.” (BUDD; KNIZEK; TEVELSON, 2012, p.2)</p>

Chart 2.14 – Scholars’ and Practitioners’ DD Phenomenon Definitions – *Continuation*

Scholars' Definitions	Practitioners' Definitions
	<p>“DD supply chain is a system of coordinated technologies and processes that senses and reacts to real-time demand signals across a network of customer, suppliers and employees.” (BUDD; KNIZEK; TEVELSON, 2012, p.3)</p> <p>“a DD supply chain offers real-time information on demand and inventory levels to all supply chain participants, so that they can react quickly and effectively when unexpected changes arise.” (HOCHFELDER, 2017, n.p.)</p> <p>“DD Manufacturing is a method of manufacturing primarily used by discrete, custom manufacturers, where production is based on actual demand (orders or consumption) rather than a forecast. This is enabled through a synchronized, closed-loop process between customer orders, production scheduling and manufacturing execution - all while simultaneously coordinating the flow of materials and resources across the supply chain. The key components of DD Manufacturing are synchronization and flow.” (SYNCHRONO, 2018, p. 3)</p> <p>“A DD Supply Chain (DDSC) is defined as a supply chain management method focused on building supply chains in response to demand signals. The main force of DDSC is that it is driven by customer demand.” (SIRAJUDEEN, 2018, n.p.)</p> <p>“DD Manufacturing as a method that incorporates the best of Lean Manufacturing, Theory of Constraints (TOC) and Six Sigma principles. It describes production that is based on actual customer demand with an aim of synchronizing everything (people, method, materials, machines, and information) in order to drive flow. This process is accelerated by technology that automates, digitizes data and connects every function within the DD organization and to every layer of the supply chain.” (SYNCHRONO, 2019, n.p.)</p>

Source: Prepared by the author

By analyzing the practitioners’ definitions, it is noticed complementary to the scholars’ definitions, with alignment of concepts. DD phenomenon, for the practitioners, also should sense and react to real-time demand, using real-time information supported by effective and efficient processes and technologies. The DD phenomenon is inserted in the supply chain context, so internal and external integration and collaboration are requirements for the successfully results. In this sense, by a flow-driven approach and synchronization, companies become able to be closer to actual market requirements and effectively respond to unexpected market changes. In order to achieve flexibility, responsiveness, agility and cost reduction, the

lean production and TOC approaches can be use, resulting also on risks mitigation and increasing of competitiveness.

Considering the provided definitions analysis and considering the prior performed analysis (from scholars and practitioners), a definition of the DD phenomenon is provided:

The DD is a phenomenon that requires the companies to have flexibility, agility, velocity and cost-efficiency. Companies needs to have access to real-time information and know the actual demand to understanding the real customers' expectative, thus processes, technologies, metrics and people should be involved to achieve companies' internal and external integration and collaboration to offer the right product and service timely, precisely and costly-efficient. Visibility and cultural change management are essential attributes that allow companies to survive in this new challenge phenomenon.

Additionally, to contribute to the body-of-knowledge of this new phenomenon, Figure 2.6 presents the suggested organizing conceptual framework for the DD phenomenon. The framework was developed considering the whole conducted research and considering both scholars' and practitioners' perspective.

Figure 2.6 – Organizing Conceptual Framework for the Demand-Driven Phenomenon

Source: Prepared by the author

By interpreting Figure 2.6, the framework proposes that the DD phenomenon considers the current complex and turbulent business environment. This point was fully explored by both scholars and practitioners.

All actions, definitions, processes, technologies and changes (shown at the top of the framework) should be guided by the necessity of flexibility, agility, traceability and cost-effectiveness; because of that, these competitiveness dimensions were considered in the top of the framework, suggesting also the necessity of being integrated and considered in the strategic perspective of the companies. To monitor and control such performance, metrics and KPI's must be defined.

At the bottom of the framework, it is possible to find the processes, tools, technologies and approaches. The criteria to consider the processes, tools, technologies and approaches were: (i) considered by both scholars and practitioners and (ii) presence of empirical data in the publications. The assumption of this criteria was to increase the robustness of the framework. Nonetheless, companies should choose and consider the applicable process and technologies, depending on their necessities. The most important is that such choices must allow a collaborative and integrative approach among the supply chain partners, supported by cultural changes.

At the center of the framework was considered the participants of the demand-driven phenomenon. It is possible to infer based on the framework that the focus must be on the final customers and companies need to have visibility about their requirements. Real-time information should be shared among the companies and such companies should be integrated by the considered processes, tools, technologies and approaches, and should be guided by the competitiveness dimensions of flexibility, agility, velocity, traceability and cost-effective.

A NEW UNDERSTANDING ABOUT THE SALES AND OPERATIONS PLANNING PROCESS

This chapter has the aim of presenting an updated understanding about the Sales and Operations Planning (S&OP) process, considering a systematic literature review. To guide the analyses, nine dimensions of competitiveness were considered, i.e., flexibility, responsivity, adaptability, visibility, velocity, agility, demand variability, demand variety and customer centricity. To have a complete understanding, the traditional S&OP process was presented and other three new approaches for the S&OP process were presented too. Thus, this chapter is organized in six sections: Section 3.1 presenting the considered method to conduct the systematic literature review, Section 3.2 presenting the traditional approach for the S&OP process, Section 3.3 presenting the findings from the systematic literature review, Section 3.4 presenting the new challenges for the S&OP process, Section 3.5 presenting new paths proposal for the S&OP process and, finally, Section 3.6 presenting approaches from practitioners for the S&OP process, considering the DD phenomenon.

3.1 Adopted Method for the Systematic Literature Review

To obtain a consistent understanding of the Sales and Operations Planning (S&OP) in the new business environment, a systematic literature review was conducted. A systematic literature review allows researchers, considering the interest, to identify, to transparently evaluate and to critically interpret all available and relevant research (KITCHENHAM, 2004; ROUSSEAU; MANNING; DENYER, 2008). To guide the research, it was used the approach suggested by Denyer and Tranfield (2009), as represented in Figure 3.1.

It is important to formalize the conducted steps in the systematic literature review in order to make researches and scholars able to evaluate the current research, to provide improvements and to continue the research by eliminating its gaps (FULMER, 2012). Considering this importance, a formalization of the steps was provided, as follow.

In **step 1** was formulated the research question, which is:

“What are the characteristics, approaches, frameworks and models for the Sales and Operations Planning considering the new environment requirements of flexibility,

responsivity, adaptability, visibility, velocity, agility, demand variability, demand variety and customer centricity?”

Figure 3.1 – Steps to conduct the systematic literature review

Source: Adapted from Denyer and Tranfield (2009)

The question was defined considering a prior scope studying, as suggested by Denyer and Tranfield (2009). The competitiveness dimensions were defined based on the new market requirements which companies need to deal with. The SCOR model considers responsiveness and agility in their reference model (APICS / ASCM, 2017) and many recent publications consider flexibility and velocity (Ganji et al., 2018, 2017; Martinelli and Tunisini, 2018; Farahani et al., 2014; Brown, 2012; Dreyer et al., 2008; Hadaya and Cassivi, 2007; Makatsoris and Chang, 2004). Lambert (2009) and Lambert and Cooper (2000) consider the focus of a company is to meet demand, thus demand variety, demand variability and customer-centricity were identified. Because of the increasing complexity of the business environment, and explored by Ptak and Smith (2018), the adaptability and visibility dimensions were defined. Thus, by combining these references, the research question considered the above-mentioned nine competitiveness dimensions, once they represent the new requirements for companies (VERDOUW et al. 2011; GRANDZOL; GRANDZOL, 2018; CASSIVI et al., 2004; HADAYA; CASSIVI, 2007; BOZUTTI; ESPOSTO 2019; RUTHERFORD, 2017; DAVIES, 2018; JULIANELLI, 2015; GARTNER, 2018; BUDD; KNIZEK; TEVELSON, 2012; SIRAJUDEEN, 2018; VERDOUW et al. 2010).

It is important to notice that

- ✓ **Responsiveness** “refers to the promptness with which an organization or supply chain provides products and services to customer” (APICS, 2016, p. 160);

- ✓ **Agility** “is the ability to quickly plan, source, make and deliver to adapt and respond to changes in the competitive environment” (APICS, 2016, p.6);
- ✓ **Flexibility** “is the ability of the manufacturing to respond quickly, in terms of range and time, to external or internal changes” (APICS, 2016, p.70);
- ✓ **Velocity** “is the relative speed of all transactions, collectively, within a supply chain community” (APICS, 2016, p.198);
- ✓ **Adaptability** “is the ability of a system to change the parameters of response to a measured change in the operating condition” (APICS, 2016, p.4);
- ✓ **Visibility** “is the transparency obtained with shared information throughout the supply chain” (APICS, 2016, p.184);
- ✓ **Demand variety** refers to the number of different products offered to the market;
- ✓ **Demand variability** refers to the changes of the demand during a period; and
- ✓ **Customer-centricity** refers to all efforts of a company or supply chain to meet to the customers’ expectation.

In **step 2** the search terms were defined. An exploratory literature review was prior performed to define the research strings. The research strings were also validated by other two researchers (these researchers have experience and have already developed researches and/or worked in companies considering the studied theme). Thus, the relevant search terms and Boolean operators were defined. The details (strings, filters and relevant information) are presented in Chart 3.1. The considered period of analysis was 20 years, i.e., publications from 1999 to 2019. This period was defined considering a prior scope studying and because of the evidence of the theme during the closer past years; the new necessities for the S&OP is a current issue, because of that older studies would not contribute with the research.

Chart 3.1 – Research’s parameters and relevant information

Strings	"Sales and Operations Planning" or "Sales & Operations Planning" or "S&OP" not "S OP"
EBSCO host	Research date: March of 2019
	Research bases: Business Source Complete, Academic Search Complete, Computers & Applied Sciences Complete, EconLit with Full Text, PsycINFO, Education Source, Entrepreneurial Studies Source, ERIC, CINAHL Plus with Full Text, Psychology and Behavioral Sciences Collection
	Research period: from 1999 to 2019 (range of 20 years)
	Other relevant filters: Scholarly (Peer Reviewed) Journals and Academic Journal
	Total of publications: 191
Emerald	Research date: March of 2019
	Research bases: N/A
	Research period: from 1999 to 2019 (range of 20 years)
	Other relevant filters: N/A
	Total of publications: 68

Chart 3.1 – Research’s parameters and relevant information – *Continuation*

Scopus	Research date: March of 2019
	Research bases: Engineering, Computer Science, Business, Management and Accounting, Social Sciences, Decision Sciences, Environmental Science, Economics, Econometrics and Finances
	Research period: from 1999 to 2019 (range of 20 years)
	Other relevant filters: Article, Conference Paper and Review
	Total of publications: 388
ScienceDirect	Research date: March of 2019
	Research bases: N/A
	Research period: from 1999 to 2019 (range of 20 years)
	Other relevant filters: Review Articles and Research Articles
Web of Science	Research date: March of 2019
	Research bases: Engineering, Business Economics, Mathematics, Computer Science and Science Technology Other Topics
	Research period: from 1999 to 2019 (range of 20 years)
	Other relevant filters: Article and Review
ABI/Inform (ProQuest)	Research date: March of 2019
	Research bases: N/A
	Research period: from 1999 to 2019 (range of 20 years)
	Other relevant filters: Scholarly Journal, Full Text and Peer Reviewed (article, case study and review)
	Total of papers: 176

Source: Prepared by the author

With the aim of providing a complete understanding of the new requirements for the sales and operations planning, in **step 3** a research was performed considering the following research tools: EBSCO host, Emerald, Scopus, ScienceDirect, Web of Science and ABI/Inform (ProQuest).

The research tools were defined considered also an exploratory literature review (considering papers that conducted systematic literature reviews similar with the theme). The number of returned publications by research tool are also presented in Chart 1.

The used strings were “Sales and Operations Planning”, “Sales & Operations Planning” (the change of “and” to “&” has broaden the results) and “S&OP”; these terms could appear in any part of the paper, not restrict to the title, abstract or keywords. This assumption was important to not exclude any relevant paper. It was not considered papers that presented the term “S OP”; this consideration was adopted, because Thomé et al. (2012b), in a S&OP systematic literature review conducted in 2012, verified that when this exclusion is not included, the search returns papers in the field of chemistry.

Finally, this string definition approach was adopted to not limit the results and to be sufficiently broad to have the desirable results (COOPER, 2010).

In the first screening, a carefully read of the title, abstract and keywords of the publications was conducted. The result of this first screening was the exclusion of 194 papers, because they dealt strictly with algorithms development/assessment, simulation approaches, heuristics development and other mathematical programming that were not included in the objective of this research. The first screening also excluded 310 papers, because they do not deal with adherent themes with the research proposal. The total excluded papers in the first screening was 504. The high level of exclusion in this first screening (64,8%) was expected because of the strings broadness to not limit the research and because of the search terms was not limited to title, abstract and keywords. It is important to notice that not limiting the search terms to title, abstract and keywords in the search tools has made possible to include 105 papers in this first screening, making the research more confident.

In the second screening a carefully reading of the title, abstract, keywords, introduction and conclusion of the papers was performed. It was also performed a search in the papers if they deal with the competitiveness dimensions considered in the research questions. In this second screening a total of 180 papers was excluded, because they did not presented findings about the competitiveness dimensions considered in the research question.

In the third screening a carefully reading of the full papers was performed. This full reading considered the 94 remaining papers. In this third screening, a total of 24 papers were excluded, because they did not present and/or discussed the competitiveness dimensions for the S&OP, as expected by the research question. Seven additional publications from grey literature were considered; these publications were found in the Google® research tool and by the researchers' expertise about the theme. These publications were included because they present new frameworks for the S&OP process or new characteristics that the S&OP process should have to respond adequately to the new business environment. Thus, a total of 77 publications were considered in this systematic literature review. The details of **step 3** are presented in Figure 3.2.

For **step 4** each competitiveness dimension was analyzed separately and, posteriorly, an integrated finding was provided. This approach was adopted to have a fully understand of each perspective without they interfere themselves.

For **step 5** the research question was answered considered the analyses presented in the **step 4**.

Prior to the systematic literature review analysis be presented, in Section 3.2 is presented the traditional Sales and Operations Planning process. The results of the systematic review are presented in Section 3.3 and the analyses are presented the Sections 3.4 and 3.5.

Figure 3.2 – Details of the screening publications process in the Step 3

Source: Prepared by the author

3.2 The S&OP traditional approach

With the aim of creating an understating of the S&OP, this section was divided in two subsections, which are:

- ✓ Sales and Operation Planning concepts: describing the newest concepts and main terms used in S&OP;
- ✓ Sales and Operation Planning process: describing the traditional S&OP planning process.

3.2.1 The S&OP traditional concepts

The S&OP is a tactical planning process, executed on monthly-basis and led by senior management (PEDROSO; SILVA, 2015; WALLACE, 2012) with the aim of balancing demand, production, distribution, procurement and finance to ensure the plans and performance are aligned to support the business strategic plan (APICS, 2016; FENG; D'AMOURS;

BEAUREGARD, 2008). It could be considered the “steering wheel” for a company’s business, thus planners must driving down to the strategic road to match the supply-demand plans (LAPIDE, 2009). In this sense, the main role of S&OP is to maintain the balance between supply and demand and, in case of misbalancing, provides proper warnings for contingency plans (VOLLMANN et al., 2005) while help the organization to overcome the silo effect, i.e., departments with individuals goals (SWAIM et al., 2016).

Additionally, other S&OP objectives can be found in the literature (PEDROSO; SILVA, 2015):

- ✓ To elaborate operational plans and the company performance;
- ✓ To evaluate the company’s performance on a continuous base;
- ✓ To align the company goals with the operational performance;
- ✓ To contribute with the strategic planning of the company;
- ✓ To guarantee the changes are done correctly;
- ✓ To promote a consistent customer service;
- ✓ To elevate workgroup;
- ✓ To link different plans and function present in the company;
- ✓ To offer consensus in decisions.

The main outputs of S&OP are (APICS, 2006, p.5-31)

- ✓ Sales plan;
- ✓ Production plan;
- ✓ Inventory plan;
- ✓ Backlog plan;
- ✓ Financial plan;
- ✓ Product and process development plan;
- ✓ Workforce plan.

Swaim et al. (2016) conducted a survey with 2690 respondents of United States and Canada and concluded to have an effective S&OP process the organizational integration positively influences to have a standardized S&OP process, and S&OP process and S&OP prioritization positively influences to S&OP engagement.

Gray and Dougherty (2017) also cite that is not need sophisticated technology tools to conduct the S&OP. In some case, spreadsheets developed to companies’ needs is enough. The most important is all information to make decisions be timely available and easily visible.

Until 1950's S&OP was not known by its denomination. Companies used to plan with the Aggregate Production Planning (APP). By mid-1980's the evolution was to Manufacturing Resources Planning (MRP-II). Currently, S&OP concept considers a business process with the aim of aligning sales, operations, development and financial (THOMÉ et al., 2012a).

Although, in practice is possible to find many definitions to S&OP and it is important to have a process well-defined (MCCOLLUM, 2011). In this thesis was adopted the American Production and Inventory Control Society (APICS) definition for S&OP; this definition considers a synthesis of the main definitions of this process (considering both scholars' and practitioners' side). APICS is a global and professional association for operations and SCM and a provider of research, education and certification programs, that involves academics and industry practitioners of SCM. According to APICS Dictionary, 15th Edition (APICS, 2016, p.164), the definition of S&OP is:

“a process to develop tactical plans that provide management the ability to strategically direct its business to achieve competitive advantage on a continuous basis by integrating customer-focused marketing plans for new and existing products with the management of 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.”

S&OP should be a collaborative process (BOWER, 2015a) and considering the definition prior described, it is noticed the importance of integrating marketing and manufacturing. This is not a new issue. Shapiro (1977) addresses this issue considering the different point of views existing in these two areas. The author pointed the market perception of lack of production customer-orientation focus and the manufacturing perception of lack of marketing costs, profit and operations orientation. He concluded that a good beginning to minimize this conflict is to have a development and promulgation of clear corporate policies.

APICS (2006) affirms that the business planning process provides S&OP with the companies and market needs. The functional areas, normally, has no integration and no cooperation, thus the S&OP process should make the plans come together. This is illustrated in Figure 3.3. A pre-requisite of the success to have all plans together is the clear, efficient and transparent communication among the functional areas (STORELLI, 2015).

In addition, and in accordance with Shapiro (1977), APICS (2006) and APICS (2016) consider S&OP more than a simple module of the MRP-II. The authors cite that S&OP

establishes three strategy levels: corporate, business and functional strategies. Going down to functional strategy, the competitive objectives should be defined, this is, costs, quality, velocity, reliability and flexibility. During such definition is essential to have a consistency of the functional strategies.

Figure 3.3 – S&OP – An Integrated Companywide Plan

Source: Adapted from APICS (2006)

The consistency of functional strategies could be divided in horizontal and vertical, as shown in Figure 3.4.

Figure 3.4 – S&OP Horizontal and Vertical Consistencies

Source: Adapted from Corrêa, Giansesi and Caon (2007) and Corrêa and Corrêa (2017)

The horizontal consistency refers to the alignment of the functional areas in determining their competitive objectives and the vertical consistency refers to the correct downsizing from the strategy through policies to the decisions in each functional area

(CORRÊA; CORRÊA, 2017; CORRÊA; GIANESI; CAON, 2007; PEDROSO; SILVA, 2015). When these consistencies exist, the probability to answer better to customer needs increases.

Pagell (2004) conducted a research whose aim was to determine the drivers of operations, purchasing and logistics integration, which are also an objective of S&OP. The author found the following drivers:

- ✓ **Structure:** centralized structure could have a positive participation for integration. Structure should enable the flow of information and be fitted to the flow of goods and services;
- ✓ **Culture:** when a problem comes up is necessary to find its root cause and not the areas blaming each other. Culture must encourage teamwork, flow of information and openness;
- ✓ **Communication:** both flow of goods and information are important to manage supply chains, communication plays an important role for the information flow. Besides the formal and possible computerized information (bar code, e-mails, paperless approaches, etc.) the face-to-face interaction and informal communication must be taken in consideration;
- ✓ **Measurement and rewards** as known, there are linkages among measurement, rewards and performance. In this situation is important to not have conflicting goals among the areas. Conflicting goals lead to lack of integration;
- ✓ **Consensus:** this item is difficult to find in the practice, because the functional areas have different goals, thus their actions will not be in consensus. To have consensus among the areas is necessary to have a well-defined business strategy and this strategy should be aligned among all involved;
- ✓ **Plant size:** although the plant size could influence the level of integration by intuition, the conducted study did not find any evidence of this affirmation. Theoretically, in small companies is easier to reach integration once the number of employees and the organizational hierarchy is less complex.

The necessity of integration could be expanded from internal integration of a company to integration among companies in a supply chain scenario. Thus, in this competitiveness scenario among companies, they cannot be dealt as isolated entities without relationships (LAMBERT; COOPER, 2000b). Considering this, companies cannot compete efficiently being isolated, thus while planning should be considered as part of a unique system (LUMMUS; VOKURKA, 1999) and the S&OP planner should take it in consideration.

Many factors make the Supply Chain Management (SCM) challenging (SIMCHI-LEVI; KAMINSKI; SIMCHI-LEVI, 2003):

- ✓ The SCM takes in consideration that each factory has an impact on costs and has a fundamental role to make the products in accordance to the customer needs;
- ✓ The SCM aim is to be efficient considering the system as a whole. It is necessary to have a global, and not a local, view, taking the benefits of a systemic view;
- ✓ Because of the SCM consideration of an efficient integration between the players in a supply chain, it is necessary to take in consideration the different management levels, from strategic to operation (at this point, the S&OP has a fundamental role).

The traditional S&OP configuration (that of running periodic, multi-functional planning meetings) should not change, but should consider the increased supply chain uncertainties (LAPIDE, 2009). The same author describes five target points to take in consideration for the new S&OP scenario:

- ✓ Supply-side planners must improve their communication with Sales and Market;
- ✓ Rely more on downstream information, to detect more effectively changes in product consumption;
- ✓ Better understanding on the economy impacts on demand;
- ✓ Focus on products and markets segments to minimize the demand uncertainties;
- ✓ Utilize more formal risk management strategies as the supply-demand risks increase.

To identify if the S&OP process is with problems and not running properly, Schneider (2014) proposes a brief checklist, as follow:

- ✓ Top management supports the process in name only;
- ✓ The financial forecast is not derived from the S&OP forecast;
- ✓ Attendance is lacking or discussion during the meetings is stagnant;
- ✓ Metrics are not improving despite the efforts.

3.2.2 The Sales and Operations Planning (S&OP) processes

As prior described, S&OP is a process, executed on monthly-basis and led by senior management with the aim of balancing demand, production, distribution, procurement and finance. One of the first difficulties in this process is the participation; scheduling time of all senior management could be arduous, but it is essential to the success of the process (SCHNEIDER, 2013a). Schneider (2013a) also completes citing that the meeting will take from one to two hours (depending on the phase) and must happens at least monthly.

Prior to begin the S&OP process is a pre-requisite to have all leaders of functional areas involved. The people should not have de perception that the S&OP preparation work and meetings are an “extra-work”, but it is a fundamental process to achieve customer needs (SCHNEIDER, 2013a).

The S&OP process could be divided in five steps (APICS, 2006; SCHNEIDER, 2013a; WALLACE; STAHL, 2008). The steps are illustrated in Figure 3.5 and next described.

Figure 3.5 – The S&OP-five-step process

Source: Adapted from APICS (2006) and Wallace and Stahl (2008)

The first step is to run the sales forecast reports. Normally this activity occurs at the end of the month and is executed in the information system department. It consists of three elements (APICS, 2006):

- ✓ Updating the file with data from the ended month (inventories, production, backlog, etc.);
- ✓ Generating information for sales and marketing personnel to support the forecasting development;
- ✓ Divulging the information to the appropriate people.

It is important to notice that is not good if the sales be superior than the planned, because production would not have capacity to produce this excess or future sales orders could be compromised. For someone, it is difficult to understand this, because the company must sell. The sales quantity must be next to the planned quantity, if this not occurs the root cause of the deviation must be analyzed (WALLACE, 2012).

The second step is the demand planning phase. In this phase, sales and marketing personnel review the information received from the first step. The aim of the second step is to update the existing forecast or generate new forecast. The forecast must include all product families and any product life-cycle phase changes.

In this step is generated a sales plan. Once the available resources are limited, it is important to prioritize markets, thus the sales plan should reflect the strategical positioning of the company in the market (WALLACE; STAHL, 2008).

Schneider (2013a) proposes that the two first steps lasts about seven days. The first two days are spent on data preparation. On the third day team members gather field intelligence, for that is important the salespeople be closer the customer. On the seventh day, a demand meeting takes place to analyze the demand forecasts and analysis; this meeting must have the participation of the higher-level managers from sales. Important to notice that the output of this meeting is an unconstrained forecast.

In the third step the operations personnel review the output from the second step. In this phase plans must be validated or changed against the availability of supply resources, using the resource planning. The supply resource should be understood as the resources necessary to produce and distribute the goods and includes materials, personnel, machines and distribution modals. In this steps is proposed a projection of inventory/production that satisfies the sales plan and production capacity restrictions (WALLACE; STAHL, 2008).

This third step lasts from the eleventh day through the fifteenth day. The master scheduler normally is the facilitator of this step. As prior described, this process identifies any potential constraints with machinery, people, or suppliers and develop a supply plan and countermeasures (SCHNEIDER, 2013a).

The objectives of the fourth step, this is the pre-sales and operations plan meeting, are (APICS, 2006):

- ✓ Decide about the balancing of supply and demand;
- ✓ Resolve problems and differences among the functional areas;
- ✓ Identify the areas where agreement cannot be reached;

- ✓ Develop scenarios to propose alternatives of actions to solve a given problem.

Decision-makers of all functional areas (sales, marketing, product development, finance and operations) must participate in this step. Their job is to check resources constraints, establish priorities and review the demand and supply plans of all product families (WALLACE; STAHL, 2008). The comparison of the actual versus planned performance should be done.

The outputs of this step are (WALLACE; STAHL, 2008):

- ✓ Financial plan updated;
- ✓ Action plan for each product family;
- ✓ Plans for new product introduction;
- ✓ Resource plan changes recommendations;
- ✓ Scenarios and impacts for areas where agreement could not be reached;
- ✓ Recommendations changes to demand and supply strategies;
- ✓ Agenda for the executive S&OP meeting.

This meeting normally occurs on the sixteenth day of the S&OP process. This meeting should last from two to three hours and must be faced as a working session. The leaders' participation is essential and they must feel ownership of the process, by collecting feedback and to make the gathering more effective (SCHNEIDER, 2013a).

The fifth step is considered the main event of the monthly S&OP process, whose objectives are (APICS, 2006):

- ✓ To make decisions on each product family, considering the outputs of the fourth step;
- ✓ To authorize changes in the rates of production and procurement;
- ✓ To compare the production plans to the business plan in financial terms;
- ✓ To make decisions where there is not agreement, as expected in the fourth step;
- ✓ To review business key performance indicators and follow up on areas where is having lack of performance.

The output of this fifth step is an authorized companywide plan which has the meeting minutes, summary of the decisions, summarized action plan with due dates and responsibilities and the complete production plan for each product family (APICS, 2006). At the end of the all five-step S&OP process, operations will have (APICS, 2006):

- ✓ The production plan (for manufactured product families);
- ✓ The purchase plan (for purchased product families);

- ✓ The inventory plan (for make-to-stock product families); and
- ✓ The backlog plan (form make-to-order families).

Schneider (2013a) and Bower (2015b) show the importance of the participation of the president or CEO of the organization to lead this last meeting. The duration of this meeting is from one to two hours and occurs normally on the eighteenth day. In addition, (SCHNEIDER, 2013b) lists six rules that never been broken to have success in a S&OP process:

- ✓ The president or chief executive officer (CEO) should own the S&OP process;
- ✓ All participants must take meeting attendance seriously;
- ✓ Promote a team environment, but encourage healthy debate;
- ✓ Supply does not change the forecast;
- ✓ Perform a kaizen event on the S&OP process at least twice a year;
- ✓ Use an action item list to keep people accountable and ensure what gets measured gets done.

To the entire process be well-succeed is necessary to establish an agenda that is followed by all people involved. Considering mainly the fourth and fifth steps, the following topics should be covered during the meetings (BOWER, 2016):

- ✓ Agenda review;
- ✓ Review of open items;
- ✓ Key Performance Indicators (KPI) analysis;
- ✓ Plan assumptions;
- ✓ Plan conversation;
- ✓ Plan approval;
- ✓ Other relevant topics;
- ✓ Executive sponsor comments and questions;
- ✓ Next steps and action items; and
- ✓ Process recap.

3.3 Findings from the Systematic Literature Review

The interest about S&OP has increased in the past twenty years. Graph 3.1 shows the number of publications per year and it is possible to infer the trend of publications increasing. Graph 3.1 considers the total of papers returned (with no duplications) considering the assumptions presented in Chart 3.1. It is also important to notice that the year of 2019 has solely 32 publications, but the research considered publications until March of 2019.

The 77 papers considered in this systematic literature review also show an increased interest about the S&OP for the challenges of the current competitiveness environment, i.e., necessity of flexibility, responsiveness, adaptability, visibility, velocity, agility, demand variability, demand variety and customer centricity. This trend is represented in Graph 3.2. It is also important to notice that the year of 2019 has solely 2 publications, but the research considered publications until March of 2019.

Graph 3.1 – Publications per year about S&OP (from 1999 to march-2019)

Source: Prepared by the author

Graph 3.2 – Publications per year about S&OP considering the competitiveness dimensions (from 1999 to march-2019)

Source: Prepared by the author

Besides the considered interest about the theme, it is perceived that there is opportunity of research. Graph 3.3 compares the number of publications considering the research question and the total of publications, considering the assumptions of Chart 3.1 and Figure 3.2.

Graph 3.3 – Comparison between the total of publications about S&OP and the S&OP approaches for the competitiveness dimensions

Source: Prepared by the author

It is possible to infer from Graph 3.3 that the publications considering the research question have gaining importance and participation among the total of publication, but there is a great opportunity of research, i.e., a gap that is represented by the green arrow in Graph 3.3.

Chart 3.2 shows the source of the publications. It is possible to infer from Chart 3.2 that 56% of the considered papers were published in academic journals. It is also important to notice that the theme have been published in relevant journals, such as, Journal of Operations Management, International Journal of Production Economics, Supply Chain Management: An International Journal, International Journal of Physical Distribution & Logistics Management and Industrial Marketing Management. This confirms the importance and relevance of the studied subject. The other 44% were published by practitioners, i.e., journals that does not apply a double-blind-review approach for publications, conference proceedings, books and white papers. The seven papers included from grey literature are books and publishing from Gartner, Supply Chain Insights LLC, BristleCone: Your Supply Chain Optimized and Industry Value Chain Strategies. These seven publications were considered because they present frameworks and approaches that enrich the further analyses that were presented, and the search tools did not return them.

Chart 3.2 – S&OP publication sources and relevant information

Type	%	Source	Authors	Quantity	%	Cumulative %	Impact Factor ⁶
Scholar	56%	International Journal of Physical Distribution & Logistics Management	Dreyer et al. (2018); Goh and Eldridge, (2015); Ivert et al. (2015b); Jonsson and Holmström (2016); Kristensen and Jonsson (2018); Nakano (2009); Thomas et al. (2011); Walters (2008)	8	19%	19%	4,215
		International Journal of Operations & Production Management	Godsell et al. (2018); Ivert and Jonsson (2014); Turner, Aitken and Bozarth (2018)	3	7%	26%	2,955
		International Journal of Production Economics	Noroozi and Wikner (2017); Thomé et al. (2012b); Tuomikangas and Kaipia (2014)	3	7%	33%	4,407
		International Journal of Production Research	Danese, Molinaro and Romano (2018); Tarafdar and Qrunfleh (2017); Thomé, Sousa and Scavarda (2014)	3	7%	40%	2,623
		Industrial Management & Data Systems	Ivert and Jonsson (2010); Swaim et al. (2016)	2	5%	44%	2,948
		Journal of Operations Management	Kaipia et al. (2017); Oliva and Watson (2011)	2	5%	49%	4,899
		Manufacturing Engineer	Kruse (2004) and Ross (2004)	2	5%	53%	-
		Supply Chain Management: An International Journal	Godsell, Birtwistle and Van Hoek (2010); Jonsson, Rudberg and Holmberg (2013)	2	5%	58%	3,833
		Business Horizons	Wagner, Ullrich and Transchel (2014)	1	2%	60%	-
		Computers in Industry	Nielsen, Nielsen and Steger-Jensen (2010)	1	2%	63%	2,850
		Industrial Marketing Management	Storbacka (2011)	1	2%	65%	3,678
		International Journal of Health Care Quality Assurance	Larsson and Fredriksson (2019)	1	2%	67%	-
		International Journal of Information Technology & Decision Making	Chae and Olson (2013)	1	2%	70%	1,755
		International Journal of Logistics Management	Grimson and Pyke (2007)	1	2%	72%	1,776
		International Journal of Production Management and Engineering	Bozutti and Esposito (2019)	1	2%	74%	-

⁶ Source: InCites Journal Citations Reports 2018 – Clarivate Analytics. / Journal Data Filtered By: Selected JCR Year: 2017 Selected Editions: SCIE,SSCI Selected Category Scheme: WoS

Chart 3.2 – S&OP publication sources and relevant information - *Continuation*

Practitioners	44%	International Journal of Retail & Distribution Management	Nucamendi-Guillén, Moreno and Mendoza (2018)	1	2%	77%	-
		ISBT Science Series	Caulfield (2013)	1	2%	79%	-
		Journal of Blood Services and Management	Keal and Hebert (2010)	1	2%	81%	-
		Journal of Enterprise Information Management	Goswami, Engel and Krcmar (2013)	1	2%	84%	2,482
		Journal of Research in Interactive Marketing	Plank and Hooker (2014)	1	2%	86%	-
		Journal of Supply Chain Management	Ralston et al. (2015)	1	2%	88%	6,105
		Journal of the Academy of Marketing Science	Esper et al. (2010)	1	2%	91%	8,488
		Logistics	Rokonuzzaman (2018)	1	2%	93%	-
		Production Planning & Control	Ivert et al. (2015a)	1	2%	95%	2,330
		Revista Inovação, Projetos e Tecnologia	Biazzin, Tomaselli and Costa Pena (2017)	1	2%	98%	-
		Total Quality Management & Business Excellence	Jung and Chung (2016)	1	2%	100%	1,526
		Journal of Business Forecasting	Baumann (2011); Bower (2017); Bower (2018); Burrows III (2007); Chase (2013); Covas (2016); Grillo (2014); Harrison (2009); Kelleher (2012); Lapide (2005a); Lapide (2005b); Lapide (2014a); Lapide (2014b); Lapide (2016); Schlegel and Murray (2010); Singh and Lee (2013); Smith, Andraski and Fawcett (2011); Warren (2012); Wilson and Raman (2017)	19	56%	56%	N/A
		The International Journal of Applied Forecasting	Boone, Ganeshan and Hicks (2015); Gray and Dougherty (2017); Lee (2013); Mello (2015); Moon and Alle (2015)	5	15%	71%	N/A
		Book	Burrows (2012); Ptak and Smith (2018)	2	6%	76%	N/A
		Gartner	Kohler and Pukkila (2016); Payne (2015)	2	6%	82%	N/A
		BMSD 2016 - Proceedings of the 6th International Symposium on Business Modeling and Software Design	Suurmond (2016)	1	3%	85%	N/A
		Proceedings of Computing Conference 2017	Li, Shakya and Owusu (2018)	1	3%	88%	N/A
		Strategic Finance	Sorensen (2013)	1	3%	91%	N/A
		Supply Chain Insights LLC	Cecere (2012)	1	3%	94%	N/A
		BristleCone: Your Supply Chain Optimized	Gollamudi (2013)	1	3%	97%	N/A
		Industry Value Chain Strategies	Cecere, Barrett and Mooraj (2009)	1	3%	100%	N/A

Source: Prepared by the author

From the scholars' perspective, 60% of the papers were published in 9 different journals compared to the total of 26 returned journals. Seven of these nine journals have a high impact factor, considering the production engineering and business administration areas.

From the practitioners' perspective, 82% of the publications were published in 3 different journals and two books. This can be explained because the Journal of Business Forecasting and The International Journal of Applied Forecasting have had specific calls for columns about S&OP. It is also perceived white papers from consulting companies, that verified the market necessity and provided solutions about the studied theme.

Chart 3.3 summarizes the research methods used in the publications. From Chart 3.3 is perceived that both scholars and practitioners in most used the Literature Review method. It is important to notice that, from practitioners, it was considered literature review if a case study was not presented, but the developed literature reviews did not follow the required rigor for academic literature review method.

Chart 3.3 – Summary of the applied research methods

Type	Method	Quantity	Percentage	Authors
Scholars	Literature Review	14	33%	Bozutti and Esposto (2019); Chae and Olson (2013); Esper et al. (2010); Goswami, Engel and Kremer (2013); Jonsson and Holmström (2016); Kristensen and Jonsson (2018); Kruse (2004); Noroozi and Wikner (2017); Plank and Hooker (2014); Rokonzaman (2018); Ross (2004); Thomé et al. (2012b); Tuomikangas and Kaipia (2014); Walters (2008)
	Case research	10	23%	Caulfield (2013); Dreyer et al. (2018); Godsell, Birtwistle and Van Hoek (2010); Grimson and Pyke (2007); Ivert et al. (2015a); Jonsson, Rudberg and Holmberg (2013); Jung and Chung (2016); Keal and Hebert (2010); Larsson and Fredriksson (2019); Oliva and Watson (2011)
	Survey	6	14%	Nakano (2009); Ralston et al. (2015); Swaim et al. (2016); Tarafdar and Qrunfleh (2017); Thomas et al. (2011); Thomé, Sousa and Scavarda (2014)
	Case research and Framework development	4	9%	Danese, Molinaro and Romano (2018); Ivert et al. (2015b); Nucamendi-Guillén, Moreno and Mendoza (2018); Storbacka (2011)
	Literature Review and Case Research	4	9%	Godsell et al. (2018); Ivert and Jonsson (2010); Turner, Aitken and Bozarth (2018); Wagner, Ullrich and Transchel (2014)
	Design Science	2	5%	Ivert and Jonsson (2014); Kaipia et al. (2017)
	Action Research	1	2%	Biazzin, Tomaselli and Costa Pena (2017)
	Literature Review and Framework development	1	2%	Nielsen, Nielsen and Steger-Jensen (2010)
	Survey and case research	1	2%	Goh and Eldridge (2015)
Practitioners	Literature Review	25	74%	Baumann (2011); Boone, Ganeshan and Hicks (2015); Bower (2018); Burrows III (2007); Cecere (2012); Cecere, Barrett and Mooraj (2009); Chase (2013); Covas (2016); Gollamudi (2013); Gray and Dougherty (2017); Harrison (2009); Kohler and Pukkila (2016); Lapide (2005a); Lapide (2005b); Lapide (2014a); Lapide (2014b); Lapide (2016); Lee (2013); Mello (2015); Moon and Alle (2015); Payne (2015); Schlegel and Murray (2010); Singh and Lee (2013); Sorensen (2013); Wilson and Raman (2017)

Chart 3.3 – Summary of the applied research methods - *Continuation*

Type	Method	Quantity	Percentage	Authors
Practitioners	Case research	7	21%	Bower (2017); Grillo (2014); Kelleher (2012); Li, Shakya and Owusu (2018); Smith, Andraski and Fawcett (2011); Suurmond (2016); Warren (2012)
	Book	2	6%	Burrows (2012); Ptak and Smith (2018)

Source: Prepared by the author

From Chart 3.3 it also perceived that both scholars and practitioners have conducted case researches. In the case of the scholars, 45% of the publications conducted case researches; for this percentage it was also included the action research, once it was performed a deep study in a company. In the case of practitioners, 21% of the publications presented a case research. Yin (2015) cites that cases researchers support the development of new theories based on practitioners' approaches; this reveals that different practices and approaches are being perceived in the companies and should be supported by improved or new approaches and frameworks.

A total of 27 publications used the case research method. Thus, Chart 3.4 presents the type of industry that each case research was performed. It is possible to realize from Chart 3.4 that the case researches were not concentrated in one type of industry, but the technology, retailers, healthcare and hospitals and food and beverage industries represent 47% of the conducted case researches.

Chart 3.4 – Sectors of the performed case researches

Industries' type	Number of Cases	Percentage	Authors
Technology, electronics, electrical and digital printing products manufacturer	7	16%	Goh and Eldridge (2015); Grimson and Pyke (2007); Jung and Chung (2016); Oliva and Watson (2011); Storbacka (2011)
Retailers	6	13%	Biazzin, Tomaselli and Costa Pena (2017); Dreyer et al. (2018); Jonsson, Rudberg and Holmberg (2013); Nucamendi-Guillén, Moreno and Mendoza (2018); Suurmond (2016); Turner, Aitken and Bozarth (2018)
Healthcare and hospitals	4	9%	Caulfield (2013); Keal and Hebert (2010); Kelleher (2012); Larsson and Fredriksson (2019)
Food and Beverage	4	9%	Danese, Molinaro and Romano (2018); Grillo (2014); Ivert et al. (2015a); Ivert et al. (2015b)
Equipment for industry	3	7%	Grimson and Pyke (2007); Storbacka (2011)
Wholesaler	2	4%	Danese, Molinaro and Romano (2018); Turner, Aitken and Bozarth (2018)
Spare parts (sailboats and cars)	2	4%	Turner, Aitken and Bozarth (2018); Warren (2012)

Chart 3.4 – Sectors of the performed case researches - *Continuation*

Industries' type	Number of Cases	Percentage	Authors
Home Appliances and Bedding manufacturers	2	4%	Grimson and Pyke (2007); Smith, Andraski and Fawcett (2011)
Telecom services and Network Infrastructure	2	4%	Li, Shakya and Owusu (2018); Storbacka (2011)
Restorer and repairer of cars	1	2%	Turner, Aitken and Bozarth (2018)
Furniture manufacturer	1	2%	Grimson and Pyke (2007)
Lighting manufacturer	1	2%	Turner, Aitken and Bozarth (2018)
Fire protection manufacturer	1	2%	Goh and Eldridge (2015)
Mining and Construction	1	2%	Storbacka (2011)
Cardboard industry	1	2%	Grimson and Pyke (2007)
Tubes manufacturer	1	2%	Storbacka (2011)
Shipbuilding	1	2%	Storbacka (2011)
Tobacco manufacturer	1	2%	Godsell, Birtwistle and Van Hoek (2010)
Aesthetics and cosmetic manufacturer	1	2%	Bower (2017)
Pharmaceutical	1	2%	Wagner, Ullrich and Transchel (2014)
Chemical products	1	2%	Ivert and Jonsson (2010)
Water service	1	2%	Godsell et al. (2018)

Source: Prepared by the author

Chart F.1 (in Appendix F) presents the problems, categories of problems, number of publications in each category, the authors, the main contributions of each category and the percentage of publications in each problem (the percentage considered the total of 77 analyzed publications). Five classes of problems were considered:

- ✓ **S&OP process** (categories: process change / design assessment; maturity model assessment / S&OP effectiveness; coordination mechanisms / integrated solutions; collaborative forecasting process and demand planning; collaboration and information sharing; S&OP implementation; inventory replenishment methodology / resource allocation; what-if analysis /scenario analysis; and S&OP for direct-to-consumer case);
- ✓ **Information System Assessment** (categories: business analytics; use of APS for S&OP process; visibility improvement; and extended supply chain and firm performance);

- ✓ **Influences on performance** (categories: agile approach affecting the supply chain performance and practices; S&OP practices affecting firms' performance; and S&OP literature affecting S&OP design and performance);
- ✓ **Organizational issues** (categories: managers' influences on a better complexity management; and S&OP studies helping managers); and
- ✓ **Supply Chain Management** (category: Supply Chain Practices on S&OP).

Another important information to be analyzed is the gaps of research cited in the papers. The gaps lead to the problem to be studied and, posteriorly, guidelines for future researches. The found gaps categories cited in the publications were:

- ✓ **S&OP** (subcategories: inventory; coordination/integration; strategy integration; business solutions/process design; environment complexity; project management; demand management and forecasting; maturity model; and implementation);
- ✓ **Information systems** (subcategories: APS; internet-based; capabilities; business analytics; and software structures);
- ✓ **Performance** (subcategories: S&OP and the firm performance; and agility effects); and
- ✓ **Organization** (subcategory: management issues).

Chart 3.5 summarizes the gaps category, gap subcategory, number of publications, percentage and the authors and Chart G.1 (in appendix G) summarizes the gaps category, gap subcategory, number of publications, percentage and summarizes the provided future researches in each subcategory, cited by the authors.

Chart 3.5 – Summary of gaps about S&OP for the new business environment

Gap Category	Gap Subcategory	Number of Publications	Percentage	Authors
S&OP	Inventory	1	1%	Nucamendi-Guillén, Moreno and Mendoza, (2018)
	Coordination / Integration	12	16%	Baumann (2011); Mello (2015); Nakano (2009); Smith Andraski and Fawcett (2011); Rokonzaman (2018); Tuomikangas and Kaipia (2014); Covas (2016); Jonsson and Holmström (2016); Jonsson, Rudberg and Holmberg (2013); Moon and Alle (2015); Wagner, Ullrich and Transchel (2014) and Oliva and Watson (2011)
	Strategy Integration	6	8%	Ralston et al. (2015); Kaipia et al. (2017); Swaim et al. (2016); Godsell, Birtwistle and Van Hoek (2010); Wilson and Raman (2017); and Esper et al. (2010)

Chart 3.5 – Summary of gaps about S&OP for the new business environment - *Continuation*

Gap Category	Gap Subcategory	Number of Publications	Percentage	Authors
	Business Solutions / Processes design	31	40%	Kelleher (2012); Storbacka (2011); Caulfield (2013); Dreyer et al. (2018); Keal and Hebert (2010); Grillo (2014); Larsson and Fredriksson (2019); Bower (2017); Chase (2013); Walters (2008); Bozutti and Esposto (2019); Burrows III (2007); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Gollamudi (2013); Kohler and Pukkila (2016); Li, Shakya and Owusu (2018); Payne (2015); Ptak and Smith (2018); Bower (2018); Kruse (2004); Lapide (2016); Lee (2013); Suurmond (2016); Ivert et al. (2015a); Noroozi and Wikner (2017); Gray and Dougherty (2017); Grimson and Pyke (2007); Thomé et al. (2012b); and Jung and Chung (2016)
	Environment Complexity	6	8%	Kristensen and Jonsson (2018); Lapide (2014b); Schlegel and Murray (2010); Singh and Lee (2013); Warren (2012); and Ivert et al. (2015b)
	Project Management	1	1%	Biazzin, Tomaselli and Costa Pena (2017)
	Demand Management and Forecasting	3	4%	Nielsen, Nielsen and Steger-Jensen (2010); Godsell et al. (2018); and Lapide (2014a)
	Maturity Model	2	3%	Lapide (2005a); and Lapide (2005b)
	Implementation	2	3%	Goh and Eldridge (2015); and Danese, Molinaro and Romano (2018)
Information Systems	APS	2	3%	Ivert and Jonsson (2014); and Ivert and Jonsson (2010)
	Internet-based	1	1%	Plank and Hooker (2014)
	Capabilities	1	1%	Goswami, Engel and Krcmar (2013)
	Business Analytics	2	3%	Boone Ganeshan and Hicks (2015); and Chae and Olson (2013)
	Software Structures	1	1%	Sorensen (2013)
Performance	S&OP and the firm performance	1	1%	Thomé, Sousa and Scavarda (2014)
	Agility effects	2	3%	Ross (2004) and Tarafdar; and Qrunfleh (2017)
Organization	Management issues	3	4%	Harrison (2009); Turner, Aitken and Bozarth (2018); and Thomas et al. (2011)

Source: Prepared by the author

3.4 New challenges for the S&OP

This section is divided in eight subsections. Each subsection is dedicated for one competitiveness dimension (excluding demand variety and demand variability that are in the same subsection); this approach allows a better and a deeper analysis of how the found necessities for each competitiveness dimension affects the S&OP process.

It was performed, for each competitiveness dimension, a similarity analysis supported by the software Iramuteq®, which performs texts qualitative analyses. Iramuteq® is supported by the statistical computing and graphics software named R®. The software analysis provides a network diagram that makes possible to identify how the found characteristics interfere on each other and to find clusters among the data, with aggregated findings about a subject. To perform the similarity analysis for each dimension competitiveness, it was used the listed publications presented in Chart 3.6.

Chart 3.6 – Competitiveness dimensions and publications

Competitiveness Dimensions	Number of publications	%	Authors
Visibility	65	84%	Baumann (2011); Biazzin, Tomaselli and Costa Pena (2017); Boone, Ganeshan and Hicks (2015); Bower (2017); Bozutti and Esposto (2019); Burrows III (2007); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Chae and Olson (2013); Chase (2013); Covas (2016); Danese, Molinaro and Romano (2018); Dreyer et al. (2018); Godsell et al. (2018); Godsell, Birtwistle and Van Hoek (2010); Goh and Eldridge (2015); Gollamudi (2013); Goswami, Engel and Krcmar (2013); Gray and Dougherty (2017); Grillo (2014); Grimson and Pyke (2007); Ivert et al. (2015a); Ivert et al. (2015b); Ivert and Jonsson (2010); Ivert and Jonsson (2014); Jonsson and Holmström (2016); Jonsson, Rudberg and Holmberg (2013); Kaipia et al. (2017); Keal and Hebert (2010); Kelleher (2012); Kohler and Pukkila (2016); Kristensen and Jonsson (2018); Kruse (2004); Lapide (2005a); Lapide (2005b); Lapide (2014b); Lapide (2016); Lee (2013); Li, Shakya and Owusu (2018); Mello (2015); Nakano, 2009; Noroozi and Wikner (2017); Oliva and Watson (2011); Payne (2015); Plank and Hooker (2014); Ptak and Smith (2018); Ralston et al. (2015); Rokonzuzaman (2018); Ross (2004); Schlegel and Murray (2010); Singh and Lee (2013); Smith, Andraski and Fawcett (2011); Sorensen (2013); Storbacka (2011); Suurmond (2016); Tarafdar and Qrunfleh (2017); Thomas et al. (2011); Thomé et al. (2012b); Tuomikangas and Kaipia (2014); Turner; Aitken and Bozarth (2018); Wagner, Ullrich and Transchel (2014); Walters (2008); Warren (2012); Wilson and Raman (2017)
Agility	54	70%	Baumann (2011); Biazzin, Tomaselli and Costa Pena (2017); Bower (2017); Bower (2018); Burrows III (2007); Burrows III (2012); Caulfield (2013); Cecere (2012); Cecere, Barrett and Mooraj (2009); Chae and Olson (2013); Chase (2013); Covas (2016); Danese, Molinaro and Romano (2018); Dreyer et al. (2018); Esper et al. (2010); Godsell, Birtwistle and Van Hoek (2010); Goh and Eldridge (2015); Gollamudi (2013); Goswami, Engel and Krcmar (2013); Gray and Dougherty (2017); Grillo (2014); Grimson and Pyke (2007); Ivert et al. (2015a); Ivert et al. (2015b); Ivert and Jonsson (2010); Ivert and Jonsson (2014); Jung and Chung (2016); Kaipia et al. (2017); Keal and Hebert (2010); Kelleher (2012); Kohler and Pukkila (2016); Kristensen and Jonsson (2018); Kruse (2004); Lapide (2005a); Lapide (2005b); Larsson and Fredriksson (2019); Lee (2013); Li, Shakya and Owusu (2018); Nakano (2009); Nucamendi-Guillén, Moreno and Mendoza (2018); Payne (2015); Ptak and Smith (2018); Rokonzuzaman (2018); Ross (2004); Singh and Lee (2013); Sorensen (2013); Suurmond (2016); Tarafdar and Qrunfleh (2017); Thomé et al. (2012b); Thomé, Sousa and Scavarda (2014); Tuomikangas and Kaipia (2014); Turner, Aitken and Bozarth (2018); Wagner, Ullrich and Transchel (2014); Wilson and Raman (2017)
Customer Centricity	45	58%	Boone, Ganeshan and Hicks (2015); Bower (2017); Bozutti and Esposto (2019); Burrows III (2007); Burrows III (2012); Caulfield (2013); Cecere (2012); Cecere, Barrett and Mooraj (2009); Chase (2013); Danese, Molinaro and Romano (2018); Dreyer et al. (2018); Esper et al. (2010); Gollamudi (2013); Goswami, Engel and Krcmar (2013); Harrison (2009); Jonsson and Holmström (2016); Kaipia et al. (2017); Kohler and Pukkila (2016); Kristensen and Jonsson (2018); Lapide (2005a); Lapide (2005b); Li, Shakya and Owusu (2018); Mello (2015); Moon and Alle (2015); Nakano (2009); Nielsen, Nielsen and Steger-Jensen (2010); Noroozi and Wikner (2017); Oliva and Watson (2011); Payne (2015); Plank and Hooker (2014); Ptak and Smith (2018); Ralston et al. (2015); Rokonzuzaman (2018); Smith, Andraski and Fawcett (2011); Storbacka (2011); Suurmond (2016); Swaim et al. (2016); Thomas et al. (2011); Thomé et al. (2012b); Thomé, Sousa and Scavarda (2014); Tuomikangas and Kaipia (2014); Turner, Aitken and Bozarth (2018); Wagner, Ullrich and Transchel (2014); Walters (2008); Wilson and Raman (2017)

Chart 3.6 – Competitiveness dimensions and publications - *Continuation*

Competitiveness Dimensions	Number of publications	%	Authors
Responsiveness	40	52%	Baumann (2011); Bower (2017); Bower (2018); Bozutti and Esposto (2019); Burrows III (2007); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Chae and Olson (2013); Chase (2013); Danese, Molinaro and Romano (2018); Dreyer et al. (2018); Godsell et al. (2018); Gollamudi (2013); Goswami, Engel and Krcmar (2013); Grimson and Pyke (2007); Ivert et al. (2015a); Ivert and Jonsson (2010); Ivert and Jonsson (2014); Kaipia et al. (2017); Keal and Hebert (2010); Kelleher (2012); Kohler and Pukkila (2016); Lapide (2014a); Larsson and Fredriksson (2019); Li, Shakya and Owusu (2018); Nielsen, Nielsen and Steger-Jensen (2010); Nucamendi-Guillén, Moreno and Mendoza (2018); Payne (2015); Ptak and Smith (2018); Ralston et al. (2015); Rokonzuzaman (2018); Schlegel and Murray (2010); Smith, Andraski and Fawcett (2011); Tarafdar and Qrunfleh (2017); Thomé et al. (2012b); Thomé, Sousa and Scavarda (2014); Wagner, Ullrich and Transchel (2014); Walters (2008); Warren (2012)
Flexibility	37	48%	Bozutti and Esposto (2019); Burrows III (2007); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Chae and Olson (2013); Danese, Molinaro and Romano (2018); Dreyer et al. (2018); Gollamudi (2013); Goswami, Engel and Krcmar (2013); Ivert et al. (2015a); Ivert et al. (2015b); Ivert and Jonsson (2010); Ivert and Jonsson (2014); Jonsson and Holmström (2016); Kaipia et al. (2017); Kohler and Pukkila (2016); Lapide (2005b); Larsson and Fredriksson (2019); Lee (2013); Nakano (2009); Noroozi and Wikner (2017); Payne (2015); Plank and hooker (2014); Ptak and Smith (2018); Ross (2004); Schlegel and Murray (2010); Singh and Lee (2013); Storbacka (2011); Swaim et al. (2016); Tarafdar and Qrunfleh (2017); Thomé, Sousa and Scavarda (2014); Tuomikangas and Kaipia (2014); Turner, Aitken and Bozarth (2018); Wagner, Ullrich and Transchel (2014); Walters (2008); Wilson and Raman (2017)
Adaptability	32	42%	Baumann (2011); Bower (2017); Bozutti and Esposto (2019); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Dreyer et al. (2018); Esper et al. (2010); Goh and Eldridge (2015); Gollamudi (2013); Goswami, Engel and Krcmar (2013); Gray and Dougherty (2017); Grillo (2014); Ivert and Jonsson (2010); Ivert and Jonsson (2014); Jonsson and Holmström (2016); Kelleher (2012); Kohler and Pukkila (2016); Kristensen and Jonsson (2018); Moon and Alle (2015); Nakano (2009); Nielsen, Nielsen and Steger-Jensen (2010); Oliva and Watson (2011); Payne (2015); Ptak and Smith (2018); Ross (2004); Schlegel and Murray (2010); Singh and Lee (2013); Storbacka (2011); Tarafdar and Qrunfleh (2017); Wagner, Ullrich and Transchel (2014); Wilson and Raman (2017)
Velocity	25	32%	Baumann (2011); Boone, Ganeshan and Hicks (2015); Burrows III (2007); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Covas (2016); Esper et al. (2010); Godsell, Birtwistle and Van Hoek (2010); Gollamudi (2013); Grimson and Pyke (2007); Ivert and Jonsson (2010); Jonsson and Holmström (2016); Jung and Chung (2016); Kaipia et al. (2017); Kohler and Pukkila (2016); Lapide (2005b); Lee (2013); Payne (2015); Ptak and Smith (2018); Rokonzuzaman (2018); Suurmond (2016); Tarafdar and Qrunfleh (2017); Wagner, Ullrich and Transchel (2014)
Demand Variability	14	18%	Biazzin, Tomaselli and Costa Pena (2017); Burrows III (2007); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Gollamudi (2013); Goswami, Engel and Krcmar (2013); Ivert et al. (2015b); Kelleher (2012); Kohler and Pukkila (2016); Nucamendi-Guillén, Moreno and Mendoza (2018); Payne (2015); Ptak, Smith and (2018); Singh and Lee (2013)
Demand Variety	13	17%	Biazzin, Tomaselli and Costa Pena (2017); Burrows III (2007); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Gollamudi (2013); Ivert et al. (2015b); Kelleher (2012); Kohler and Pukkila is (2016); Nucamendi-Guillén, Moreno and Mendoza (2018); Payne (2015); Ptak and Smith (2018); Singh and Lee (2013)

Source: Prepared by the author

From Chart 3.6 it possible infer that the main dimension studied was visibility, followed by agility and customer-centricity. Because of publications could deal with more than one competitiveness dimension, it could be considered in more than one competitiveness dimension, thus the percentage presented in the Chart 3.6 considered the participation of the publications on the total of 77 publications included in this systematic literature review.

3.4.1 Visibility

Figure 3.6 presents the similarity diagram for the visibility competitive dimension. There are three main cluster: (i) sales and operations planning core, (ii) visibility core and (iii) plan core.

Some findings are not new for the S&OP considering the plan cluster (cluster III). The planning is a tactical planning that should provide/develop the consensus between demand and supply. To plan, forecasts should be considered to obtain a historical perspective of the demand behavior, in order to establish the better inventory and/or capacity levels to respond to the market. The focus is on the consumer, because they generate the demand, but costs must not be dismissed in order to obtain profitability. Nonetheless, there are new insights for the S&OP, considering the planning process.

The traditional S&OP process consider the family-product-level to make all involved decisions (WALLACE, 2012), however, Jonsson, Rudberg and Holmberg (2013), Grillo (2014), Oliva and Watson (2011), Grimson and Pyke (2007) and Ivert et al. (2015a) considered that the planning could be done at the SKU level. Ivert et al. (2015b) complement that SKU-level-planning approach should be adopted when the company does not deal with a huge quantity of SKU. Biazzin, Tomaselli and Costa Pena (2017) presented the necessity of the S&OP be performed at SKU-level at a food service company. Kelleher (2012) cited the importance to review the SKU information, because it can be used in the S&OP process. Thomé et al. (2012b) realized, in their systematic literature review, that there are companies that consider solely SKU-level planning and others consider both SKU-level and family-level, depending on their necessity of visibility. The goal to consider the SKU-level in the planning process is to improve the visibility of the demand behavior, even this approach could lead to an increase in forecast errors.

To enhance the visibility (core of cluster II) the main dealt approach is to share information, and this is not new for the S&OP process. If information is not shared among departments, each department conduct forecasting and assumptions for their own needs, thus the company's goals could not be reached (OLIVA; WATSON, 2011a; THOMAS et al., 2011). Covas (2016) suggests going to the “*gemba*” to see how the work is really executed, combining the S&OP process with Lean Production practices.

Figure 3.6 – Visibility similarity diagram

Source: Prepared by the author

Nonetheless, Goswami, Engel and Krcmar (2013) consider that information should be shared among the members of the supply chain network, besides internal sharing. The same authors complete affirming that shared information along the supply chain network allows the companies to make the process quicker, to improve inventory quantities, synchronize production and to improve the forecast development, thus the S&OP process should have an expansion of its scope and become more external and not solely an internal process, considering strategic integration of customers and suppliers (DANESE; MOLINARO; ROMANO, 2018; GOH; ELDRIDGE, 2015; KRUSE, 2004; LAPIDE, 2005a, 2005b; RALSTON et al., 2015; THOMÉ et al., 2012b). To share the information effectively among the supply chain partners, the information systems have an important role (DANESE; MOLINARO; ROMANO, 2018; DREYER et al., 2018; GOSWAMI; ENGEL; KRCMAR, 2013; GRAY; DOUGHERTY, 2017; PLANK; HOOKER, 2014; THOMÉ et al., 2012b; TUOMIKANGAS; KAIPIA, 2014a; WILSON; RAMAN, 2017) to improve the market monitoring, enhance future scenarios planning, aid new product and services introduction (TARAFDAR; QRUNFLEH, 2017) and, by using data-warehouses, develop KPI's (KEAL; HEBERT, 2010). Approaches like the CPFR can be used to improve the sharing information process (BAUMANN, 2011; SMITH; ANDRASKI; FAWCETT, 2011). It is important to classify the information to obtain the better results, i.e., standardized information (forecasts and shipments, for instance) and customized information (factors of demand fluctuation, types of operational constraints, for instance) (NAKANO, 2009).

To capture market information, Storbacka (2011) considered the partnership among companies and research/media agencies. Social medias (likes and dislikes on Facebook, Instagram, and others) as well as the web-viewing/internet habits are powerful source of information in current days and should be shared in the S&OP meetings (BOWER, 2017; GRIMSON; PYKE, 2007). Boone, Ganeshan and Hicks (2015) suggest considering Google trend data to improve the sales forecasting accuracy and visibility.

Turner, Aitken and Bozarth (2018) also studied the information sharing importance and realize that the formal communications plan development is necessary, but it also necessary to consider the informal communication to have a cross-organizational-boundaries disruptions.

By analyzing the cluster I, it is possible to infer that the S&OP process is nearly related to the supply chain environment. This could also be inferred by the previous clusters' analysis.

Thus, a logical path can be proposed, which an effective plan improves the visibility effectiveness that will improve the overall S&OP process.

The S&OP process should consider new approaches and these approaches are presented in Figure 3.6. The first one considers that with the aid of the information systems' evolution, the S&OP process become able to deal with real-time data and information (IVERT; JONSSON, 2010; LAPIDE, 2005a; SUURMOND, 2016) and not solely with the historical information, thus becoming also a more proactive process (TUOMIKANGAS; KAIPIA, 2014a). Such real-time data and information can be obtained with clickstreams, tags, sensors, trackers and other smart devices, usually connect with and supported by the internet network (BOONE; GANESHAN; HICKS, 2015; GRIMSON; PYKE, 2007). Covas (2016) cites that multiple scenarios reports can be provided with the use of real-time data. All these collected real-time data and information can be shared among the supply chain participants (BOZUTTI; ESPOSTO, 2019; GRIMSON; PYKE, 2007).

Another source of real-time information can be provided by the POS data collection and sharing (CHASE, 2013a; IVERT et al., 2015b; ROKONUZZAMAN, 2018). POS data can aid the company to understand the consumers' behavior (BURROWS III, 2007) and helps to build the demand forecasting (DREYER et al., 2018).

Kaipia et al. (2017) and Kristensen and Jonsson (2018) cite that sharing POS data among the supply chain partners can improve operational performance related to the demand uncertainty during the product launches and should also be shared during weekly S&OP meetings to enhance corrective actions during the fulfillment process.

Real-time data and information collection and use can be related to the Industry 4.0 concepts and this can influence the S&OP process. Jonsson and Holmström (2016) cite the use the Internet of Things concepts and Li, Shakyia and Owusu (2018) cite the big data approach to provide information that can support the S&OP process. An interactive view of the data and information provided by all previous cited approaches can be supported by dashboards and business analytics, guaranteeing the visibility enhancement (CHAE; OLSON, 2013; GODSELL; BIRTWISTLE; VAN HOEK, 2010; LI; SHAKYA; OWUSU, 2018). Examples of data that can be shown in dashboards are related to equipment, labor, facilities, material and finance (HARRISON, 2009).

Another important finding is about the use of APS to optimize scenarios and generating visibility of information (IVERT; JONSSON, 2010). This visibility can be affirmed by the APS capacity of aggregate and disaggregate information (forecasts, for instance) as user

needs (IVERT; JONSSON, 2014) and perform scenarios simulation and what-if analysis (IVERT; JONSSON, 2010). Rokonuzzaman (2018) cites that by using APS companies will benefit by improving on-time deliveries and Walters (2008) cites that the visibility provided by the what-if analysis aid operations to effectively respond to changes in demand or supply of products.

Wagner, Ullrich and Transchel (2014) considers that financial visibility is another important approach that should be considered and Noroozi and Wikner (2017), in their conducted literature review, found that financial management should be considered in all steps of the S&OP process. Ralston et al. (2015) considered, in the perspective of a strategic supplier integration, financial information should be shared with the suppliers and this could be an import input for the S&OP process. On the other side, Sorensen (2013) presented a concerning that the traditional S&OP systems and applications could not support adequately the financial requirements for the process, reaffirming the previous related importance of the information systems.

Risk management is the last approach that is being discussed in this cluster I analysis and should be considered in the S&OP process (WAGNER; ULLRICH; TRANSCHEL, 2014). This is not a new issue for the S&OP process, but once visibility should be improved, risk management may offer more benefits. Schlegel and Murray (2010) cite that, after the scenarios and what-if analysis, is necessary to create a risk response plan that should consider four elements: (i) identification of know risks, (ii) identification of the owners of risks, (iii) articulation of risks responses and (iv) articulation of the measures of successful mitigation.

Thus, the main contributions from the visibility competitiveness dimensions that lead to changes for the traditional S&OP process are:

- ✓ Possibility of planning at the SKU-level;
- ✓ The information should not be shared solely internally, but should be shared among the strategic partners of the supply chain (customer, suppliers and/or third-parties' companies);
- ✓ The importance and relevance to have a robust information system implemented, allowing to take advantage from real-time data and POS data;
- ✓ Be aware and/or consider in the planning process data from social media and customer web-based behaviors;
- ✓ S&OP in beginning to be influenced by Industry 4.0 concepts, i.e., Internet-of-Things, big data and dashboards;

- ✓ Utilization of software to optimize scenarios and make what-if analysis, such as APS; and
- ✓ Increased importance of Risk Management and Financial Management (should be presented in all steps of the S&OP process).

3.4.2 Agility

Figure 3.7 presents the similarity diagram for the agility competitive dimension. There are three main cluster: (i) sales and operations planning core, (ii) demand core and (iii) plan core.

The second competitive dimension that has been more analyzed by the returned publications was the agility. All organizations currently need to have agility and, the S&OP process, can aid to reach this goal, with the executive support in the decisions (SORENSEN, 2013).

From cluster III (the plan core) is possible to infer that S&OP should obtain a more external perspective (align departments and suppliers in the process) (BAUMANN, 2011), thus, with timely information, benefits come from inventory reduction, stock-outs reduction and marking down products reduction are achieved (ESPER et al., 2010; GOSWAMI; ENGEL; KRCMAR, 2013). With a collaborative planning (for instance, suppliers using the customers' demand plans), the supply chain gains agility (NAKANO, 2009; TUOMIKANGAS; KAIPIA, 2014a). Completing, Turner, Aitken and Bozarth (2018) cite the possibility to use third-party source to increase agility and Rokonuzzaman (2018) related agility to the company strategy and reinforced the importance of a free and fast information flow among the members of the supply chain. Information technology, in this sense, has an important role (SINGH; LEE, 2013; SMITH; ANDRASKI; FAWCETT, 2011).

From cluster II (sales and operations planning core), it is possible to infer that S&OP cannot be dealt as a once-month exercise (GRAY; DOUGHERTY, 2017; JUNG; CHUNG, 2016; SINGH; LEE, 2013), thus specifically to the its process, many authors suggested the inclusion of a shorter cycle (compared to the traditional monthly process), in order to be able to respond in an agiler manner to issues (production, selling, distributions, financial, and others) that can occur during the monthly demand fulfillment activity (CHAE; OLSON, 2013; DREYER et al., 2018; GRILLO, 2014; GRIMSON; PYKE, 2007; IVERT et al., 2015a; IVERT; JONSSON, 2014; KRISTENSEN; JONSSON, 2018; LEE, 2013; LI; SHAKYA; OWUSU, 2018; NAKANO, 2009; NUCAMENDI-GUILLÉN; MORENO; MENDOZA, 2018;

SUURMOND, 2016; THOMÉ et al., 2012b; THOMÉ; SOUSA; SCAVARDA, 2014). This shorter cycle can be weekly or even daily (BURROWS III, 2007; COVAS, 2016).

Ivert et al. (2015b) and Thomé et al. (2012b) found that shorter cycles can be related solely to a group of critical products to the company, and they named this shorter cycle as mini-S&OP. On the other side, Covas (2016) named this short cycle as S&OE (Sales and Operations Execution) and Biazzin, Tomaselli and Costa Pena (2017) and Lee (2013) named as Emergencies Management. Danese, Molinaro and Romano (2018), Goh and Eldridge (2015), Grimson and Pyke (2007), Ivert et al. (2015a), Ivert et al. (2015b), Lapide (2005a), Lapide (2005b), Larsson and Fredriksson (2019) and Wagner, Ullrich and Transchel (2014) consider the concept of event-driven meeting to react effectively to a detected imbalance of supply and demand. Bower (2017) and Bower (2018) consider that this monitoring of supply and demand imbalances make part of the S&OP demand control process.

To monitor and respond to the real sales behavior becomes essential (CHASE, 2013a; GRIMSON; PYKE, 2007; KRUSE, 2004; NUCAMENDI-GUILLÉN; MORENO; MENDOZA, 2018; SINGH; LEE, 2013; WILSON; RAMAN, 2017) and Lapide (2005a) considers the use of MES. Additionally, Ivert et al. (2015b), Kaipia et al. (2017) and Kristensen and Jonsson (2018) cite the use of POS data during the weekly S&OP meetings, allowing the number of corrective action, thus becoming more agile. Ivert and Jonsson (2010) and Kelleher (2012) cite the use of the SAP APO to provide alerts in order to manage exceptions, that can be responsive alerts (advance warnings) or reactive alerts (detailed report about what happened); the important is evolve to responsive alerts. With APS it is also possible to perform what-if analysis leading to an agility in respond to exceptions (IVERT; JONSSON, 2014).

Ross (2004) studied the combination of the S&OP and JIT techniques approaches to obtain agility in the process, considering the concepts of waste reduction. Covas (2016), in this sense, cites the importance to go to the “*gemba*” to visualize how work really happens.

From cluster III (demand core), it is possible to perceive that S&OP should balance the supply and demand, and this is not new for this process. The same for considering price in the planning process. As cited in the cluster II analysis, it is necessary to monitor the demand, and system should support this activity.

From analyzing this cluster, it was also perceived that the necessity of shorter cycles into the S&OP process is not a exclusivity of the manufacturing companies. Caulfield (2013) and Keal and Hebert (2010) consider a weekly review of the supply and demand in the blood bank service. This is also motivated by the fact of a short shelf-life of the “product” (i.e., blood)

Figure 3.7 – Agility similarity diagram

Source: Prepared by the author

and the difficult to forecast both supply and demand. Singh and Lee (2013) contribute exemplifying the use of reduced cycles of the S&OP to manage exceptions in the planning of water distribution in the Mississippi.

Tarafdar and Qrunfleh (2017) consider the necessity of agility to be successful in the new products introduction and Kaipia et al. (2017) completes by saying that S&OP must be collaborative both company internally and externally and can contribute during this introduction phase because of its inherent uncertainty. Goh and Eldridge (2015) reinforce the necessity of weekly S&OP meetings during the new product introduction phase.

Thus, the main contributions from the agility competitiveness dimensions that lead to changes for the traditional S&OP process are:

- ✓ External perspective and collaborative planning with the supply chain partners;
- ✓ To have timely and fast information with the support of information systems;
- ✓ Agility should be supported by the business' strategy;
- ✓ Inclusion of shorter cycles (weekly or daily) to respond effectively to exceptions. These cycles were named as S&OE and Emergencies Meetings. These cycles also can be related to a group of a critical products;
- ✓ Inclusion of event-driven meetings. At these meetings should participate solely members of S&OP team that would contribute to give a solution or will be affected by the solution of the found exception;
- ✓ To monitor and to respond to real sales data;
- ✓ Use of POS data on the weekly meetings;
- ✓ Use of the SAP APO to support the identification of issues;
- ✓ Combination of S&OP and JIT approaches to get agility, by waste elimination; and
- ✓ Can contribute directly to the new product introduction with the weekly/daily meetings, because its inherent uncertainty.

3.4.3 Customer-centricity

Figure 3.8 presents the similarity diagram for the visibility competitive dimension. There are five main cluster: (i) customer-centricity core, (ii) customer core, (iii) supply core, (iv) plan core and (v) supplier core.

Figure 3.8 – Customer-centricity similarity diagram

Source: Prepared by the author

Some findings are not new for the traditional S&OP process. S&OP should identify gaps between the planned and real actions in order to create value to customers and shareholders (BOWER, 2017; TUOMIKANGAS; KAIPIA, 2014a). The customer importance and its dimension should be visible in the organizational structure; thus, the whole company can perceive the customer's value and requirements (MOON; ALLE, 2015; STORBACKA, 2011). Swaim et al. (2016) named this customer-centricity approach as market orientation. Bower (2017) and Smith, Andraski and Fawcett (2011) complete by saying that the portfolio review management step is important to clearly know and communicate what will be offered to customers and Oliva and Watson (2011) cite that is important to take in consideration the product life cycle in the S&OP process.

Information sharing with customers have a huge potential of knowing their preferences, thus both company's profitability and customer's satisfaction will increase (GOSWAMI; ENGEL; KRCMAR, 2013; MELLO, 2015; NIELSEN; NIELSEN; STEGER-JENSEN, 2010; RALSTON et al., 2015). Smith, Andraski and Fawcett (2011) and Tuomikangas and Kaipia (2014) considered that suppliers should use customer's demand plans in their S&OP forums; these actions can be supported by information systems integration tools as portals and web-based services. Dreyer et al. (2018), Harrison (2009) and Wagner, Ullrich and Transchel (2014) suggest the inclusion of the key suppliers and customers in the S&OP forums.

Kaipia et al. (2017) and Kristensen and Jonsson (2018) consider the possibility of sharing POS data and Boone, Ganeshan and Hicks (2015) consider, in the case of online business, to get metrics from the consumer behavior in the website and Plank and Hooker (2014) consider the utilization of social media and network to obtain customer's information. A benefit that comes from the use of information systems is a better inventory level to reach customer requirements (THOMAS et al., 2011).

Jonsson and Holmström (2016), Lapide (2005a), Lapide (2005b), Mello (2015), Nakano (2009), Nielsen, Nielsen and Steger-Jensen (2010), Noroozi and Wikner (2017), Smith, Andraski and Fawcett (2011), Thomé et al. (2012b), Thomé, Sousa and Scavarda (2014), Tuomikangas and Kaipia (2014), Wagner, Ullrich and Transchel (2014) and Walters (2008) cite the cooperation among the suppliers and customers and this can be achieved by combining the S&OP process with other management approaches, such as, CPFR, VMI and ECR. Bozutti and Esposto (2019), Danese, Molinaro and Romano (2018) and Turner, Aitken and Bozarth (2018) complete by saying that collaboration should be among the key supply chain partners, offering a differentiated pack of products and services, thus customers can be sorted by their

value approach (BURROWS III, 2007). Esper et al. (2010) complete by saying that both supplier and customer integration should be considered, because, in case of integration fail in one side, the value creation for customer will be affected.

S&OP may gain a more strategic perspective (DANESE; MOLINARO; ROMANO, 2018) by its closer necessary interaction with customer intelligence areas (CAULFIELD, 2013; LI; SHAKYA; OWUSU, 2018; ROKONUZZAMAN, 2018). This allow to get information and trends about customers, competitors and prices (OLIVA; WATSON, 2011a). In this perspective, it is important to perform risk management and obtain a list of lessons learned of previous mistakes (SUURMOND, 2016). The S&OP meetings can be customized depending on the relevant issue to be discussed, thus experts from all relevant function can attend (KAIPIA et al., 2017); demand sensing, demand shaping and demand shifting are strategies that could be used (CHASE, 2013a). Customer service management can evolve to online applications in order to have a closer communication and interaction with the customers (PLANK; HOOKER, 2014), creating the possibility to have a superior pre and post sales service and customer intimacy (WILSON; RAMAN, 2017).

By analyzing the relationship among the clusters, it is possible to infer that to have the customer-centricity requirement reached is necessary to have a planning process well established, a close relationship with the suppliers in order to obtain a consistent supply and to have a deep understanding of the customers' requirements.

Thus, the main contributions from the customer-centricity competitiveness dimensions that lead to changes for the traditional S&OP process are:

- ✓ Portfolio review management and product life cycle management are important approaches to gain importance in the S&OP forums;
- ✓ Information sharing among the partners of the supply chain (or among the key partners) becomes important to know the customer's requirements. Demand plans from customers can be used by the suppliers;
- ✓ Internet-based and social media behaviors are important to know deeply the customers' interests. POS data can also be used to have a more confident forecast;
- ✓ Management approaches, such as CPFR, VMI and ECR, that expands externally the S&OP amplitude can be considered in the S&OP forums. These approaches lead to improve the cooperation among the supply chain partners;

- ✓ In order to propose the correct and expect value to the customers, they can be segmented to have a better management. In this sense, demand sensing, demand shaping and demand shifting can be used;
- ✓ S&OP becomes more strategic and with more intimacy with market and customer intelligence areas. Customer service management should evolve to online platforms to enhance the communication and interaction with the customers.

3.4.4 Responsiveness

Figure 3.9 presents the similarity diagram for the responsiveness competitive dimension. There are four main cluster: (i) responsiveness core, (ii) supply core, (iii) demand core and (iv) plan core.

The importance to be responsive to the market is to quick respond to disruptions in demand with a non-prohibitive cost (KEAL; HEBERT, 2010; NUCAMENDI-GUILLÉN; MORENO; MENDOZA, 2018; TARAFDAR; QRUNFLEH, 2017). In this sense, robust information systems has gained an important role to make companies able to respond effectively to the customer requirements and S&OP should be supported by technologies (CHASE, 2013a; GOSWAMI; ENGEL; KRCMAR, 2013; GRIMSON; PYKE, 2007; THOMÉ; SOUSA; SCAVARDA, 2014). Danese, Molinaro and Romano (2018) and Nielsen, Nielsen and Steger-Jensen (2010) suggest the use of APS.

Additionally, Chae and Olson (2013) consider the use of data warehouses to manage adequately all available data, to find trends and anticipate misalignments to respond quickly to the market and Ivert and Jonsson (2010), Ivert and Jonsson (2014) and Schlegel and Murray (2010) consider the use of advanced methods, such as stochastic optimization.

To improve visibility and be more responsive, Kelleher (2012) suggests the use of event forecasting, providing a proactive aspect to forecasting by representing, besides quantities on a timeline, risks and opportunities. Kaipia et al. (2017) cite the use of POS data to improve the forecast accuracy.

Weekly cycle review in the S&OP process , in order to reduce lead time to react to realized sales, is also another approach to become more responsive (KAIPIA et al., 2017). Li, Shakya and Owusu (2018) considered an operational forecasting model during the conducted case research in a Telecom company with the aim of dealing with short-demand profiles and

Figure 3.9 – Responsiveness similarity diagram

Source: Prepared by the author

Ivert et al. (2015a) consider a shorter planning horizon. Such demand profile can be treated in a SKU level in order to reduce uncertainties (DREYER et al., 2018).

Event-driven meetings (GRIMSON; PYKE, 2007; WAGNER; ULLRICH; TRANSCHEL, 2014) with scenario analysis (WARREN, 2012) can be used in the S&OP process to result in an active tactical planning to adjust the demand and supply imbalances (LARSSON; FREDRIKSSON, 2019). This can be supported by automated workflow synchronization which allows to obtain alert mechanisms to support critical decisions (BAUMANN, 2011).

To increase responsiveness, Ralston et al. (2015), Rokonuzzaman (2018) and Tarafdar and Qrunfleh (2017) suggest the inclusion of strategic customer and supplier in the S&OP process. Godsell et al. (2018) and Smith, Andraski and Fawcett (2011) consider an integration between S&OP and CPFR and misalignments (regarding to products, demand, supply and financials) may be discussed in a process called integrated reconciliation. To obtain responsiveness S&OP should consider a response management process in which integrates logistics operations with sales operations (WALTERS, 2008). In this sense, Bower (2018) and Lapide (2014a) consider the use of demand-shaping during S&OP meetings.

Another processes management approaches can be used and/or considering during the S&OP process. Postponement can be a strategy to be considered in the S&OP forums to improve the responsiveness to the market (TARAFDAR; QRUNFLEH, 2017). Lean and JIT initiatives can also be used to improve responsiveness (NIELSEN; NIELSEN; STEGER-JENSEN, 2010; ROKONUZZAMAN, 2018). In this sense, Burrows III (2007) considers the planning based on production rate and not based on volume and Bozutti and Esposto (2019) and Thomé et al. (2012b) cited the use of risk and constraints management.

The leadership has the importance to not solely attend the meeting but also to bring to the meetings ideas and perceptions to contribute to responsiveness; a proactive attitude should be part of the leadership (BOWER, 2017).

By analyzing the clusters relationships, it is possible to infer that to be responsive the company should match adequately the demand and supply (by closer relationship among supply chain partners) support by an effective planning process.

Thus, the main contributions from the responsiveness competitiveness dimensions that lead to changes for the traditional S&OP process are:

- ✓ S&OP being supported by information systems, such as APS and Data Warehouses;

- ✓ Use of advanced mathematical and algorithms, such as stochastic optimization;
- ✓ To perform event-driven meetings, event-driven forecasting, normally supported by POS data and with a SKU-level visibility;
- ✓ Include in the process a weekly review step;
- ✓ Integration in the S&OP process of the main supply chain partners. This can be achieved by the combination between S&OP and CPRF and the inclusion of a response management process;
- ✓ To consider processes management approaches, such as postponement, JIT, lean production and risk management; and
- ✓ Leadership has a critical importance.

3.4.5 Flexibility

Figure 3.10 presents the similarity diagram for the flexibility competitive dimension. There are five main cluster: (i) flexibility core, (ii) management core, (iii) plan core, (iv) customer core and (v) supply core.

The found clusters interferes one each other. The planning cluster must take in consideration the customer cluster and the supply cluster. Once the planning cluster take in consideration these other two cluster, it can feed adequately the management cluster, thus the management cluster can feed adequately the flexibility cluster. In this sense, the flexibility to fulfill customer requirements will be improved by the S&OP process.

Some finds are not essentially new for the S&OP process. To obtain flexibility is necessary a cooperation among operations and production areas and the commercialization process (STORBACKA, 2011). Such flexibility could be in form of volume, product launch, distribution access and product differentiation (BOZUTTI; ESPOSTO, 2019; HADAYA; CASSIVI, 2007b).

Goswami, Engel and Krcmar (2013) and Swaim et al. (2016) considered the timely access to information as an important factor to gain flexibility by obtaining improved production planning and enhanced management of resources and assets or by performing short-term demand adjustments (LARSSON; FREDRIKSSON, 2019). To obtain the timely access to information, the information systems have an important role (DANESE; MOLINARO; ROMANO, 2018; LAPIDE, 2005a; THOMÉ; SOUSA; SCAVARDA, 2014). Ivert and Jonsson (2010) and Tuomikangas and Kaipia (2014) complete by citing the information systems have a

positive influence on flexibility and suggests the use of APS. Complementarily, Chae and Olson (2013) and Ivert and Jonsson (2014) suggest the use of descriptive and time series analysis as well as advanced analytics to identify exceptions and trends, Ross (2004) suggests optimization tools and Wilson and Raman (2017) suggest the use of artificial intelligence and Big Data. In this sense, Schlegel and Murray (2010) suggest the dynamic inventory planning to support the S&OP process.

Figure 3.10 – Flexibility similarity diagram

Source: Prepared by the author

To improve the flexibility, Ivert et al. (2015a) and Turner, Aitken and Bozarth (2018) consider the possibility to use third-party providers. For that, it is important a good data sharing

among the partners (KAIPIA et al., 2017). The risk management cannot be dismissed in both internal or external activities (TURNER; AITKEN; BOZARTH, 2018).

To gain flexibility, it is possible to consider in the S&OP process the option of use the postponement strategy (TARAFDAR; QRUNFLEH, 2017). This makes fulfilment process more flexible and responsive considering a greater product variety.

When defining the supply strategy, Swaim et al. (2016) consider the possibility of job rotation and cross-departmental training to increase the flexibility. Additionally, Nakano (2009) considers the necessity of new processes, new manners of data source, new manners of knowledge sharing, elimination of unnecessary processes and organizational redesign. Dreyer et al. (2018) proposes a change in the S&OP, considering a meeting between supply planners (as well as performed by manufacturing teams), when there is uncertainty in the supply process and Lee (2013) considers the possibility of tolerances establishment and trigger points for planning again.

What-if scenario planning (DREYER et al., 2018; IVERT; JONSSON, 2010, 2014; JONSSON; HOLMSTRÖM, 2016a; ROSS, 2004; SINGH; LEE, 2013; SWAIM et al., 2016), simulation (BURROWS III, 2007; IVERT et al., 2015b) and sensitive analysis (WAGNER; ULLRICH; TRANSCHEL, 2014) make companies able to support the front-line manufacturing to respond quickly to market changes, thus being more flexible. These analyses must be included in the S&OP forums because allow companies to shape the demand, leading to an increase profitability (NOROOZI; WIKNER, 2017).

Thus, the main contributions from flexibility dimension are:

- ✓ Obtain timely decisions to information;
- ✓ Possibility to have short-term demand adjustments;
- ✓ Importance of information systems support, to make effective the use of artificial intelligence, Big Data and APS;
- ✓ Utilization of optimization tools, descriptive and time series analysis and advanced analytics;
- ✓ Include in the S&OP forum the possibility of third-party providers utilization;
- ✓ Use of risk management in the S&OP process;
- ✓ Possibility to consider the postponement strategy;
- ✓ Take in consideration organizational issues, for instance, job rotation, cross-departmental training;

It possible to infer from cluster I that adaptability is between the S&OP process and the demand and supply activities. In this sense, some actions can be taken to influence demand (price and advertising, for instance) and/or supply (using overtime and hiring, for instance); with such actions, the companies are able to be adapted to the market requirements (NIELSEN; NIELSEN; STEGER-JENSEN, 2010). To gain visibility and can be adapted to the market, Bower (2017) suggests as the first step of the S&OP process to be a portfolio review, where all issues regarding product and service life cycle are reviewed. Esper et al. (2010) consider the importance to create a business intelligence in order to offer the right product and/or service, as this also needs to be explored in the S&OP process. On the other side, Dreyer et al. (2018) consider the importance to be the first step of the S&OP process the supply planning, especially in cases where the supply have uncertainty.

Collaboration among the partners in the supply chain, such as strategic supplier relationship, makes companies more responsive and adaptable (TARAFDAR; QRUNFLEH, 2017). Baumann (2011) considers the possibility of integration between S&OP and CPFR, increasing the collaboration between customer and supplier.

Collaborating with the cluster I results, Goh and Eldridge (2015) cite the importance of SKU segmentation in the S&OP process. This approach aids companies to focus the efforts where is necessary.

The utilization of information systems for S&OP and supply chain planning has gained the importance to make companies to adapt to the new business environment (as possible to see in Cluster III); normally the information systems are supported by interned-based functions (GOSWAMI; ENGEL; KRCMAR, 2013). This make companies able to adapt themselves to the customer behaviors (STORBACKA, 2011). Scenario planning and what-if analysis are also important (BOZUTTI; ESPOSTO, 2019; KRISTENSEN; JONSSON, 2018; ROSS, 2004; SINGH; LEE, 2013) and should be supported by the information systems, as APS (IVERT; JONSSON, 2010). Oliva and Watson (2011) named this analysis process as gap-filling, where the team discusses the issues and proposes actions to fulfill the customer requirements. Moreover, Schlegel and Murray (2010) considered the possibility to use stochastic optimization and algorithms to provide a better understanding of the studied scenarios (as possible to see in cluster I).

The S&OP process cannot be static (WILSON; RAMAN, 2017), as shown in cluster III. New process, new source of data, new systems to improve analysis and new organizational design must always be considered; processes, organizational culture and leadership have an

important role for the S&OP process (GRAY; DOUGHERTY, 2017; MOON; ALLE, 2015). For the S&OP, financial, risk and business planning must be integrated in the process (JONSSON; HOLMSTRÖM, 2016a; KELLEHER, 2012). Event-driven meetings on a virtual base can take place (WAGNER; ULLRICH; TRANSCHEL, 2014). In this sense, companies will evolve in the competition environment (NAKANO, 2009). Such changes must always be integrated with the company's strategy, once S&OP has the role to be the bridge between the strategic level and the operational level (BAUMANN, 2011) and the S&OP process should be part of a continuous improvement, for the company and for the process itself (THOMAS et al., 2011).

Thus, the main contributions from adaptability dimension are:

- ✓ S&OP should have a proactive role in influencing the demand and supply;
- ✓ Suggested changes in the S&OP process: including portfolio review in the first step and/or business intelligence and/or supply planning;
- ✓ S&OP should include supply chain partners in the process, thus collaboration in the supply chain is more important. The use of the CPFR concepts is a possibility;
- ✓ Necessary use of information systems, normally web-based supported;
- ✓ Use of scenario planning, what-if analysis or gap-filling supported by the information systems;
- ✓ S&OP should be always improved continuously, with new steps, new source of data, new systems and/or new organization designs.

3.4.7 Velocity

Figure 3.12 presents the similarity diagram for the velocity competitive dimension. There are two main cluster: (i) velocity core and (ii) sales and operations planning core.

The velocity (the cluster II core) is a critical characteristic of the business environment. Leadership normally requires velocity in decisions, and the S&OP process cannot be dealt differently (COVAS, 2016). The necessity of velocity is evident, but (JUNG; CHUNG, 2016; WALLACE, 2012; WALLACE; STAHL, 2008) advise the possibility of having informal communication to take decisions, but the formal S&OP meetings cannot be dismissed.

Tarafdar and Qrunfleh (2017) cited the importance to take in consideration the timely access to information about customer behaviors, markets trend and competitive actions when the companies are introducing new products; and this should be considered in the S&OP

process. Godsell, Birtwistle and Van Hoek (2010) also consider the necessity of new products introductions make part of the S&OP forum, and they complete arguing that it could minimize the complexity of the new product implementation project. In this sense, Kaipia et al. (2017) considers the use of POS data to understand how the market is respond for the new product introduction.

To have all information in a quick manner, Burrows III (2007), Grimson and Pyke (2007), Lapide (2005b) and Wagner, Ullrich and Transchel (2014) consider the necessity of the

Figure 3.12 – Velocity similarity diagram

Source: Prepared by the author

technology (ERP, APS and EDI) to support decisions and systems that are able to provide real-time data and information. Jonsson, Rudberg and Holmberg (2013), during their study at IKEA, realized the importance to have an APS system to provide velocity to decisions. Ivert and Jonsson (2010) and Rokonuzzaman (2018) also consider the use of APS to aid the S&OP process and to guarantee on-time delivery. The technology and processing velocity currently available, make able to provide the S&OP team a high quantity of what-if calculations and scenarios analysis to make all necessary decisions (JONSSON; HOLMSTRÖM, 2016). The velocity can also be gained by making available different information and analysis in a visual form. That's why Rokonuzzaman (2018) and Suurmond (2016) consider the necessity of dashboard use during the S&OP meetings and the dashboard should be connected with real-time information and data. Such data can also be from social media, web-based tools and internet behavior of the customer (BOONE; GANESHAN; HICKS, 2015).

Related to the S&OP process (represented in the cluster I), an approach considered by Esper et al. (2010) is to perform the customer forecast processes and the capacity forecast/assumptions in parallel. Lee (2013) considers the S&OP process necessity to provide sustainability to day-to-day operations, thus, to respond effectively to the velocity requirements, S&OP should have approaches that permits to take corrective actions to daily issues (BAUMANN, 2011). The use of software is important, as discussed in the cluster II) and the necessary meetings should be performed effectively.

Thus, the main contributions from velocity dimension are:

- ✓ Possibility to use informal communication to obtain velocity (but formal communication and meetings cannot be dismissed);
- ✓ Timely access to information about customer behaviors, market trends and competitors. This is especially important to new products introduction in order to have velocity to corrective actions;
- ✓ Use of POS data to support decisions;
- ✓ Information technology (ERP, APS and EDI) assumes an important role. This technology provides velocity to execute what-if analysis of different scenarios;
- ✓ Information should be showed in a visual form, for instance, dashboards (normally connected with real-time data);
- ✓ Importance of data from social media and internet sources; and
- ✓ S&OP should be able to respond effectively to day-to-day issues.

3.4.8 Demand Variability and Demand Variety

Figure 3.13 presents the similarity diagram for the demand variability competitive dimension. There are two main cluster: (i) demand variability core and (ii) demand core and the Figure 3.14 presents the similarity diagram for the demand variety competitive dimension. There are two main cluster: (i) demand variability core and (ii) demand core.

The discussion of these last two dimensions will be together, once they are related and during the findings, they propose the same or similar challenges to the S&OP process.

It is possible to verify that the term Sales and Operations Planning did not appear in both diagram, this can be explained by the fact that the demand variability and variety can be

Figure 3.13 – Demand variability similarity diagram

considered environmental characteristics that influence the S&OP process. It also importance to infer from both diagrams that some results are like the traditional S&OP process, i.e., monthly cycle, aggregate planning and use of forecasts.

Demand variability and demand variety can be dealt by sharing information about actual sales among the partners in the supply chain, so the companies have the visibility to take corrective actions for inventory and/or capacity adjustments (GOSWAMI; ENGEL; KRCMAR, 2013). Burrows III (2007) completes considering the use of POS data. It is important to compare the real demand with the forecasted numbers in order to understand the causes of the non-order-fulfillment (NUCAMENDI-GUILLÉN; MORENO; MENDOZA, 2018), and this is not different from the traditional S&OP process.

Figure 3.14 – Demand variety similarity diagram

Source: Prepared by the author

In order to deal with the demand variability, Ivert et al. (2015b) cite that the planning frequency has a positive effect on how the companies respond to the demand, thus it possible to infer if the demand has a high variation, the planning frequency must be higher. The same authors considered that if the company have many SKU's, could be difficult to create families and be responsive, so it better to plan at the SKU-level. Kelleher (2012) contributes by proposing the division of the products depending on their importance, i.e., if the products is strategically important for the company, event meetings should be conducted; if they have a medium importance, it can be used a monthly based planning; and if they have a low importance, a quarterly-based could be considered. On the other side, Biazzin, Tomaselli and Costa Pena (2017) considered the use of mathematical models to have a better understand of the demand variability and demand variety. With the aid of information systems, what-if analysis and scenarios creation/analysis should provide conditions to face the demand variability and variety (SINGH; LEE, 2013).

Thus, the main contributions from these last two analyzed dimensions are:

- ✓ The information should be shared among the supply chain partner in order to increase the visibility;
- ✓ Use of POS data to improve the quality of the planning;
- ✓ Shorten the S&OP planning frequency;
- ✓ Possibility to plan at the SKU-level; and
- ✓ Use of information systems, mathematical modeling, what-if analysis and scenarios analysis.

3.5 New paths proposal for the S&OP process

A challenge comes up to companies knowing how to change their S&OP process to respond effectively to new business requirements. By the conducted systematic literature review, a list of 20 approaches were found to contribute to the S&OP process improvement. The list is presented in Chart 3.7 and it is also presented if the approach impacts or not in the considered competitive dimensions. It is possible to infer from Chart 3.7 that 11 approaches contribute to at least four of the defined competitiveness dimensions, revealing the importance of these approaches' adoption.

By analyzing this 20-approach list, the S&OP process must have a fundamental change: its broadness should be increased. The concept of vertical and horizontal consistencies does not change, but it should be expanded.

Chart 3.7 – New approaches for the S&OP process

New approaches for the S&OP process	Visibility	Agility	Customer-centricity	Responsiveness	Flexibility	Adaptability	Velocity	Demand Variability and Variety
Information shared and collaboration among supply chain partners	✓	✓	✓	✓		✓		✓
POS data	✓	✓	✓	✓			✓	✓
Importance of a robust information system	✓			✓		✓	✓	✓
Use of APS (SAP APO, for instance)	✓	✓		✓	✓		✓	
Shorter planning cycles into the S&OP process		✓		✓	✓		✓	✓
Receipt and management of real-time data and timely information	✓	✓			✓		✓	
Internet and web-based behavior	✓		✓			✓	✓	
S&OP combined with JIT and Lean Approaches (continuous improvement, for instance)		✓		✓	✓	✓		
Postponement, CPFR, VMI and/or ECR			✓	✓	✓	✓		
Planning at the SKU-level	✓			✓				✓
Social media data	✓		✓				✓	
Influences of Industry 4.0, IoT, Big Data, AI and Dashboards	✓				✓		✓	
Optimization of scenarios and advanced analytics	✓				✓			✓
What-if scenarios analysis, simulation and sensitive analysis	✓				✓			✓
Risk Management included in all steps	✓			✓	✓			
S&OP more strategic - Business and Market Intelligence		✓	✓			✓		
S&OP and a closer interface with New Product Development and Introduction and Product Life Cycle Management		✓	✓			✓		
Event-driven meetings		✓		✓				
Demand sensing, Demand Shaping and or Demand Shifting - S&OP being more proactive			✓			✓		
Informal communication							✓	
Data Warehouses				✓				
Financial Management included in all steps	✓							
Customer Service Management with online platforms			✓					
Event-driven forecasting				✓				
Customer Segmentation			✓					
Organizational issues (job rotation, cross-departmental training)					✓			
Third-party providers					✓			
Leadership importance				✓				

Source: Prepared by the author

When thinking about the vertical consistency, the S&OP should be more strategic and should have an enhanced interaction with market intelligence and product/service development; on the other side, it should also be more operational, with shorter planning cycles to react adequately and with agility to the short-term demand variations or supply misalignments.

When looking at the strategic perspective, the S&OP has a threefold participation: (i) to support the strategies' definition and execution, (ii) to support new products development and introduction, and (iii) to improve the customer intimacy with market intelligence. Chart 3.8 shows which approaches can support each of these three contributions.

Chart 3.8 – S&OP process approaches for strategies' support

New approaches for the S&OP process	To support the strategies' definition and execution	To support new products development and introduction	To improve the customer intimacy with market intelligence
Information shared and collaboration among supply chain partners	✓	✓	✓
Importance of a robust information system	✓	✓	✓
Use of APS (SAP APO, for instance)	✓		✓
Internet and web-based behavior	✓	✓	✓
S&OP combined with JIT and Lean Approaches	✓		
Postponement, CPFR, VMI and/or ECR			✓
Social media data	✓	✓	✓
Influences of Industry 4.0, IoT, Big Data, AI and Dashboards	✓	✓	✓
Optimization of scenarios and advanced analytics	✓		✓
What-if scenarios analysis, simulation and sensitive analysis	✓		✓
Risk Management included in all steps	✓	✓	✓
S&OP more strategic - Business and Market Intelligence	✓		✓
S&OP and a closer interface with New Product Development and Introduction and Product Life Cycle Management		✓	
Demand sensing, Demand Shaping and or Demand Shifting			✓

Chart 3.8 – S&OP process approaches for strategies' support - *Continuation*

New approaches for the S&OP process	To support the strategies' definition and execution	To support new products development and introduction	To improve the customer intimacy with market intelligence
Data Warehouses	✓		
Financial Management included in all steps	✓	✓	✓
Customer Segmentation			✓
Organizational issues (job rotation, cross-departmental training)	✓		
Third-party providers	✓		✓
Leadership importance	✓		

Source: Prepared by the author

When looking at the operational perspective, the S&OP has a twofold participation: (i) to better respond to the demand, and (ii) to promote agility to solve issues. Chart 3.9 shows which approaches can support each of these two contributions.

Chart 3.9 – S&OP process approaches for operational support

New approaches for the S&OP process	To better respond to the demand	To promote agility to solve issues
Information shared and collaboration among supply chain partners	✓	✓
POS data	✓	✓
Importance of a robust information system	✓	✓
Use of APS (SAP APO, for instance)	✓	✓
Shorter planning cycles into the S&OP process		✓
Receipt and management of real-time data and timely information	✓	✓
S&OP combined with JIT and Lean Approaches (continuous improvement, for instance)	✓	✓
Planning at the SKU-level	✓	
Influences of Industry 4.0, IoT, Big Data, AI and Dashboards	✓	✓
Optimization of scenarios and advanced analytics	✓	
What-if scenarios analysis, simulation and sensitive analysis	✓	✓
Risk Management included in all steps	✓	✓
Event-driven meetings		✓
Demand sensing, Demand Shaping and or Demand Shifting	✓	

Chart 3.9 – S&OP process approaches for operational support - *Continuation*

New approaches for the S&OP process	To better respond to the demand	To promote agility to solve issues
Informal communication	✓	✓
Financial Management included in all steps	✓	✓
Customer Service Management with online platforms	✓	
Event-driven forecasting	✓	✓
Leadership importance	✓	✓

Source: Prepared by the author

When thinking about the horizontal consistency, the S&OP should look beyond the company's boundaries. Suppliers and customers should be integrated in the S&OP process and S&OP should be integrated with the CPFR process. Perceptions and behavior from the final consumer should also be considered.

Considering the supplier and customer integration and collaboration, the S&OP has a threefold participation: (i) to promote visibility in the supply chain, (ii) to support the new product development, and (iii) to better respond to the final customer demand. Chart 3.10 shows which approaches can support each of these three contributions.

Chart 3.10 – S&OP process approaches for supplier and customer integration and collaboration

New approaches for the S&OP process	Supplier Integration			Customer Integration		
	To promote visibility in the supply chain	To support the new product development	To better respond to the final customer demand	To promote visibility in the supply chain	To support the new product development	To better respond to the final customer demand
Information shared and collaboration among supply chain partners	✓	✓	✓	✓	✓	✓
POS data	✓		✓	✓		✓
Importance of a robust information system	✓		✓	✓		✓
Receipt and management of real-time data and timely information	✓			✓		
Internet and web-based behavior	✓	✓	✓	✓	✓	✓
Social media data	✓	✓		✓	✓	
Shorter planning cycles into the S&OP process			✓			✓
Postponement, CPFR, VMI and/or ECR			✓			✓
Planning at the SKU-level	✓			✓		
Optimization of scenarios and advanced analytics	✓		✓	✓		✓

Chart 3.10 – S&OP process approaches for supplier and customer integration and collaboration - *Continuation*

New approaches for the S&OP process	Supplier Integration			Customer Integration		
	To promote visibility in the supply chain	To support the new product development	To better respond to the final customer demand	To promote visibility in the supply chain	To support the new product development	To better respond to the final customer demand
What-if scenarios analysis, simulation and sensitive analysis	✓		✓	✓		✓
Risk Management included in all steps	✓	✓	✓	✓	✓	✓
S&OP more strategic - Business and Market Intelligence	✓	✓	✓	✓	✓	✓
S&OP and a closer interface with New Product Development and Introduction and Product Life Cycle Management		✓			✓	
Event-driven meetings			✓			✓
Financial Management included in all steps	✓	✓	✓	✓	✓	✓
Customer Segmentation						✓
Customer Service Management with online platforms	✓			✓		
Third-party providers			✓			✓

Source: Prepared by the author

Considering the final customers' requirements, the S&OP has a twofold participation: (i) to promote visibility of the final customers' requirements, and (ii) to promote agility to possible issues. Chart 3.11 shows which approaches can support each of these two contributions.

Chart 3.11 – S&OP process approaches for final customer integration and collaboration

New approaches for the S&OP process	To promote visibility of the final customers' requirements	To promote agility to possible issues
Information shared and collaboration among supply chain partners	✓	✓
POS data	✓	✓
Internet and web-based behavior	✓	
S&OP combined with JIT and Lean Approaches (continuous improvement, for instance)	✓	✓
Postponement, CPFR, VMI and/or ECR		✓
Social media data	✓	
Risk Management included in all steps	✓	✓
S&OP more strategic - Business and Market Intelligence	✓	✓
Customer Service Management with online platforms	✓	✓

Source: Prepared by the author

Considering the expansion of the vertical and horizontal S&OP consistencies, the Figures 3.15 (vertical consistency) and 3.16 (horizontal consistency) summarize which approach can contribute to each type of consistency.

Figure 3.15 – Approaches and consistencies for vertical expansion

Source: Prepared by the author

Figure 3.16 – Approaches and consistencies for horizontal expansion

Source: Prepared by the author

3.6 S&OP approaches for the demand-driven phenomenon (practitioners' findings)

In the new Supply Chain Management environment, the planners should not solely react to the market but they need to plan effectively (LAPIDE, 2009).

The traditional S&OP process does not bring high value to the companies as before, because it is outdated (CECERE; BARRETT; MOORAJ, 2009). The same authors conducted a research with more than 150 companies, and they realize that the S&OP has been transformed from the traditional approach. The key components of the traditional S&OP, i.e., demand, customer, products, organization and financial, should be considered, but in a different manner, considering volatility, variety and value (GOLLAMUDI, 2013).

The Demand-Driven S&OP could eliminate some problems found in the traditional S&OP process and outputs, by adding and considering (GOLLAMUDI, 2013):

- ✓ Visibility;
- ✓ Collaboration;
- ✓ Demand planning;
- ✓ Demand shaping;
- ✓ Order predictions;
- ✓ Logistics planning; and
- ✓ Material planning.

Chart 3.12 describes the main differences between traditional and Demand-Driven S&OP.

Chart 3.12 – Comparison between traditional and Demand-Driven S&OP

	Traditional S&OP	Demand-Driven S&OP
Demand	Predictable / Linear	Unpredictable / Volatile
Product Variety	Limited	Large
Customers	Demographic considerations	Value proposal
Organization	Silos / Functional	Collaboration approach
Operations	Reactive to demand	Proactive with simulations
Finance	Profit-loss focus	Balance-sheet focus

Source: adapted from Gollamudi (2013)

Burrows (2012) cites that one fundamental point to have success in the Demand-Driven S&OP implementation is education. It is necessary to through people, not solely with them. The main idea is to develop people to be able to work in the entire process and not just in part of process that is on a “prepackaged form”.

Burrows (2012) completes affirming that Demand-Driven S&OP should be designing to implement the company's strategy. For that, two other points, besides education, should be handles carefully:

- ✓ **Design S&OP to run the business:** as S&OP brings all functions together, it becomes the way the business is run. Through the S&OP meeting, handled in a collaborative manner, the team determines how to interpret the information and makes decision with consensus. The responsibility for results belongs to entire team;
- ✓ **Design to enable customer centricity:** the demand-driven S&OP should be centered on customer and this is possible with a strategy focused on market. The market feedback should be handled in the S&OP's meeting and the team must have the functions well-defined and briefly described. The metrics and strategical goals are different compared with the traditional process, i.e., not solely considering internal goals but measuring enabling concepts to fulfill customer's need. For that metrics should consider complexity, flexibility, customization and strategic alignment.

There are four steps of maturity to achieve the Demand-Driven S&OP (CECERE; BARRETT; MOORAJ, 2009):

- ✓ **Step 1: Reacting.** At this step the goal is to develop an operations planning. The main metrics are: order fill rate, asset utilization and inventory levels;
- ✓ **Step 2: Anticipating.** At this step the goal is demand and supply matching. The main metrics are: order fill rate, forecasts errors, inventory turns and functional costs;
- ✓ **Step 3: Collaborating.** At this step the goal is profitability. The main metrics are demand error, customer service, working capital and total costs;
- ✓ **Step 4: Orchestrating.** At this step the goal is demand sensing to drive an optimized demand response. The main metrics are: demand risk, customer service, cash flow, market share and profit.

From the practitioners, there were found four established frameworks for the Demand-Driven S&OP, provided by: (i) Cecere, Barrett and Mooraj (2009), (ii) Burrows III (2012) and (iii) Ptak and Smith (2018).

3.6.1 Cecere, Barrett and Mooraj (2009) approach

According to Cecere, Barrett and Mooraj (2009), the Demand-Driven S&OP evolved from the five-step S&OP to nine-step S&OP, with the aim of being more sensitive and respond correctly to the demand and market complexity. The nine steps are illustrated in the Figure 3.17 and after described.

Figure 3.17 – Demand-Driven S&OP process

Source: Adapted from Cecere, Barrett and Mooraj (2009)

First step, to collect sales and market inputs, has the aim of collecting data, in a collaborative manner, from sales and marketing. The data is historical data and bias should be evaluated.

Second step, to develop a demand plan, has the aim of building multi-period forecasting plan, considering many sources of demand and information from the first step.

Third step, demand consensus and refinement, has the aim of finding exceptions, understand and deal with them through a comparison between the statistically multi-period forecast and the collective sales forecast.

Fourth step, shape demand based on what-if analysis on demand for supply, has the aim of developing a demand plan based on quantity and financial. It can be used marketing intelligence to take advantage from the competitors. At this point the demand should be shaped.

Fifth step, develop a constrained plan by supply, has the aim of identifying manufacturing constraints and capacity opportunities for the consensus meeting review. The output from the third step should be used and options should be provided considering return on assets, profitability, revenue, customer service and working capital.

Sixth step, conduct a what-if analysis by supply to determine trade-offs on the measurements and identify demand-shaping opportunities, has the aim of performing an

evaluation of the fourth step what-if demand shaping based on profitability, revenue, customer service and working capital. The constraints of demand shortfalls and capacities opportunities should be clearly identified.

Seventh step, review and gain agreement through a consensus meeting, has the aim of reviewing scenarios and have a consensus on an operating plan based on pricing, operational and functional trade-offs.

Eighth step, publish the constrained plan, has the aim of communicating the plan to the global operational and financial teams for execution.

Ninth step, measure and communicate the plan, has the aim of evaluating how the decision prior taken are being performed during the month. The goal is to have a learning cycle to be used in the next DDS&OP monthly cycle.

Cecere, Barrett and Mooraj (2009) propose a chronogram to perform the S&OP process, as shown in Figure 3.18.

The chronogram considers all nine steps of the approach proposal. It is a monthly cycle in which overlapping of activities are foreseen in order to perform all activities (as it is possible to see in Figure 3.18, collect sales and market and develop a demand plan of the next cycle begins during the publish of the constrained plan and measure and communicate the plan of the previous cycle). Operational reviews are necessary to check if the decisions taken during the cycle are being properly performed, if not, actions must be taken.

Figure 3.18 – S&OP chronogram

Source: Adapted from Cecere, Barrett and Mooraj (2009)

3.6.2 Burrows (2012) approach

Burrows (2012) considers twenty-six horizontal planning processes that should be aligned during the Demand-Driven S&OP process. The process is illustrated in the Figure 3.19. The numbers presented in Figure 3.19 may lead to a sequence of steps to be dealt. Nonetheless, it differs from the process proposed by Cecere, Barrett and Mooraj (2009) and from the traditional S&OP process.

Figure 3.19 – 26 processes to be aligned

Source: Adapted from Burrows (2012)

The **strategic integration** has the aim of coming back to the company's strategy in order to find gaps between what is being executed and what was planned. It is important to understand such gaps to find errors in the strategic planning or to make corrections in what is being executed during the month.

The **demand planning** receives the information obtained during the **strategic integration** to plan how explore the market and customers' segments. At this point, it is not solely a forecasting, but it is a fundamental process that links the company's strategy to the market exploration.

The **rated-based planning** has the aim of creating a production plan that fulfills the demand at a minimal inventory accumulation based on an agreed service level.

The **planning in cross-functional coordinating families** may be considered an enable process that lead to the success of the S&OP process. Companies works with a large number of items, when these items are aggregate in families, planning and forecast errors are minimized

and the decision-making process becomes easier. When these families are planned in a cross-functional way, many areas have the visibility of the concerning issues of the families, thus opportunities can be found easily, and contingencies plans can be done faster.

The **network design** has the aim of understanding the supply chain issues and opportunities, to evaluate which plant would produce which items, to define distribution strategy (inventory's position in the supply chain and modals of transport), to understand lead-times and to make visible the constraints to reach the market.

The **inventory simulation** has the aim of evaluating and define the quantity and location of the inventory in the supply chain. On the one hand inventory is costly but on the other hand inventory defines the service level. By using simulation (specialized software may be used), it would help the decision makers to define the better strategy concerning inventory issues in the supply chain.

The **cost to serve analysis** evaluates all costs incurred to serve the customer segments considering the network design and inventory positions and quantities.

The **view of forecasts** should not be limited to statistical forecast analysis. Multiple views should make part of this process, i.e., salesperson forecast, customer forecasts, trade association forecasts, marketing forecast of promotions, customers' segments forecasts, etc. All these forecast views should be displayed on a chart, in order to have a great visibility of different points of view.

The **risk/opportunity** analysis has the aim analyze the agreed prior decisions and look for the risks of them and opportunities. This process is important because issues may occur, depending on made decisions and opportunities may not be foreseen.

The **contingency planning** deals with the information of the **risk/opportunity analysis** to create system resilience. Issues may occur and, based on the risks prior evaluated, a contingency plan should be defined in order to keep the plan on the rails.

The **sales-gap closure** is the last foreseen process for sales planning in which salespersons should present the final considerations about market and customers and based on the value-chain program a final sales planning is defined in order to continue the entire Demand-Driven S&OP process.

The **financial report** brings to financial terms all prior decisions. Not solely costs, but a complete report considering the financials data.

The **integrated projections** consider the financial reports to be formulated. These projections consider the financial impacts in the future in all evolved areas in the process, that's why, it is called integrated. The important aspect of this process is the holistic approach,

because some areas, sometimes, need to have a poor result in order that the whole company have a positive result.

The **annual operating planning** is not an exclusive process of the S&OP, but it inputs information in order to make financial decisions and the S&OP process support the creation/review of the annual operating planning. The annual operating planning has the importance to evaluate the company's financial healthy.

The **tilt meetings** have the aim of formalizing all financial decisions made during the S&OP process. These meetings also bring the opportunity to find mistakes, to look for opportunities, to evaluate and mitigate financial risks and to make financial information available to the S&OP team.

The **demand sensing** is one of the key process of the Demand-Driven S&OP, that's why, it is a process that is also in evidence at the Cecere, Barrett and Mooraj (2009) proposal. In this process is necessary to identify few and important leading indicators, and not try to go into the terabytes of company's system information. It is important to analyze, besides the internal perspective of the company, the external perspective, i.e., customer trends, point-of-sale data, economy trends, populational changes, habits change, and so on. The idea is to be prepared and aware with the environment the company is inserted. Forecasting may be used to support the decisions of this process.

The **promotional alignment** has the aim of making clear all marketing efforts to promote products. This is an important point to be dealt, because promotions affect the demand and, thus, the necessity of using the manufacturing capacity.

The **supplier alignment** has the aim of communicating the suppliers with the decisions provided by **demand sensing** and **promotional alignment**. Suppliers should not be aside of the company's decisions, because, if this happens, raw materials could not be available for production. Strong relationships and enhanced information shared should be better with key suppliers.

The **competitors' analysis** brings the opportunity to understand and analyze the competitors' movement and actions in the market. It is important to have competitiveness advantages with internal capabilities, but it is also necessary to analyze the competitors.

The **monthly S&OP meeting** is a cross-functional meeting in which the decisions must be taken considering the taken considerations foreseen in the previous steps. The areas' leaders must have a participation in this meeting.

The **customer alignment** has the aim of understanding the restrictions of customer's segment and to define and make clear the service level of each customer's segment. All areas involved in the process should know the service level of each customer's segment with the aim of providing with the correct fulfillment strategy.

The **new product planning** brings to all involved the strategy of new products launch. The new product planning is important because action of all areas could be taken, for instance, manufacturing capacity utilization, warehouse occupation, sales-force efforts, marketing efforts, financial assumptions, etc.

The **meeting performance metrics** brings the view of how the company is performing, considering the operational side. Capacity utilization, transportation performance, warehouse occupation and breakdowns analysis are issues that could be analyzed. The metrics should be shown in a dashboard in order to make the visualization and analysis of each defined key performance indicator easier.

The **generating free cash** is an important process because to be demand-driven companies may face financial issues to perform the proposed service level. This process evaluates financial issues and compares with the agreed service level.

The **customer metrics meeting** is a meeting performed after **performance metrics meeting** and **generating free cash**. The aim is to understand and make clear to all involved how the company's customer segments is being fulfilled. Lessons learned may be used to the next monthly cycle and the metrics should be shown in a dashboard in order to make the visualization and analysis of each defined key performance indicator easier.

The **process governance** is a core process in which all issues must be shared in order to improve the process as a whole. Lessons learned of previous monthly cycles should be tracked to check if they are being applied. Improvements actions should also be set to the next cycles.

Burrows (2012) proposes another time frame, as shown in Figure 3.20. Each step represents a formal meeting to be performed.

As show in Figure 3.20, Burrows (2012) proposes seven steps during the monthly cycle:

- ✓ **Step #1:** it is the first pre-meeting to review the previous cycle and it is supported by financial planning cycle. Some activities should be done: (i) financial analysis, (ii) closing preparation steps and (iii) others financial work steps. The financial cycle goes along from the Step #7;

Figure 3.20 – S&OP monthly cycle

Source: Adapted from Burrows (2012)

- ✓ **Step #2:** this second step considers the end of the sales planning activity. The main output of this step is a consensus forecast to be used during the month cycle;
- ✓ **Step #3:** this meeting has the aim of discussing the impacts and effects of the decisions taken in the Step #2. Capacity updates are used to agree upon a new manufacturing and procurement master plan;
- ✓ **Step #4:** this meeting compares the consensus plan for sales and manufacturing to the output for the market planning cycle. Prior to this meeting demand sensing activities should be performed. The main goal of this meeting is to find issues between sales and supply areas. Once issues are found, actions must be taken, i.e., if there are risks, a mitigation plan must be set or if there are opportunities, a planning should be set to gain the better benefits;
- ✓ **Step #5:** in this meeting everything come together. At this point, a formalized risk mitigation plan or a formalized capitalized on opportunity plan should be shared among all process' participants;
- ✓ **Step #6:** senior management and representatives of all involved areas should participate at this meeting. This meeting provides senior management with all necessary information in order to avoid surprises;

- ✓ **Step #7:** this step represents the end of the financial planning cycle. At this point, it is important to note that value-chain activities should be performed in an ongoing manner, and it is not a part of the cycle. Inventory, manufacturing and distribution simulation can be performed monthly, and their results should feed the Step #5.

3.6.3 Ptak and Smith (2018) approach

This last approach, provided by Ptak and Smith (2018), is linked with the Demand-Driven Institute (DDI). It is considered two main S&OP classes: Demand-Driven S&OP and the Adaptive S&OP. Both classes make part of a whole model named Demand-Driven Adaptive Enterprise Model. This model is presented in Figure 3.21. This model was developed with the aim of enabling companies to be more sensitive and adapted to new market requirements, i.e., fast market changes and complex and volatile environments.

It can be considered that the Demand-Driven Operating model is a short-term planning. The demand-driven S&OP is mainly a tactical-medium-term planning, but it participates in short-term decisions. The Adaptive S&OP is mainly a tactical-medium-term planning, but it participates in long-term-strategic decisions. This comprehension is presented in Figure 3.22.

The main characteristic of this approach is to protect and promote the flow (information, materials and service). Thus, it is a rate-based approach and not a volume-quantity planning approach.

Figure 3.21– The Demand-Driven Adaptive Enterprise Model

Source: Ptak and Smith (2018)

Figure 3.22 – Demand-Driven Adaptive Enterprise Model planning hierarchy

Source: elaborated from Ptak and Smith (2018)

The **Demand-driven operating model** has the objective to execute the operational activities by ordering and scheduling with the use of the actual demand and with strategic decoupling and control points along the production process. This is not the focus of this thesis, that's why, this process will not be detailed; more information can be consulted in (PTAK; SMITH, 2016b).

The **Demand-driven S&OP** is characterized as a bi-directional tactical reconciliation hub that connects strategic plans (annual, quarterly) to operational plans (hourly, daily or weekly).

In this process is considered that the S&OP should not have a single number to run the business, but it must work with relevant ranges (between a pessimistic and an optimistic range).

This Demand-driven S&OP considers six main steps, as illustrated in Figure 3.23.

Figure 3.23 – Demand-Driven S&OP – 6 processes

Source: elaborated from Ptak and Smith (2018)

The **tactical review** step evaluates the past performance of the demand-driven operating model, considering reliability, stability and velocity. Variance analysis is conducted.

The **tactical projection** reveals the proactivity characteristic that new S&OP models must have. It projects different scenarios in the tactical relevant range, considering any kind of events that could lead to problems to fulfill the demand (for instance, seasonality, promotions, introduction of a new product and/or a planned shut-down).

The **tactical configuration** and reconciliation, as the step name suggests, is responsible to configure the operating model based on the performed analysis in the previous steps. The configuration should consider: time buffer profiles and assignments, resource assignment and properties and part properties. The configuration parameters for the Demand-driven MRP (details in Ptak and Smith (2016)) is also conducted.

The **tactical exploitation** tries to take advantage from short-term issues when they occur. This shows the flexibility of the model and how it can influence directly the operational issues, thus it is not necessary to wait the whole monthly cycle to make decisions, but opportunities can be considered and/or issues can be dealt when they occur.

The **strategic recommendation** is the first link to the Adaptive S&OP. Considering the occurred issues in the operational level, the team presents to senior-level management ideas for a better operational performance (for instance, reengineering of a specific product).

The **strategic projection** formalizes the vertical integration that must have in the new S&OP approaches. Thus, the team from the Demand-driven S&OP helps the Adaptive S&OP team to project relevant outcomes in the strategic relevant range, by providing feasibility check from an operational perspective.

The **Adaptive S&OP** is characterized by being more strategic. This allows the S&OP to be more responsive and flexible. Notwithstanding the Adaptive S&OP has a strategic approach, it does not encompass all strategic planning; the objective is to overlap the strategic planning and aid it to do a better annual business plan. The Adaptive S&OP has seven steps, as shown in Figure 3.24.

Figure 3.24 – Adaptive S&OP – 7 processes

Source: elaborated from Ptak and Smith (2018)

The **Portfolio and New Activities** establishes the company's offers for the future, regarding products and services. At this point four business's perspective should be considered, i.e., Research and Development, Manufacturing, Sales and Marketing and Finance. The

products are analyzed in families and can be categorized as existing products, line extensions, new to the company and/or new to the world. The risk management should also be conducted at this stage.

The **Demand Plan** has a more proactive approach compared to the traditional S&OP process. It is composed by four activities:

- ✓ **Sales Planning:** besides the forecast (that can be in families or even at SKU-level for critical products), this activity has a fully integration with market intelligence with the aim of having a deep understand of the market, customers and competitors' activities;
- ✓ **Demand Creation:** this is the most proactive activity of the Demand Plan. It has the aim of creating and manage the demand in order to provide customers with the required perceived value (products and services). It considers unconstrained possibilities;
- ✓ **Demand planning:** by considering the product life cycle, it is established the future unconstrained demand plan. Different scenarios should be analyzed and compared;
- ✓ **Demand execution:** it establishes activities, based on the developed scenarios, that enable the execution of the demand plan. These activities are established in the tactical relevant range.

The **Supply Plan** defines the necessary capabilities the company should have in the future to accomplish with the value proposition to the market. It is not solely thinking about add and invest in new capacity, but, if possible, strategically define buffers in the production steps. It is important to consider the firm strategy to guide the Demand-Driven S&OP activities (quick response or cost effective, for instance). The output should be an achievable supply plan by product family in volume, timing and cost. At this step, it is also conducted risk management in order to identify gaps and mitigate them.

The **Financial Plan** defines financial performance that are important in the strategic time frame. It important to notice that the financial strategy can be different for each product family, depending on their purpose for the market. That's why, it is important to have an integration with Sales and Marketing in order to obtain the correct pricing definition.

In the **Integrated Reconciliation** all plans come together in order to find and resolve misalignments and gaps. It is important to have representatives from Research and Development, Sales, Marketing, Supply Chain Management, Operations and Financial. It also

performs risk management and makes link with the strategic planning. The management team is critical to participate in this forum, with the aim of exploiting possibilities.

As previously described, the **Demand-driven S&OP** makes the link between the tactical and operational time frame. It provides what-if analyses in order to sense correctly the market demand and adapt the operations to fulfill the demand. The conducted analyses consider strategic, financial, market and operational perspectives.

The **Management Review** is a forum dedicated to senior level management. They review the plan, analyze its validity and take the final decision. Opportunities and vulnerabilities should be identified. The focus of this forum is to verify how company is performing compared to strategic assumptions and guidelines for the business plan.

THE DEMAND-DRIVEN S&OP FRAMEWORK

This chapter has the aim of presenting the Demand-Driven S&OP (DDS&OP) framework proposal. The modeling language used to represent the framework was the Business Process and Model Notation (BPMN), considering its last version, i.e., BPMN 2.0. Thus, this chapter is organized in four sections: Section 4.1 presenting the main concepts of process modeling and BPMN, Section 4.2 presenting the necessary elements for the DDS&OP framework, considering the prior conducted systematic literature reviews, Section 4.3 presenting an overview of the DDS&OP framework and Section 4.4 presenting the DDS&OP framework modeled in BPMN.

4.1 Process Modeling and The Business Process Model and Notation (BPMN)

Prior to model a process (in the case of this thesis, a business process), it is important to understand what business process means. In this sense, “a business process consists of a set of activities that are performed in coordination in an organizational and technical environment. These activities jointly realize a business goal” (WESKE, 2007, p. 5). Slack, Brandon-Jones and Johnston (2015) cite that a process work with inputs (which could be elements of transformation and transformed elements) to produce outputs (which could be product, service or information). The same authors also consider that processes should be modeled for a better understanding of them.

So, the process modeling can be defined as “the time period when manual and/or automated (workflow) descriptions of a process are defined and/or modified electronically” (WFMC, 1999, p. 25).

The business process cannot be static, it must always be evolving. In this sense, Weske (2007, p. 5) suggest the business processes being managed, so “the business process management includes concepts, methods and techniques to support the design, administration, configuration, enactment and analysis of business process”.

To help modelers to develop the processes modeling and to standardize such procedures, some languages/approaches were developed. One of these developed languages is the Business Process Model and Notation (BPMN). Thus, BPMN, by providing a graphical notation to represent the business processes, makes people involved in the process (from design

to control) to have of full understand of it and making possible to perform effective improvement cycles (CHINOSI; TROMBETTA, 2012; MARRELLA, 2015; OMG, 2015).

BPMN provides five basic categories to be used to model processes (OMG, 2015): (i) flow objects, (ii) data, (iii) connecting objects, (iv) swimlanes, and (v) artifacts.

The origin of the BPMN was in 2004 published by the Business Process Modeling Initiative with the aim of representing graphically the business process. The increased companies' interest and use of the model caused the adoption the BPMN as OMG (Object Management Group) standard in 2006 (CHINOSI; TROMBETTA, 2012).

Currently, the BPMN in the 2.0 version. The first version 1.0 has evolved to version 1.1 in 2007, version 1.2 in 2008 and 2.0 in 2010, with its formal specification in 2011 (SHAPIRO et al., 2012).

The main updates done for the BPMN version 2.0 are (SHAPIRO et al., 2012):

- ✓ Process including collaboration;
- ✓ Process execution to support execution engines;
- ✓ Business Processes Execution Language (BPEL) to support BPEL engines; and
- ✓ Choreography tools.

Chart 4.1 illustrates the basic BPMN's modeling elements. Such elements were used for the framework development. Additionally, the model was designed supported by yEd Graph Editor®, which is an opensource software developed by yWorks® that supports BPMN modeling language.

Chart 4.1 – Basic BPMN's modeling elements

Element	Description	Notation
Event	The Event represents somethings that “happens” during the course of the process. They affect the flow by causing or impacting something. There are three main types of events: Start, Intermediate and End.
Activity	The Activity can be considered a work that is performed in a process. There are two types of activities that can be considered in a process: sub-process and/or task.
Gateway	A Gateway determines a branching, forking, merging and/or joining in the course of a process. Thus, it is used to control the sequence flow in a process.
Sequence Flow	The Sequence Flow represents the execution order of the activities in a process.
Message Flow	The Message Flow represents how messages are shared between two separate pools (two separate pools are considered two participants).

Chart 4.1 – Basic BPMN’s modeling elements – *Continuation*

Element	Description	Notation
Association	The Association links information and artifacts with the graphical elements. When a direction of flow is necessary to be represented, an arrowhead is used.	>
Pool	A Pool represents a participant in the process, when it is in collaboration. It has the aim of partitioning a set of activities from other pools. It also may have or not internal details. If it does not have internal details, it is named as “black box”.
Lane	A Lane is used when a Pool (or a Process) needs to be sub-partitioned. The lane is extended through the entire length of the process, either vertically or horizontally. It also can be used to organize and/or categorize the activities.
Data Object	Data objects are used to represent information required by activities to be performed and/or to represent the outputs of the activities. Data objects can be individual or a collection.
Message	The Message details the contents of a communication between two participants (i.e., two pools).
Group	The Group can be used to categorize the elements along the process; it does not affect the sequence of the flow, but it should be used when some documentation or analysis are required.
Text Annotation	A Text Annotation should be used when the modeler faces a necessity to provide additional information in the diagram, with the purpose to make the diagram clearer for the reader.

Source: Adapted from OMG (2015)

4.2 Necessary elements for the Demand-Driven S&OP

Before beginning the modeling process, it is important to understand and to list the main elements that must be considered in the designed process. In order to keep the coherency, the systematic literature reviews conducted and described in Chapters 2 and 3 were used to identify such elements.

From Chapter 2, it was concluded that the Demand-Driven (DD) Phenomenon focuses on demand fulfillment, it is inserted in the supply chain environment, should manage information and processes to respond timely to the market, must be flexible, quick, collaborative and integrated and requires changes in the culture, processes, systems and approaches to obtain visibility of the demand, improving levels of inventory and reduce costs.

On the other side, from Chapter 3, the new tendencies to the S&OP process reveal the necessity to broaden the scope of the S&OP. When considering the horizontal expansion, the

S&OP should be collaborative and integrated with suppliers and customers, this will improve the visibility of demand and the decisions would be better made. When considering the vertical expansion, the S&OP should be more strategic and, at the same time, more operational; thus, interaction with market intelligence and product/service development as well as agility to percept short-term demand variations should be part of the S&OP process.

In this sense, it is possible to infer a convergence between the S&OP tendencies and the DD phenomenon. Nonetheless, what is necessary to consider making this convergence clear to understand? With the aim of answering this question, Chart 4.2 was developed.

Chart 4.2 – Matching between the S&OP process' tendencies and the DD Phenomenon

<div> <div>DD Phenomenon characteristics</div> <div>New approaches for the S&OP process</div> </div>	Collaboration / Integration	Visibility	Technology Change	Process Change	Velocity / Responsiveness	Flexibility / Agility	Strategy Linkage	Cost reduction
Information shared and collaboration among supply chain partners	✓	✓	✓	✓		✓		✓
POS data	✓	✓	✓			✓		
Importance of a robust information system			✓					
Use of APS (SAP APO, for instance)		✓	✓			✓		✓
Shorter planning cycles into the S&OP process		✓		✓	✓	✓		✓
Receipt and management of real-time data and timely information	✓	✓	✓	✓	✓	✓		
Internet and web-based behavior		✓	✓					
S&OP combined with JIT and Lean Approaches (continuous improvement, for instance)				✓	✓	✓	✓	✓
Postponement, CPFR, VMI and/or ECR	✓	✓	✓	✓	✓	✓	✓	✓
Planning at the SKU-level		✓		✓				
Social media data		✓	✓	✓				
Influences of Industry 4.0, IoT, Big Data, AI and Dashboards	✓	✓	✓	✓	✓	✓	✓	✓
Optimization of scenarios and advanced analytics			✓		✓	✓		✓
What-if scenarios analysis, simulation and sensitive analysis		✓	✓	✓			✓	✓
Risk Management included in all steps		✓		✓		✓	✓	✓
S&OP more strategic - Business and Market Intelligence		✓					✓	
S&OP and a closer interface with New Product Development and Introduction and Product Life Cycle Management				✓			✓	
Event-driven meetings		✓		✓	✓	✓		
Demand sensing, Demand Shaping and or Demand Shifting - S&OP being more proactive		✓			✓	✓		
Informal communication		✓			✓	✓		

Chart 4.2 – Matching between the S&OP process' tendencies and the DD Phenomenon – *Continuation*

New approaches for the S&OP process	DD Phenomenon characteristics							
	Collaboration / Integration	Visibility	Technology Change	Process Change	Velocity / Responsiveness	Flexibility / Agility	Strategy Linkage	Cost reduction
Data Warehouses			✓					
Financial Management included in all steps	✓	✓	✓	✓	✓	✓	✓	✓
Customer Service Management with online platforms	✓	✓	✓	✓	✓	✓	✓	
Event-driven forecasting				✓	✓	✓		
Customer Segmentation				✓			✓	
Organizational issues (job rotation, cross-departmental training)				✓		✓	✓	
Third-party providers	✓				✓	✓		✓
Leadership importance					✓	✓	✓	✓

Source: Prepared by the author

The 20-approach-list for S&OP, presented in Chapter 3, was extended in Chart 4.2 in order to make clear the necessities and relationships with DD phenomenon. By analyzing Chart 4.2 is possible to infer new insights for the S&OP process. Firstly, there is a match between the DD phenomenon and the new approaches for the S&OP process; thus, the proposed framework is named Demand-Driven S&OP (DDS&OP).

It is also possible to infer from Chart 4.2 news trade-offs that the S&OP process will need to deal with. 68% of the approaches requires and contributes with flexibility / agility. This can be considered one of the most important performance objectives in the DD phenomenon. Because of the increasing complexity of the environment (market, manufacturing, customers' expectative, sources of materials and services and alternatives possibilities of commercialization) flexibility and agility became a pre-requisite for the companies which want to survive in the market.

64% of the approaches contributes with the gain of visibility. Visibility is essential to be aware about changes in the customers' behavior and changes in the market. With visibility companies become more prepared to face the market challenges. In this sense, S&OP, being a process that contributes to match the demand and supply, with more visibility will perform better its steps and will provide the right information for the decision making.

Velocity and responsiveness are also important, and the new approaches for the S&OP process contributes with them. In this case, 50% of the approaches contributes with cost reduction. With the same percentage, 50%, technologies need attention. Due to the necessity of flexibility, agility, visibility, velocity and responsiveness, without the correct support provided by technology, such objectives would not be achieved.

One of the main objectives of a company, cost reduction, was not the main objective to be pursuit in the S&OP, considering the DD phenomenon. This is not an affirmation to not be aware about costs, but it is necessary to prioritize other objectives, such flexibility, agility and visibility, for instance. If a company perform well in flexibility, agility and visibility, even having higher costs, will have higher profits (because of the new behavior of the market and customers). In this case, 43% of the approaches contributes with cost reduction.

Contributing with the necessity of processes changing, the proposed DDS&OP framework promotes the gain of flexibility, agility, velocity and responsiveness by the inclusion of other two perspectives, the operational and the strategic. The inclusion of these perspectives allows a better relationship among the involved areas and improve the communication of decisions, from strategic to operational.

4.3 The Demand-Driven Sales and Operations Planning (S&OP) process

As already discussed, from the conducted systematic literature review, the S&OP process should be expanded both vertically and horizontally to respond effectively to the DD phenomenon. The summary of the main contributions to guide the framework design is presented in Chart 4.3.

Chart 4.3 – Main theoretical contributions for the S&OP framework design

Planning horizon	Main findings	Authors
Strategic Perspective	Strategy Review and Linkage	Burrows III (2012); Caulfield (2013); Cecere (2012); Cecere, Barrett and Mooraj (2009); Danese, Molinaro and romano (2018); Esper et al. (2010); Godsell, Birtwistle and Van Hoek (2010); Gollamudi (2013); Kaipia et al. (2017); Li, Shaky and Owusu (2018); Ptak and Smith (2018); Ralston et al. (2015); Rokonzuzaman, (2018); Swaim et al. (2016) and Wilson and Raman (2017)
	Product Portfolio Management	Bower (2017); Cecere (2012); Cecere, Barrett and Mooraj (2009); Goh and Eldridge (2015); Gollamudi (2013); Kaipia et al. (2017); Ptak and Smith (2018); Smith, Andraski and Fawcett (2011) and Tarafdar and Qrunfleh (2017)
	Supply Chain Intelligence Activities	Baumann (2011); Bozutti and Esposto (2019); Danese, Molinaro and Romano (2018); Esper et al. (2010); Goh and Eldridge (2015); Goswami, Engel and Krcmar (2013); Jonsson and Holmström (2016); Kruse (2004); Lapide (2005a); Lapide (2005b); Mello (2015); Nakano (2009); Nielsen, Nielsen and Steger-Jensen (2010); Noroozi and Wikner (2017); Plank and Hooker (2014); Ralston et al. (2015); Rokonzuzaman (2018); Smith, Andraski and Fawcett (2011); Storbacka (2011); Tarafdar and Qrunfleh (2017); Thomé et al., (2012b); Tuomikangas and Kaipia (2014); Turner, Aitken and Bozarth (2018); Wagner, Ullrich and Transchel (2014) and Walters (2008)
	Contingency Plans Elaboration	Bozutti and Esposto (2019); Burrows III (2007); Dreyer et al. (2018); Ivert et al. (2015b); Ivert and Jonsson (2014); Jonsson and Holmström (2016); Larsson and Fredriksson (2019); Nucamendi-Guillén, Moreno and Mendoza (2018); Ross (2004); Singh and Lee (2013); Swaim et al. (2016); Wagner, Ullrich and Transchel (2014) and Warren (2012)

Chart 4.3 – Main theoretical contributions for the S&OP framework design – *Continuation*

Operational Perspective	Financial Management	Bozutti and Esposito (2019); Cecere (2012); Cecere, Barrett and Mooraj (2009); Gollamudi (2013); Noroozi and Wikner (2017); Ptak and Smith (2018); Ralston et al. (2015); Sorensen (2013); Wagner, Ullrich and Transchel (2014)
	Risk Management	Bozutti and Esposito (2019); Cecere (2012); Cecere, Barrett and Mooraj (2009); Gollamudi (2013); Ptak and Smith (2018); Schlegel and Murray (2010); Suurmond (2016); Wagner, Ullrich and Transchel (2014)
	Performance Management	Kristensen and Jonsson (2018); Ross (2004); Tarafdar and Qrunfleh (2017); Thomé et al. (2012b); Thomé, Sousa and Scavarda (2014)
	Short planning cycles / SKU-planning level	Biazzin, Tomaselli and Costa Pena (2017); Bower (2017); Bower (2018); Burrows III (2007); Caulfield (2013); Chae and Olson (2013); Covas (2016); Dreyer et al. (2018); Goh and Eldridge (2015); Grillo (2014); Grimson and Pyke (2007); Ivert et al. (2015a); Ivert et al. (2015b); Ivert and Jonsson (2014); Jonsson, Rudberg and Holmberg (2013); Jung and Chung (2016); Keal and Hebert (2010); Kelleher (2012); Kristensen and Jonsson (2018); Lee (2013); Li, Shakya and Owusu (2018); Nakano (2009); Noroozi and Wikner (2017); Nucamendi-Guillén, Moreno and Mendoza (2018); Oliva and Watson (2011); Ptak and Smith (2018); Singh and Lee (2013); Suurmond (2016); Thomé et al. (2012b) and Thomé, Sousa and Carmo (2014)
	Timely data reception	Boone, Ganeshan and Hicks (2015); Burrows III (2007); Chae and Olson (2013); Chase (2013); Covas (2016); Dreyer et al. (2018); Esper et al. (2010); Godsell, Birtwistle and Van Hoek (2010); Goswami, Engel and Krcmar (2013); Grimson and Pyke (2007); Ivert et al. (2015b); Ivert and Jonsson (2010); Kaipia et al. (2017); Kelleher (2012); Kristensen and Jonsson (2018); Kruse (2004); Lapide (2005a); Li, Shakya and Owusu (2018); Nucamendi-Guillén, Moreno and Mendoza (2018); Rokonzaman (2018); Singh and Lee (2013); Suurmond (2016); Swaim et al. (2016); Tuomikangas and Kaipia (2014) and Wilson and Raman (2017)
	Financial Management	Bozutti and Esposito (2019); Cecere (2012); Cecere, Barrett and Mooraj (2009); Gollamudi (2013); Noroozi and Wikner (2017); Ptak and Smith (2018); Ralston et al. (2015); Sorensen (2013); Wagner, Ullrich and Transchel (2014)
	Risk Management	Bozutti and Esposito (2019); Cecere (2012); Cecere, Barrett and Mooraj (2009); Gollamudi (2013); Ptak and Smith (2018); Schlegel and Murray (2010); Suurmond (2016); Wagner, Ullrich and Transchel (2014)
	Performance Management	Kristensen and Jonsson (2018); Ross (2004); Tarafdar and Qrunfleh (2017); Thomé et al. (2012b); Thomé, Sousa and Scavarda (2014)
	Event-driven meetings	Danese, Molinaro and Romano (2018); Goh and Eldridge (2015); Grimson and Pyke (2007); Ivert et al. (2015a); Ivert et al. (2015b); Lapide (2005a); Lapide (2005b); Larsson and Fredriksson (2019); Wagner, Ullrich and Transchel (2014)

Source: Prepared by the author

Based on the findings summarized in Chart 4.3, Figure 4.1 was developed to represent the proposed Demand-Driven S&OP (DDS&OP) framework. The DD&SOP process, differently from the traditional S&OP process, has three perspectives: (i) strategic perspective; (ii) tactical perspective; and (iii) operational perspective. It is also suggested a cross-functional ongoing process named process governance.

In the **strategic perspective**, the role of the S&OP is to make the link between the strategic decisions and the tactical decisions. That's why, in this perspective, it is not necessary to have monthly meetings, because strategic decisions have the characteristics of long-term decisions. It was proposed that the process should be performed each two, four or six months, depending on the company's necessity and the production lead time. The strategic DDS&OP process is composed by eight processes: (i) strategy review; (ii) product portfolio review; (iii) supply chain intelligence activities; (iv) contingency plans elaboration; (v) communicate the plans; (vi) financial management; (vii) risk management; and

Figure 4.1 – The Demand-Driven S&OP framework

Source: Prepared by the author

(viii) performance management. The three last described processes should be executed on an ongoing basis with the other processes, as suggested by the conducted systematic literature review.

The strategic perspective should be performed by a strategic S&OP team, a financial assessment team and a risk assessment team. The financial assessment and risk assessment team should be the same for the other perspectives (tactical and operational) in order to have a holistic view of the process. Chart 4.4 describes the suggested participants of the strategic S&OP team, financial assessment team and risk assessment team to conduct the strategic perspective of the DDS&OP.

Chart 4.4 – Strategic perspective team

Perspective	Team	Participants
Strategic Perspective	Strategic S&OP team	<ul style="list-style-type: none"> ✓ Director/Vice-president of operations ✓ Director/Vice-president of sales and marketing ✓ Senior management of operations ✓ Senior management of sales and marketing ✓ Senior management of product development ✓ Senior analysts of operations, sales, marketing, product development and performance management
	Financial Assessment Team	<ul style="list-style-type: none"> ✓ Director/Vice-president of financials ✓ Senior management of financials ✓ Senior analysts of financials
	Risk Assessment Team	<ul style="list-style-type: none"> ✓ Senior management of risk management ✓ Senior analysts of risk management

Source: Prepared by the author

It is important to notice that these teams have a matrix organizational characteristic, i.e., they are not strictly dedicated to process, but they have to participate when defined; exception to this, it is recommended that the senior analysts of financial and risk assessment be exclusively dedicated to the process.

In the **tactical perspective** the S&OP does not have substantial changes compared to the traditional S&OP process. This perspective should be performed on a monthly basis, but three processes were added: (i) portfolio management review (in order to have a more robust link with the demand requirements and customer's necessities), (ii) communicate the plans (in order to establish a more robust flow of information) and (iii) scenario analysis (with the aid of information system, evaluate different planning possibilities). Thus, the tactical DDS&OP process is composed by nine processes: (i) portfolio review; (ii) demand planning; (iii) supply planning; (iv) scenario analysis; (v) consensus meeting; (vi) communicate the plans;

(vii) financial management; (viii) risk management; and (ix) performance management. The three last described processes should be executed on an ongoing basis with the other processes, as suggested by the conducted systematic literature review.

The tactical perspective should be performed by a tactical S&OP team, a marketing and sales team, an operations team, a financial assessment team, a risk assessment team and a final participation of the strategic S&OP team. The financial and risk assessment team is the same of the considered in the strategic perspective. The tactical S&OP team should be fixed and exclusively for this activity. The strategic S&OP team, marketing and sales team and operations team can be considered with the matrix organizational approach. It just recommended that the analysts from the financial and risk assessment team be exclusively dedicated to the process. Chart 4.5 describes the suggested participants of the tactical S&OP team, sales and marketing team, operations team, financial assessment team, risk assessment team and strategic S&OP team to conduct the tactical perspective of the DDS&OP.

Chart 4.5 – Tactical perspective team

Perspective	Team	Participants
Tactical Perspective	Tactical S&OP team	✓ Tactical S&OP manager
		✓ Operations analysts
		✓ Sales and Marketing analysts
		✓ Product Developments analysts
		✓ Performance management analysts
	Sales and Marketing Team	✓ Sales and marketing managers
		✓ Junior to Senior Analysts of sales and marketing
	Operations Team	✓ Operations managers
		✓ Junior to Senior Analysts of operations
	Financial Assessment Team	✓ Senior management of financials
		✓ From Junior to Senior analysts of financials
	Risk Assessment Team	✓ Senior management of risk management
		✓ From Junior to Senior analysts of risk management
	Strategic S&OP team	✓ Director/Vice-president of operations
		✓ Director/Vice-president of sales and marketing
		✓ Director/Vice-president of financials
		✓ Senior management of operations
		✓ Senior management of sales and marketing
		✓ Senior management of product development

Source: Prepared by the author

While the strategic perspective covers the need of demand and customer understanding and make the company able to prompt respond to these requirements, the operational perspective has the role to promote agility and velocity in case of problems, new customers' requirements and mismatch between the demand and supply in the short-term. That's why the operational perspective should be conducted on daily or weekly basis, considering the

company's requirement. With these two added perspectives, the S&OP responds effectively to the DD phenomenon requirements.

Finally, the **operational perspective** is composed by nine processes: (i) disaggregate the plans; (ii) check orders and priorities; (iii) receive data and information; (iv) solve issues; (v) communicate decisions; (vi) financial control; (vii) risk control; (viii) performance management; and (ix) event-driven meetings. The four last described processes should be executed on an ongoing basis with the other processes, as suggested by the conducted systematic literature review.

The operational perspective should be performed by the order fulfillment team, operations team, sales and marketing team, financial assessment team and risk assessment team. These teams should be organized considering the matrix approach (exception to the financial and risk assessment team). It is important to not limit this process to an order fulfillment process; it is more than that. Once there is a direct link with operations and sales and marketing teams, the issues could be easily and quickly solved (and validated by these teams). The process considers the financial and risk control, and these processes are performed by the same team that performed the strategic and tactical activities, this guarantee an alignment of the decision-making process with the medium and long-terms directions. Besides of that, it is foreseen event-driven meetings in case of issues; these meetings should be performed if a problem appears and the participants convocation will depend on the issue characteristics (the decisions will be visible to all involved and will be made in consensus, thus, leading to a minimization of mistakes). Chart 4.6 described the suggested participants of the order fulfillment team, sales and marketing team, operations team, financial assessment team and risk assessment team to conduct the operational perspective of the DDS&OP.

Chart 4.6 – Operational perspective team

Perspective	Team	Participants
Operational Perspective	Order Fulfillment Team	✓ Order fulfillment manager
		✓ Order fulfillment analysts
	Sales and Marketing Team	✓ Sales and marketing supervisor
		✓ Sales and marketing analysts
	Operations Team	✓ Operations supervisor
		✓ Operations analysts
	Financial Management Team	✓ Financial analysts
	Risk Management Team	✓ Risk analysts

Source: Prepared by the author

By the process of disaggregate the plans, the operational perspective covers the necessity of SKU visibility and by the process receive data and information, it covers the

necessity of timely data reception and visibility. Both necessities were found in the conducted literature review.

Besides the three perspectives for the S&OP process, it was considered another ongoing process named Process Governance. The objective of this process is to promote a continuous improvement for the company considering the output of the DDS&OP process and to promote the improvement of the DDS&OP itself.

4.4 The Demand-Driven Sales and Operations Planning (S&OP) process framework model – BPMN modeling

Figure 4.2 represents the three prior described perspectives for the DDS&OP process modeled in BPMN. One important factor to be considered is the necessity of one database for each perspective. These databases have the objective to store the made decisions, to guide the use of the information technology to support future decisions and to promote the continuous improvement foreseen in the process governance step.

It is dedicated one subsection for each perspective in order to detail the considered processes.

4.4.1 The strategic perspective for the DDS&OP

The defined processes in the strategic perspective have the aim of making the companies closer to the market requirements and to be a bridge between the strategic planning and the tactical planning (make easier to long-term considerations be translated in mid-term considerations). It can be considered a set of processes that periodically evaluate the company's strategy and check if the sales and operations activities are performing in accordance with the long-term considerations.

The first process is the **strategy review**, which will be detailed in the subsection 4.4.1.1. This process checks, analyzes and makes decisions considering company's internal and external perspectives. The aim is, based on company's strategy and market responses, guiding the company to a better fulfillment of customers' requirements.

Once the purpose of a company is to deliver to market a set of products and services, the second process is the **product portfolio management**; this process will be detailed in the subsection 4.4.1.2. Considering the inputs of the strategy review, it is analyzed if the portfolio served to the market is still adequate. This process also has the characteristic of company's internal and external perspectives, because it receives feedbacks of how the product/service

Figure 4.2 – The Demand-Driven S&OP framework modeled in BPMN

Source: Prepared by the author

is performing in the market and it receives feedback of the supply/manufacturing to offer the product/service to the market.

The third process is the **supply chain intelligence activities**; which will be detailed in the subsection 4.4.1.3. This process has the aim of evaluating how the products/services is being delivered to the market based on company's strategy and considering logistics, production, sales, marketing channels and market intelligence.

After the three first defined processes, it is important to define **contingency plans**; this fourth process will be detailed in the subsection 4.4.1.4. This process has the aim of creating visibility to the supply chain and to guide the decision-making process if any issues appear. This process promotes agility to decisions, provides directions to delegate decisions and creates responsiveness, linked with the company's strategy.

After the execution of each described four processes, it is foreseen that the outputs be assessed considering financials, risks and performance (metrics and KPI's). The details of each of these processes will not be considered in this thesis, once it is not its objective, but these assessments are important to guarantee the validity and robustness of the decisions. The assessments are evaluated by the strategic S&OP team, and if any issues should be taken in consideration, the process with the issue should be executed again.

The last process is to **communicate plans**. This process was defined to guarantee that the information flow be respected and followed. If the decisions be not adequately communicated to the other processes and teams, their effectiveness will not be reached. In this process, it can be used the information technology, in order to deliver the right information to the right team at the right time and keep its traceability.

Finally, it was represented in the model the output data of each process. These data should be stored in a database to guide future decisions and to make easier reports elaboration.

4.4.1.1 Strategy Review

Figure 4.3 shows the Strategy Review process.

The first step is running the reports to support the decisions. For that, it is necessary to use data from operations, sales and marketing, market intelligence, product development and financial. These data provide to the process both internal and external views of the company, i.e., from the company to the market and from the market to the company. To run the reports is recommend using the information technology supported by software and systems, such as, ERP, APS and BI.

Figure 4.3 – The Strategy Review Process

Source: Prepared by the author

The next step is to review the strategy. The importance of this step is to visualize the strategic directions defined in the strategic planning. The points to be reviewed should focus on the sales and operations activities to match the customers' requirements.

Based on the first and the second steps, the third step is to verify the current performance. With the aid of the reports, the team should verify gaps and misalignments between the planned and the executed. This can be considered an activity of strategy control, to check if the defined strategy is adherent with the market and with the company. It is important to notice that is not foreseen to change the whole strategy or to perform a strategy plan again, because this process has not the long-term horizon as the strategic planning.

If gaps or misalignments are found, new directions should be defined and communicated by the team. If gaps or misalignments are not found, just communicate that the current company's performance is adherent with the company's strategy guidelines.

4.4.1.2 Product Portfolio Management

Figure 4.4 shows the Product Portfolio Management process.

This process represents two elements to the S&OP evolution. Firstly, once has a strategic perspective, shows the expansion of the vertical consistency and, secondly, it is foreseen the participation of strategic customers, showing the expansion of the horizontal consistency.

The DD phenomenon requires a closer relationship with the customers' requirements and this process has this objective. One of the main links between the company and the customer is the product/service provided; thus, this process has the objective to look after this link.

Figure 4.4 – The Product Portfolio Management Process

Source: Prepared by the author

To model the customers' participation in the process, it was used the black box pool, because the customers' processes are unknown.

The first step is to receive data and information from operations, sales and marketing, market intelligence, product development and from the customer. POS data should be used as well as data and information that can be available on customer's online portals.

The second step considers an integrated analysis of all product/service data performance. It is integrated because all dimensions should be verified to figure out if some issue concerning the product performance is affecting the fulfillment of the customer's requirements. From operations, it can be considered manufacturing or distribution concerns, for example. From sales and market, it can be considered sales performance versus product/service attributes, for instance. From market intelligence, it can be considered a comparison among the company's products/services and competitors' products/services. From Product Development, it can be considered new components/characteristics to enhance manufacturing, distribution or sales. And, finally, from customer, the real perception from the market.

So, if no issue is found, just communicate that the products/services offered by the company is adherent with the customers' requirements and company's strategy. If some issue

is found, it should be delegated the activity for the responsible area. It is importance to notice, that if a change is provided by one area, this change should be analyzed by the other areas in order to keep coherency in the whole process. If the change impacts a strategic customer, the customer should give its perception (can be by a presential or virtual meeting, for instance). Before the communication of the changes, the analysis of all areas and from the customer should be consolidated (in this case information technology and software can be used) in order to avoid decision-making mistakes.

4.4.1.3 Supply Chain Intelligence Activities

Figure 4.5 shows the Supply Chain Intelligence Activities process.

Figure 4.5 – The Supply Chain Intelligence Activities Process

Source: Prepared by the author

This process represents clearly the expansion of the S&OP horizontal consistency. It is foreseen a participation of strategic customers and suppliers and of the distribution partners

and third-party providers. Thus, it is clearly that the S&OP should look beyond the company's boundaries; this is what is proposed in the DDS&OP.

To represent the participation of the customers, suppliers, distribution partners and third-party providers, it was adopted the black box pool approach, because it is not known their internal processes.

The first step is to analyze the supplier base. This is critical for the company, because if the raw materials or service do not arrive adequately, the company's aggregation value processes will be affected. The aim is to find gaps considering quality, delivering, flexibility, velocity and costs, for instance; thus, the relationship with the suppliers should be analyzed as a whole. If a gap is found, such issue should be analyzed, and solutions should be proposed. In the case of strategic suppliers' involvement, the solutions can be shared with them and, after their approval, the decisions can be communicated. If no gap is found, the communication should be done concluding that the supplier base is performing accordingly with the planned.

The second step is to analyze the third-party providers. Third-party providers can be responsible to perform part of the value aggregation processes and this can be critical for the company. It also can be used in case of capacity improvement necessities (production capacity, for instance). The same dimensions that suppliers were analyzed, can be used to analyze the third-party providers, i.e., considering quality, delivering, flexibility, velocity and costs, for instance. If a gap is found, such issue should be analyzed, and solutions should be proposed. Before communicating the solution, it is necessary to check if it is necessary to contact the third-party provider for validation, and after its validation, the solution can be communicated. If no gap is found, the communication should be done concluding that the third-party providers are performing accordingly with the planned.

The third step is to analyze the distribution network. This step does not focus exclusively to the logistics field, but it is broader. From a logistic perspective, it should be analyzed the modals of transportation, level of inventory in the supply chain and service level for each customer or segment of customer. On the other side, it is important to analyze the location of manufacturing plants, location of deposits and to assess the adoption/execution of supply chain practices, such as, VMI, CPFR, ECI, postponement and cross-docking, for instance. If a gap is found, such issue should be analyzed, and solutions should be proposed. If some activity requires a distribution partner to be performed, the solution should be shared with it to validate; after its validation, the communication can be done. If no gap is found, the communication should be done concluding that the distribution network is performing accordingly with the planned.

The fourth step considers the market channels analysis. The aim of this process is to assess how the product/service is reaching/serving the customers. This is critical for the DD phenomenon, because it defines how easily customers will be in touch with the company's products; in this sense new approaches cannot be dismissed, such as online platforms and social media divulgation. If a gap is found, such issue should be analyzed, and solutions should be proposed. In the case of strategic customers' involvement, the solutions can be shared with them and, after their approval, the decisions can be communicated. If no gap is found, the communication should be done concluding that the market channels are performing accordingly with the planned.

These four described steps cover the main stages of the supply chain, i.e., since the supplier to the customer. They can be performed in parallel and, then, all decisions should be consolidated (for consolidation, it is recommended the use of information technology systems). Operations, Sales and Marketing perform a final validation of these decisions, and if no issue is found, just communicate the decisions. In case of some issue, it is necessary to identify the responsible to review the process and rebegin the analysis and solution processes, until a final solution is provided and communicated.

4.4.1.4 Contingency Plans Elaboration

Figure 4.6 shows the Contingency Plans Elaboration process.

Figure 4.6 – The Contingency Plans Elaboration Process

Source: Prepared by the author

As prior described, this process has the aim of promoting visibility, agility, velocity and flexibility in the decision-making process, because scenarios are defined, and issues owners are defined with the guidelines to solve them.

The first step to consolidate the information and decisions of all previous steps. This step can be supported by information technology and software.

The second step is to perform an integrated analysis. It is important to be integrated in order to not have conflicting decisions, because operations, sales, marketing, market intelligence, performance, financial and risk data are supposed to be analyzed.

The integrated analysis supports the development of scenarios. The scenarios creation can be based on lessons learned from the past and must not focus solely internally, but should consider external factors, such as, competitors, customers' behavior, economic and politic trends.

With the scenarios developed, what-if analysis with simulation should be performed. This can be supported by information technology, software, heuristics and/or mathematical algorithms for optimization. This step has the importance to provide consistency to the scenarios' assessment.

Based on what-if analysis, it is possible to create contingency plans. For each scenario and based on what-if analysis, a list of guidelines should be provided for each possible considered issue.

With the guidelines list, the responsible for its execution should be defined. This promotes agility, because the top management has visibility of each delegate activity, thus some approvals steps can be avoided.

Finally, the communication of the decisions should be done.

4.4.2 The tactical perspective for the DDS&OP

The tactical perspective for the DDS&OP has a great similarity with the traditional S&OP process. It is a mid-term planning process with a planning horizon from 2 to 18 months and should be conducted on a monthly basis. However, some changes had to be done to make this process more adherent with the DD phenomenon.

The first difference appears in the first step. In order to be closer to the customers' requirements, the first process is the **portfolio review** (detailed in the subsection 4.4.2.1). This process has not the aim of assessing the offering matching of products/services; this is the aim of the product portfolio management presented in the strategic perspective. The objective of this process is to assess and to control if the decisions made in the strategic perspective are

being followed in the tactical planning horizon. If issues are found, the solutions should be presented and be evaluated by operations, marketing and sales, financial, risks and performance teams.

The second process, **demand planning** (detailed in the subsection 4.4.2.2), comprises the first two processes of the traditional S&OP process, i.e., data collection and forecasting and demand planning. Because these two activities have the same objective of an unrestricted demand plan generation, they were considered in the same process. As an evolution from the traditional S&OP process, it is the possibility of strategic customers participation in this process with the aim of having a closer relationship and a better understanding of their requirements. Another difference is the inclusion of demand sensing and demand shaping in the process. After the execution of the process, the decisions should be assessed by financial, risks and performance teams.

The third process is the **supply planning** (detailed in the subsection 4.4.2.3) and this process is very similar with the traditional S&OP process. Supply constraints should be found in order to generate a restricted demand plan. The main difference compared with the traditional S&OP process is the participation of strategic suppliers and other supply chain partners that can be considered important for the decision-making process and can present constraints to the demand fulfillment process. After the execution of the process, the decisions should be assessed by financial, risks and performance teams.

The fourth step is the **scenario analysis** (detailed in the subsection 4.4.2.4). This process has the aim of being more robust than the pre-S&OP meeting foreseen in the traditional S&OP process. This robustness is achieved by using information technology and software, in order to support simulation, what-if analysis and mathematical algorithms. After the execution of the process, the decisions should be assessed by operations, marketing and sales, financial, risks and performance teams.

The **consensus meeting** is the fifth process of the tactical perspective of the DDS&OP. This meeting is equal to the executive S&OP meeting foreseen in the traditional S&OP process. The strategic S&OP team must attend to this meeting in order to understand, agree and sponsor the decisions.

Finally, the last process is to **communicate plans**. This process was defined to guarantee that the information flow be respected and followed. If the decisions be not adequately communicated to other processes and teams, their effectiveness will not be reached.

In this process, information technology can be used, in order to deliver the right information to the right team at the right time and keep its traceability.

4.4.2.1 Portfolio Review

Figure 4.7 shows the Portfolio Review process.

Figure 4.7 – The Portfolio Review Process

Source: Prepared by the author

The aim of this process is to check and assess if the product/service offering is in accordance with the established in the strategic perspective of the DDS&OP. Thus, the first step is to get information about the product performance in the market. This information can be obtained with the salesforce personnel or directly with customers (information technology, internet and social media data and software can be used for it).

All gathered information about the product/service performance should be compared with the product portfolio strategy to check if there is any gap. In case of any found issue, it must be analyzed, and solutions should be proposed. In case of no gap found, the process can keep to next step, that is market intelligence analysis.

The market intelligence analysis should find opportunities or check if the issues' solutions propositions are in accordance with the markets' requirements (to perform such activity, it gathers information of the customers' perspective). The market intelligence has the

objective to analyze from the company to the market and from the market to the company perspectives. From the company to the market, it is important to check the current products/services availability, new products/services introductions and products/services removal from the market. From the market to the company, it is important to check new markets, new customers and the competitors' actions. In case of any found issue, it must be analyzed, and solutions should be proposed. In case of no gap found, the process can keep to next step, that is verify product/service supply.

This step is not equal to the supply planning. It is just rough-cut analysis (based on operations information, containing capacity and constraints data) about the products/services offering proposal. If there is any found issue, it can be solved in the beginning of the process and the product offer be determined during the tactical DDS&OP planning horizon.

It is perceived that the portfolio review process creates agility to the tactical DDS&OP process as a whole. The agility is obtained because it guides the demand planning and the supply planning by considering the right products/services to the right markets, so analyses of demand and supply that would not contribute to the DDS&OP success will be minimized.

4.4.2.2 Demand Planning

Figure 4.8 shows the Demand Planning process. A new BPMN element was used to model this process. It was used the group element, that is considered an artifact in the BPMN approach. This was necessary because the demand planning process is comprised by two groups of steps; the first group comprises the forecasting activities and the second group comprises the unrestricted demand planning activities. As prior observed, these two groups have similarity with the two first processes of the traditional S&OP process, but for the DDS&OP makes part of the demand planning process as a unique process.

It is important to notice that the forecasting can be used for both make-to-stock (MTS) items and make-to-order (MTO) items. In the case of MTS items, it will be defined volume or rate of production. In the case of MTO items, it will be provided guidelines to capacity planning and backlog management.

The first step is to identify the product type, i.e., in what phase of the life cycle the product is and if it is an MTS or MTO item. This is important because it will guide the methods to be chosen to perform the forecasting activities. So, the next step is to verify if there are available historical data about the product.

The next step is to collect external data (economical, political and social, for instance) that can influence the demand. So, the potential demand numbers from qualitative and quantitative methods are compared with these external data to define a reviewed potential demand number. If the products are offered to strategic customers, the potential number can be validated with these customers (in presential or virtual meetings), in order to improve the reliability. After the customers' analyses, the final potential demand number is generated, and the forecast activity is concluded.

Based on the forecast activity, the unrestricted demand planning activities are started. The first step is to compare the forecast numbers with product portfolio management decisions. After, MTS and MTO items are identified. The sales personnel analyzes the potential forecasted numbers with the market possibilities; in the case of MTO items, before the market analysis, it is verified the confirmed orders already received.

Based on these first steps of the unrestricted demand plan generation, it performed the demand sensing and demand shaping activities. The demand sensing aims to understand the customers' behaviors and purchase patterns and the demand shaping aims to guide the rights products to the right customers; the objective of these two activities is to match the product (in quantity and type) with the customers' requirements. So, a reviewed potential demand number is generated. If the product will be offered to strategic customers, the numbers can be validated with them.

With the number validated by the strategic customers, a consensus demand meeting is conducted by the sales and marketing team. Based on the consensus meeting, not just a demand number is generated, but unrestricted demand plan scenarios are provided and communicated to the next process. The next process (supply planning) will present the constraints to fulfill the unrestricted demand plan, generating a restricted demand plan.

4.4.2.3 Supply Planning

Figure 4.9 shows the Supply Planning process. The objective of this process is to verify if the company and the supply chain is capable to fulfill the demand numbers provided by the demand planning process.

The first step is to analyze the provided unrestricted demand plan to understand the numbers and scenarios to conduct supply chain constraints analyses.

The first constraint to be analyzed is the supply restrictions. Considering the supplier restrictions data (based on contracts, for example) is verified if there is any issue to fulfill the

demand. In case of any issue, it should be analyzed, and solutions be proposed. The solutions should be validated by the suppliers (in presential or virtual meetings), if they are considered strategic for the company.

The next constraint to be analyzed is the manufacturing restrictions. Considering the manufacturing data (capacity, scheduled maintenance and dedicated capacity for new products tests and introductions, for instance) is verified if there is any issue to fulfill the demand. In case of any issue, it should be analyzed, and solutions be proposed. One solution can consider a third-party provider participation (to improve capacity, for instance); in such case, it is important to contact the third-party provider (via presential or virtual meetings) to validate the solutions. After its validation, the decisions can be communicated.

Figure 4.9 – The Supply Planning Process

Source: Prepared by the author

To complete the supply chain constraints analyses, it is important to verify logistics and distributions restrictions. Based on logistics and distribution restriction data (types of modals, capacity of transportation, warehousing capacities and geographic location of products, for instance) is verified if there is any issue to fulfill the demand. In case of any issue, it should be analyzed, and solutions be proposed. If the company has distribution partners, it can be necessary to validate the solutions with them. After their validation, the decisions can be communicated.

The next step is to consolidate all constraints and solutions provided by the prior steps (information technology and software should be used). With the consolidated information, it is conducted a consensus meeting by the operations team in order to generate the restricted demand plan. As provided by the demand planning, it cannot be defined just one set of number for the restricted demand plan, but it is necessary to provide a set of restricted demand plans scenarios. Finally, the decisions should be communicated.

4.4.2.4 Scenario Analysis

Figure 4.10 shows the Scenario Analysis process. The Scenario Analysis process represents an evolution of the pre-S&OP meeting (presented in the traditional S&OP process). The evolution is consisted by presence of simulation and/or mathematical modeling to analyze the scenarios and the presence of what-if analyses.

Figure 4.10 – The Scenario Analysis Process

Source: Prepared by the author

The first step is to present to the tactical S&OP team the restricted plan scenarios, that were developed in the previous stages. This step is important to make clear to all participants what was taken in consideration.

The second step is to compare the results of the restricted demand plan with the unrestricted demand plan with the objective to understand all constraints that made impossible

to respond to the total considered demand by the sales and marketing team. By this comparison, some adjustments can be done and communicated.

After the conclusion of the comparison among the restricted and unrestricted plans, the simulation and/or mathematical models should be selected and calibrated to analyze the proposed scenarios. With the simulation and/or mathematical models' solutions, a set of what-if analyses should be conducted (with the aid of information technology and systems) with the aim of validating the demand plan scenarios and to communicate a final restricted demand plan scenario, that will be presented in the consensus meeting for the strategic S&OP team.

4.4.3 The operational perspective for the DDS&OP

The operational perspective of the DDS&OP has the objective to provide agility to decisions during the production orders planning and the demand fulfillment process. Normally, problems could happen and the decisions to solve them should be aligned with the tactical and strategic decisions; this is the aim of this process, to close the gap between tactical planning and operations execution in a consistent manner. This process is executed weekly or even daily, depending on the company's requirements. Although, it is important to notice, that this process does not substitute the production planning activities, such as MRP running, order generation and shop floor control.

The first process is to **Disaggregate the Plans**. This process provides SKU's visibility to the order fulfillment team. At this point a choice can be made for disaggregation, i.e., it can be conducted a disaggregation of all families or solely the disaggregation of the strategic families. If there are products' families that were not disaggregated, this should be a responsibility of the operations team. The trade-off to be dealt to this decision is between complexity and visibility. After the process the operations team of production and planning control runs the MRP and define the order scheduling. These activities are not executed by the order fulfillment S&OP team.

The second process is to **Check Orders and Priorities**. Considering the production planning and control activities of order generation and scheduling, the order fulfillment team assesses such orders and their priorities, to make sure that is in accordance with previously definitions of the tactical perspective of the DDS&OP. This process provides a proactiveness to the process in order to avoid misalignments issues between sales and marketing decisions and operations decisions.

The third process, to **Receive Data and Information**, can be considered an ongoing process. The objective is to receive data and information from the supply chain that can result

in problems to the demand fulfillment. With the data and information analyzed, **Event-Driven Meetings** can be held. The event-driven meeting does not have previously defined date, time or attendants, because it will depend upon the problem or issue to be dealt. If no problems or issues are identified, no meeting is necessary to be conducted. If a problem or issue is identified, it will verify the applicable personnel to solve the issue and a meeting is scheduled. This approach is important to have the right people to solve the problem, providing visibility to the involved and do not have isolated solutions.

After the execution of each process is foreseen the analysis and control from the operations, sales and marketing, performance, financial and risk teams. The aim is to provide robustness to the decision-making process. At the end, the plans should be communicated to the involved teams.

4.4.3.1 Disaggregate the Plans

Figure 4.11 shows the Disaggregate Plans process.

Figure 4.11 – The Disaggregate Plans Process

Source: Prepared by the author

The first step is to analyze the S&OP plans, provided by the tactical S&OP team, with the aim of understanding the considerations.

The received S&OP plans considers product-family approach. So, the next step is to disaggregate the plans, with the aid of information technology and software, to unique products (that can be represented as a SKU). The disaggregation should be analyzed by the order fulfillment team and, if an issue or problem is found, it should be analyzed, and a new disaggregation proposition should be provided.

The next step is to create the Master Production Schedule (MPS) plan or to define the production rates, depending on the production and planning control approach used by the company. Thus, finally, the decisions should be communicated.

4.4.3.2 Check Orders and Priorities

Figure 4.12 shows the Check Orders and Priorities process.

Figure 4.12 – The Check Orders and Priorities

Source: Prepared by the author

As previously said, it is not foreseen for the operations S&OP team to execute activities that is responsibility of the production planning and control (operations team). So, prior to the execution of this process, the operations team should run the MRP and perform the shop floor control (SFC) activities (such as order prioritization and scheduling). Based on this, the first step is to check if the orders, scheduling and prioritization is in accordance with the customers' requirements. If an issue is found, it should be analyzed, and solutions be proposed. If the involved customer is strategic for the company, it should be communicated about the issues and it can participate and validate to the issue solving. Finally, the decisions of this process should be communicated.

4.4.3.3 Receive Data and Information

Figure 4.13 shows the Receive Data and Information process.

This process can be considered a monitoring process, with the aim of receiving data and information of problems and issues from the supply chain that can compromise the demand fulfillment. The information technology, internet and social media has a critical role in this process, because they can make the companies able to receive in a timely manner the customers' perceptions and supply chain difficulties. Here, it can be considered the straight link between the DDS&OP and the Industry 4.0 concepts.

Figure 4.13 – The Receive Data and Information process

Source: Prepared by the author

Four steps should be executed in parallel. Each step represents a supply chain participant or partner. So, data and information should be received from customers, suppliers, third-party providers and distribution partners.

These data should be analyzed and, if a problem or issue is found, solutions should be provided. If the supplier or customers are strategic, they can be contacted to validate the solutions. Third-party providers and distribution partners can also be contacted to validate the solutions, if the company considers necessary. Finally, all decisions should be consolidated and communicated.

THE DEMAND-DRIVEN SALES AND OPERATIONS PLANNING (DDS&OP) FRAMEWORK AGREEMENT LEVEL

This chapter has the aim of presenting the Fuzzy-Delphi method and its parameters used to obtain the framework agreement level among the experts, to discuss the agreement level process and its results and to present the considerations that emerged from the agreement level, in order to improve the proposed framework for the DDS&OP. Thus, this chapter is organized in four sections: Section 5.1 presenting the Fuzzy-Delphi Method, Section 5.2 presenting the considered parameters for the Fuzzy-Delphi Method, Section 5.3 presenting the agreement level process and its results and, finally, Section 5.4 presenting considerations to the DDS&OP proposed framework, based on the agreement level process.

5.1 The Fuzzy-Delphi Method

The Delphi Method was firstly introduced, and used in research as a scientific method, to collect opinions from experts on a military defense project in the United States in the late 1950's (OKOLI; PWALOWSKI, 2004; POWELL, 2003). Linstone and Turoff (1975, p.3) propose a definition for the Delphi Method:

“Delphi may be characterized as a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem.”

Linstone and Turoff (1975, p.4) also suggest characteristics that lead to the utilization of the Delphi Method:

- ✓ The problem does not lend itself to precise analytical techniques but can benefit from subjective judgments;
- ✓ The individuals needed to contribute to the maximum broad or complex problem have no history of adequate communication;
- ✓ More individuals are needed than can effectively interact in a face-to-face exchange;
- ✓ Time and cost make frequent group meetings infeasible;

- ✓ The efficiency of face-to-face meetings can be increased by a supplemental group communication process;
- ✓ Disagreements among individuals are so severe or politically unpalatable that the communication process must be refereed and/or anonymity assured;
- ✓ The heterogeneity of the participants must be preserved to assure validity of the results.

Most of these cited characteristics meet with the purposes of this thesis, that's why, the Delphi Method was considered an applicable method.

The Delphi Method usually involves the interaction of three activities (GARCIA REYES; GIACHETTI, 2010): (i) to collect opinions from experts, (ii) synthetize and statistically summarize the opinions, and (iii) provide feedback to the participants and return to step 1, until a consensus is reached. Some authors consider a five-step approach, including steps for planning purposes (FERNANDES; GODINHO, 2010; SLACK; BRANDON-JONES; JOHNSTON, 2015): (i) choose the participants of the survey (considering variety), (ii) collect the responses from participants using questionnaires, (iii) summarize the results and evaluate them to find concordance among them, (iv) if concordance is not found, reformulate the questionnaire and redistribute it to the participants, and (v) repeat the previous step up to a concordance among the response is found and disclose the results to the participants.

One disadvantage of the Delphi Method is the number of interactions and the difficulty to obtain consensus among the responses; normally is foreseen four interactions to obtain consensus (STEFANO; CASAROTTO FILHO; DUARTE, 2014). Based on this, Murry, Pipino and Gigch (1985) *apud* Stefano, Casarotto Filho and Duarte (2014) proposed the Fuzzy-Delphi Method, which has the major advantage of solely one step of interaction among the participants (LIU; WANG, 2009; MA et al., 2011). Thus, the consensus and evaluation are obtained by the calculation of the pertinence degree, allowing not losing information and respecting the experts opinions, because they do not need to change the responses (STEFANO; CASAROTTO FILHO; DUARTE, 2014).

Another key issue, in the Delphi Method, is the selection of the group of experts (GARCIA REYES; GIACHETTI, 2010). Normally, a number of experts vary between 10 and 30 (MARQUES; FREITAS, 2018); less than 10 participants will not return the desirable results and more than 30 participants does not included extra value for the research and becomes it more complex to manage. On the other side, Linstone and Turoff (1975) cite that there is not a minimum of participants for the Delphi Method, but it is important to define them with strict criteria.

Based on the disadvantages of the Delphi Method, it has been combined with other methods, such as Fuzzy and Analytical Hierarchical Process (AHP). Examples of these combinations were described in the Section 1.4, Chart 1.1.

The importance for the Fuzzy-Delphi method is the introduction of the Fuzzy Logic. It is known that in the real-world exists uncertainty, becoming the decision-making process more difficult and complex; such uncertainty and complexity come from the lack of and subjective information (HERRERA; MARTÍNEZ, 2001; MARDANI; JUSOH; ZAVADSKAS, 2015). In this sense, the fuzzy approach promotes guidelines to support the decision-making and solve problems that are typically qualitative (WANG, 2010) and problems that cannot be quantified (HERRERA; MARTÍNEZ, 2001). These characteristics are totally adherent with the purposes of this research, because of an unprecedented framework was proposed, thus the answering process to find the agreement level among the experts has uncertainty.

The crisp approach, i.e., classical set theory, considers Boolean value, that is, true or false or acceptable or not acceptable, for instance. Differently, the fuzzy approach considers infinites values that can between 0 and 1 (RIGNEL; CHENCI; LUCAS, 2011).

To illustrate the concepts described, Figure 5.1 represents the crisp approach. Considering the measured performance has a goal of 70%, so all values between 0% and 70% will be set as low performance (for instance, 55% is low performance). On the other hand, all values between 70% and 100% will be set as high performance (for instance, 90% is high performance). Thus, the result is a Boolean value, either low performance or high performance.

Figure 5.1 – Crisp Logic Representation

Source: Prepared by the author

By using fuzzy logic, a transition zone is noted between the low performance and high performance (represented in Figure 5.2). This zone is nebulous and represents the uncertainty transition between low and high performance because this zone may contain characteristics of

both low and high performance. This zone represents the difference between the crisp and fuzzy logics. Thus, the fuzzy logic becomes important to understand such nebulous and uncertain zone.

Figure 5.2 – Fuzzy Logic Representation

Source: Prepared by the author

Once the main idea of the fuzzy logic was presented, it is important to understand some concepts and mathematical operations of the fuzzy logic, such as fuzzy set, pertinence function and fuzzy numbers.

Zadeh (1965, p. 339) defines the fuzzy set:

“considering X being a space of points, with a generic element of X denoted by x . Thus, $X = \{x\}$. In this sense, a fuzzy set A in X is characterized by a membership function $f_a(x)$ which associates with each point in X a real number in the interval $[0,1]$, with the value of $f_a(x)$ at x representing the grade of membership of x in A . Thus, nearer the value of $f_a(x)$ to unity, the higher the grade of membership of x in A ”.

In this sense, Bellman (1970, p.5-6) adds:

“A fuzzy set A in X is set of ordered pairs (Equation 1)

$$A = \{(x, \mu_A(x))\}, \quad x \in X \quad (1)$$

where μ_A is termed grade of membership of x in A and $\mu_A: X \rightarrow M$ is function from X to a space M called the membership space. When M contains only two points, 0 and 1, A is non-fuzzy and its membership function becomes identical with the characteristic function of a non-fuzzy set”.

Another important concept in the fuzzy logic, besides the fuzzy set, is the pertinence function. A pertinence function can be understood as a numeric function, being represented graphically or in a chart (Figure 5.3 presents an example, considering triangular fuzzy numbers).

Figure 5.3 – Pertinence function example

Source: Prepared by the author

The following proprieties and mathematical operations are applicable to the fuzzy logic (BELLMAN, 1970; ZADEH, 1965):

- a) A fuzzy set A is normal if and only if exists at least one element with $\mu_A(x) = 1$;
- b) A fuzzy set is empty if and only if its membership function is identically zero on X;
- c) Two fuzzy sets A and B are equal ($A=B$) if and only if $f_a(x) = f_b(x)$ for all x in X;
- d) A fuzzy set is convex if and only if $\forall x_1, x_2 \in X \text{ e } \forall \lambda \in [0,1], f_A(x)[\lambda x_1 + (1 - \lambda)x_2] \geq \text{Min}[f_A(x_1), f_A(x_2)]$;
- e) The *complement* of a fuzzy set A is denoted A' and is defined as shown by Equation 2;

$$f_{A'} = 1 - f_A \quad (2)$$

- f) A is *contained in* B if and only if $f_a \leq f_b$, as shown by Equation 3;

$$A \subset B \Leftrightarrow f_a \leq f_b \quad (3)$$

- g) The *union* of two fuzzy sets A and B with respective memberships functions $f_a(x)$ and $f_b(x)$ is a fuzzy set C ($C = A \cup B$), whose membership function is related to those A and B and shown by Equation 4.

$$f_c = f_a \vee f_b \quad (4)$$

- h) The intersection of two fuzzy sets A and B with respective memberships functions $f_a(x)$ and $f_b(x)$ is a fuzzy set C ($C = A \cap B$) whose membership function is related to those A and B and shown by Equation 5.

$$f_c = f_a \wedge f_b \quad (5)$$

In this thesis was used a triangular fuzzy number (because it is simples and many studies in the area of operations management considered this type of fuzzy number). A triangular fuzzy number can be defined by the Equation 6 (ANAND; BHARATRAJ, 2017):

$$\mu(x_i) = \begin{cases} 0, & \text{if } x_i \leq a \\ \frac{x_i - a}{m - a}, & \text{if } x_i \in [a, m] \\ \frac{b - x_i}{b - m}, & \text{if } x_i \in [m, b] \\ 0, & \text{if } x_i \geq b \end{cases} \quad (6)$$

The Figure 5.4 represents the triangular fuzzy number, considering its pertinence fuction.

Figure 5.4 – Triangular Fuzzy Number

Considering the triangular fuzzy numbers represented by the Equation 7 and 8, the following operations can be applied (Equations 9, 10, 11, 12, 13 and 14) (HABIBI; JAHANTIGH; SARAFRAZI, 2015; XIE et al., 2018):

$$F_1 = (a_1, m_1, b_1) \quad (7)$$

$$F_2 = (a_2, m_2, b_2) \quad (8)$$

$$F_1 + F_2 = (a_1 + a_2, m_1 + m_2, b_1 + b_2) \quad (9)$$

$$F_1 - F_2 = (a_1 - b_2, m_1 - m_2, b_1 - a_2) \quad (10)$$

$$F_1 \times F_2 = (a_1 \times a_2, m_1 \times m_2, b_1 \times b_2) \quad (11)$$

$$F_1 \div F_2 = (a_1 \div b_2, m_1 \div m_2, b_1 \div a_2) \quad (12)$$

$$kF = (ka, km, kb), k \text{ being a constant} \quad (13)$$

$$\frac{1}{F} = \left(\frac{1}{a}, \frac{1}{m}, \frac{1}{b} \right) \quad (14)$$

The main concepts of the Delphi Method, Fuzzy Approach and Fuzzy-Delphi Method were presented. Thus, the definition of the steps to conduct the Fuzzy-Delphi Method is important.

The Fuzzy-Delphi method should consider the following steps (HABIBI; JAHANTIGH; SARAFRAZI, 2015; KUO; CHEN, 2008):

1. Define the problem to be studied;
2. Design the questionnaire considering an appropriate spectrum for fuzzification of linguistic expressions;
3. Define the sample of experts to participate;
4. Send questionnaires to the participants;
5. Receive questionnaires from the participants;
6. Define the fuzzy values for the responses;

7. Aggregate the fuzzy values;
8. Defuzzificate the aggregate fuzzy values;
9. Select the threshold value and response consensus;
10. Analyze the results;
11. Provide feedback to the participants.

The details of each steps, with the considered parameters, is presented in the Section 5.2.

5.2 Considered parameters for the applied Fuzzy-Delphi Method

This section has the aim of presenting the considered parameters for the Fuzzy-Delphi. This formalization is critical for future research replication and valuation.

The utilization of the Fuzzy-Delphi method considered the steps described at the end of Section 5.1. With the aim of detailing each step, it was dedicated one subsection for each one of them.

5.2.1 Define the problem to be studied

The problem to be studied with the Fuzzy-Delphi method is related with the RQ4 defined in Section 1.2. Additionally, for the Fuzzy-Delphi method purposes, the problem to be studied is to find agreement level of the developed DDS&OP among the experts. This problem is in accordance with the objectives of this thesis; the objectives were also defined in Section 1.2.

5.2.2 Design the questionnaire considering an appropriate spectrum for fuzzification of linguistic expressions be studied

The questionnaire was designed considering four main sections, as presented in Appendix H and described below:

- ✓ **Presentation of the research:** the questionnaire began with an introduction, considering the scope and objectives of the research. In this section was also provided an informed consent form with aim of making clear that all collected information would not be disclosed and the secrecy of the participants would be kept;
- ✓ **Information for the participants:** this section was important to define the rules with the participants. Thus, the participant would know why he/she was

chosen to participate, the right to decline the participation at any moment, the time to complete the survey, how the survey was conducted, details of confidentiality, the use of information and when the results would be available. At this point the contact of the researcher was also provided and the participant should fill the participant statement (including name, current position and date);

- ✓ **Framework presentation:** it was important for the expert to know the designed framework, prior to its valuation. This was the purposes of this section, to present the DDS&OP framework. It is important to notice that all details provided by this thesis in BPMN was not included in this section. The objective was to validate the perspectives and main processes shown in the Figure 4.1 in order to become a feasible validation process. The proposed teams of each perspective, defined in the Charts 4.4, 4.5 and 4.6, were also presented and validate by the experts;
- ✓ **Survey responses:** this section was dedicated to obtaining the agreement level of the framework. Firstly, it was provided an explanation of how the participant should fill the survey. This section was divided in four groups: (i) strategic perspective, (ii) tactical perspective, (iii) operational perspective and (iv) process governance. The strategic perspective was composed by 16 questions; question 1 was related to obtain the validation of a strategic perspective for the S&OP, questions from 2 to 12 to validate the considered processes, questions from 13 to 15 to validate the considerations for the team and question 16 to validate the planning horizon for the strategic perspective. The tactical perspective was composed by 24 questions; questions from 17 to 33 to validate the considered processes, questions from 34 to 39 to validate the considerations for the teams and question 40 to validate the planning horizon for the tactical perspective. The operational perspective was composed by 20 questions; question 41 to obtain validation of the operational perspective for the S&OP, questions from 42 to 54 to validate the considered processes, questions from 55 to 59 to validate the considerations for the teams and question 60 to validate planning horizon for the operational perspective. The process governance was composed solely by one question, to validate the

pertinence of this process. Thus, the survey was composed by a total of 61 questions.

To fill the survey, the participants should choose, for each question, the level of importance, i.e., very unimportant (the process/approach must not be considered in the framework), unimportant (the process/approach does not bring any advantage to the S&OP process), important (the process/approach brings advantages to the S&OP process) or very important (the process/approach must be considered in the framework). Thus, it was considered a 4-point-Likert Scale. Ruggeri (2008) suggests the utilization of an even number of points in a Likert scale, with the aim of making easier the valuation decision and to avoid the choice of the central point.

The fuzzification process will consider the 4-point-Likert Scale, as further detailed in Section 5.2.6.

5.2.3 Define the sample of experts to participate

The sample of experts to participate in the survey was a critical step to reach the desirable results for the research. For that, three main criteria were considered to select and define the experts (BOKRANTZ et al., 2017; VON DER GRACHT; DARKOW, 2010):

- ✓ Position and responsibilities;
- ✓ Experience and knowledge in the researched field; and
- ✓ Availability to participate.

Based on the described criteria, the following characteristics were considered to define the sample of experts: to have extensive knowledge and practical experience in Demand-Driven Concepts, Sales and Operations Planning, Supply Chain Management, Materials Planning, Production Planning and Control and correlated areas, availability to answer the survey and to have occupied senior levels in organizations.

In order to minimize bias from the sample definition, diversity was also considered in the sample, i.e., professionals from different industries, professionals from consulting companies, researchers and professors. Nonetheless, these experts should respect the prior defined criteria and characteristics.

The initial sample considered a total of 38 experts. This initial sample was defined based on the previously described criteria.

The details of the sample are shown in Table 5.1.

Table 5.1 – Initial considered sample of experts

Position	Number of Participants
Supply Chain Management and Demand-Driven Education Consultant	3
Researchers (Masters and/or Doctoral Degree)	2
University Professor	3
Demand-Driven Consultant	1
Supply Chain Consultant	11
Supply Chain and/or S&OP Manager	9
Supply Chain Professional	3
Production Planning and Control Manager	2
Supply Chain Consultant Partner	2
Supply Chain and Technology Consultant	2
Total	38

Source: Prepared by the author

It was obtained responses from 17 experts, 44,74% from total expected. The details of the considered sample of experts is detailed in Table 5.2.

Table 5.2 – Considered sample of experts

Position	Number of Participants
Supply Chain Management and Demand-Driven Education Consultant	2
Researchers (Masters and/or Doctoral Degree)	2
University Professor	1
Supply Chain Consultant	4
Supply Chain and/or S&OP Manager	3
Production Planning and Control Manager	2
Supply Chain Consultant Partner	1
Supply Chain and Technology Consultant	2
Total	17

Source: Prepared by the author

Excluding the Professor and the researchers, the details of the industries/companies of the experts are shown in Table 5.3.

Table 5.3 – Industries/Companies of the experts

Type of industry/company	Number of Participants
Education Consulting	2
ERP Consulting	2
Processes and Technology Consulting	5
Dental materials company	1
Steel Company	1
Agrobusiness Company	1
Beverage Company	2
Total	14

Source: Prepared by the author

Based on Table 5.2 and 5.3, it is possible to infer that the diversity of the sample was reached. The minimum number of participants was also reached, as proposed by Marques and Freitas (2018) and described in Section 5.1. Finally, the criteria and desirable characteristics of the participants were reached too.

It is important to notice that, excluding one researcher, all the participants have at least 10 years of experience within the theme. It is also important to notice that 9 participants (64,29% of the total) work with consulting, thus they have a broader view of the theme, because they worked with projects in more than one type of company. Thus, the quality of the agreement level process for the proposed framework was proved by the characteristic of the experts' sample.

5.2.4 Send questionnaires to the participants

The tool used to distribute the questionnaires was the e-mail. Prior to send the questionnaires, it was sent an e-mail with a brief description of the research project and kindly asking participation for the experts. For who's agreed of participating, it was send the questionnaire in a protected Microsoft Word format. The structure of the questionnaire was presented in Section 5.2.2 and the questionnaire itself was presented in Appendix H.

5.2.5 Receive questionnaires from the participants

The questionnaires were received by e-mail. In order to keep the quality and loyalty of the data, the advisor of this thesis was copied in the responses.

5.2.6 Define the fuzzy value for the responses

The purpose of the adopted Fuzzy-Delphi method was for screening (with the aim of performing the agreement level definition for the proposed framework). In this case, Habibi, Jahantigh and Sarafrazi (2015) suggest the utilization of a Triangular Fuzzy Number.

Based on this, Figure 5.5 shows the pertinence function for Triangular Fuzzy Number considering a 4-point-Likert scale (used in the questionnaire).

By geometric interpretation from Figure 5.5, it is possible to define the Triangular Fuzzy Numbers for each Likert point of the questionnaire. These numbers are shown in the Table 5.4.

Thus, for each response was defined a Triangular Fuzzy Number, based on the expert responses. In Appendix I, Charts I.1, I.2, I.3 and I.4 show the responses from the experts and the defined Triangular Fuzzy Number, considering the notation of Formula 7.

Figure 5.5 – Triangular fuzzy numbers for 4-point-Likert Scale

Source: Prepared by the author

Table 5.4 – Triangular fuzzy numbers definition

4-point-Likert Scale considered in the survey questionnaire				
	Very Unimportant	Unimportant	Important	Very Important
Triangular Fuzzy Numbers	(0, 0, 1/3)	(0, 1/3, 2/3)	(1/3, 2/3, 1)	(2/3, 1, 1)

Source: Prepared by the author

5.2.7 Aggregate Fuzzy Values

The next step is to aggregate the fuzzy values. Considering the screening purposes, Habibi, Jahantigh and Sarafrazi (2015) suggest three possibilities for aggregation, shown by Formulas 15, 16 and 17.

$$F_{AGR} = \left(\frac{\sum a}{n}, \frac{\sum m}{n}, \frac{\sum b}{n} \right) \quad (15)$$

$$F_{AGR} = \left(\min\{a\}, \left\{ \frac{\sum m}{n} \right\}, \max\{b\} \right) \quad (16)$$

$$F_{AGR} = (\min\{a\}, \prod\{m\}, \max\{b\}) \quad (17)$$

For this thesis, it was used the Formula 15 to aggregate the fuzzy values. The criteria to use this approach is its simplicity and its use in other studies, for instance, Chen and Wang (2010) and Manakandan et al. (2017). It is importance to notice that Formula 15 is in accordance with arithmetic operation with triangular fuzzy numbers presented in the Formulas 9, 10, 11, 12, 13 and 14. For each answered question was found an aggregate fuzzy number, based on all experts' responses.

The results of the aggregation are presented in Section 5.3.

5.2.8 Desfuzzificate the aggregate fuzzy values

To interpret the values, it is necessary to desfuzzificate the aggregate fuzzy values with the aim of finding a crisp number. Habibi, Jahantigh and Sarafrazi (2015) cite that to desfuzzificate is necessary, firstly, to find x_m^1 , x_m^2 and x_m^3 values, shown by Formulas 18, 19 and 20.

$$x_m^1 = \frac{A+M+B}{3} \quad (18)$$

$$x_m^2 = \frac{A+2M+B}{4} \quad (19)$$

$$x_m^3 = \frac{A+4M+B}{6} \quad (20)$$

With the found x_m^1 , x_m^2 and x_m^3 values, the Crisp Number (Z^*) is the maximum value among them, as shown in the Formula 21.

$$\text{Crisp Number} = Z^* = \max (x_m^1, x_m^2, x_m^3) \quad (21)$$

For each answered question is found a Crisp Number, based on all experts' responses. These results are presented in Section 5.3.

5.2.9 Select the threshold value and response consensus

This thesis considered two approaches to select the threshold and the response consensus. The selection of two approaches is based on the necessity of having a solid discussion about the conformation or not of the valued processes.

Habibi, Jahantigh and Sarafrazi (2015) suggest that, if the Crisp Number (Formula 21) is equal or higher than 0,7, then the criteria should be accepted and confirmed (for the purposes of this thesis, the agreement among the experts was achieved); if not, the criteria should not be confirmed (for the purposes of this thesis, the agreement among the experts was not achieved).

On the other hand, Manakandan et al. (2017) and Yu-Feng and Hsiao-Lin (2008) consider another approach. First, it is necessary to determine $d_i(\bar{z}, \bar{n})$ value for each expert in each answered question. This calculation is represented by Formula 22.

$$d_i(\bar{z}, \bar{n}) = \sqrt{\frac{1}{3} [(\bar{a} - a_i)^2 + (\bar{m} - m_i)^2 + (\bar{b} - b_i)^2]} \quad (22)$$

After this calculation, it necessary to find the average of the $d_i(\bar{z}, \bar{n})$ for each question, considering the value of $d_i(\bar{z}, \bar{n})$ found for each expert, representing the proximity of the responses. The average is calculated by Formula 23.

$$d_i(\bar{z}, \bar{n})_{ave} = \frac{\sum d_i(\bar{z}, \bar{n})}{\text{Number of experts}} \quad (23)$$

Two conditions must be respected to accept the criteria being evaluated; first, the $d_i(\bar{z}, \bar{n})_{ave}$ must be lower or equal than 0,2 and the consensus must be higher or equal than 75% (in this case, for the purposes of this thesis, the agreement among the experts was achieved) The consensus is found by Formula 24.

$$\text{Consensus (\%)} = \frac{\text{Number of } d_i(\bar{z}, \bar{n}) \leq 0,2}{\text{Number of experts}} \quad (24)$$

The results of the threshold and consensus validation are presented in Section 5.3 and the discussion about the results is presented in Section 5.4.

5.2.10 Analyze the results

The analysis and discussion about the results are presented in Section 5.4. This discussion provides important considerations about the proposed framework. It is not foreseen in the Fuzzy-Delphi Method comments about the evaluated items from the participants, but some experts, besides the 4-point-Lickert scale pointing, provided extra comments. Such comments were also considered in the discussion and enriched the level agreement definition process.

5.2.11 Provide feedback to the participants

The Fuzzy-Delphi Method was used to define the agreement level of the proposed framework among the experts, as a part of a Doctor's degree thesis. Thus, it was provided an executive summary with the main results for the participants (because it make easier and faster to see and interpret the results) and made available a copy of the final version of the thesis (if the participant wants to appreciate the research as a whole), as a feedback of their participation.

5.3 Fuzzy-Delphi Method results and validation

As previously informed, in Appendix I, Charts I.1, I.2, I.3 and I.4 show the responses from the experts and the defined Triangular Fuzzy Number, considering the notation of the Formula 7.

As an initial analysis, Table J.1 (in appendix J) shows the absolute response frequency of each question. Table J.1 also provides the percentage of the answer with higher frequency response (with the aim of having an initial perception of the agreement level among the participants) and the frequency of “important” and “very important” answers (with the aim of verifying the pertinence of the proposed processes in the framework).

It was achieved a great level of agreement among the responses, concluding that the participants had a common view about the proposed framework. From Table J.1 and summarized in Graph 5.1, it was perceived that 55,7% of the questions achieved a level of agreement between 50% and 75% and 24,6% of the questions achieved a level of agreement between 75% and 100%. This reveals that 80,3% of the responses had a level of agreement higher than 50%, i.e., more than half of the experts had the same answers in this set of questions.

Source: Prepared by the author

It is also possible to infer from Table J.1 and summarized in Graph 5.2 that most of processes were considered important or very important in the view of the experts, i.e., 87% of the responses had a level of agreement between 75% and 100% considering the range of importance for important and very important. From the results, 98% of the responses had a level

of agreement higher than 50%, i.e., more than half of the experts considered the answers important or very important in this set of questions.

Graph 5.2 – Level of agreement among the questions with important and very important responses

Source: Prepared by the author

This first analysis does not make part of the Fuzzy-Delphi Method, but it was considered because of the importance to understand the behavior of responses among the participants. From now, it is presented the results of the Fuzzy-Delph Method.

Table J.2 (in Appendix J) shows the aggregation of the fuzzy values for each question, considering the values presented in Appendix C. The aggregated fuzzy value for each question considered the expression presented in Formula 25 and the operation presented in Formula 15.

$$F_i = (A_i, M_i, B_i), \text{ where } i \text{ represents each question} \quad (25)$$

After the aggregation of the fuzzy values, it is necessary to defuzzificate them. Thus, to defuzzificate the values for each question, Formulas 18, 19, 20 and 21 were used. At the end of this process, a crisp number (Z^*) was found for each question. Results are presented in Table J.3.

By analyzing Table J.3 and taking in consideration the approach of Habibi, Jahantigh and Sarafrazi (2015), it was perceived that most of the questions were agreed among the experts, because their crisp number (Z^*) were equal or higher than 0,7. Chart 5.1 shows the questions agreed and not agreed.

Chart 5.1 – Validation considering the crisp number (Z*)

	Questions	Description	Result		Questions	Description	Result
Strategic	Question 1	S&OP process should be strategically expanded	Agreed	Tactical	Question 32	Performance Management process	Agreed
	Question 2	The Strategy Review process	Agreed		Question 33	Performance Management process / performed in each step	Agreed
	Question 3	The Product Portfolio Management process	Agreed		Question 34	Strategic S&OP team participation (in a matrix approach)	Agreed
	Question 4	The Supply Chain Intelligence Activities process	Agreed		Question 35	Sales and Marketing team participation (in a matrix approach)	Agreed
	Question 5	The Contingency Plans Elaboration process	Agreed		Question 36	Operations team participation (in a matrix approach)	Agreed
	Question 6	The Communicate the plans process	Agreed		Question 37	Tactical S&OP team	Agreed
	Question 7	The Financial Management process	Agreed		Question 38	Financial Assessment team	Agreed
	Question 8	The Financial Management process / performed in each step	Agreed		Question 39	Risk Assessment team	Agreed
	Question 9	Risk Management process	Agreed		Question 40	Tactical Perspective should be monthly	Agreed
	Question 10	Risk Management process / performed in each step	Not Agreed	Operational	Question 41	S&OP process should be operationally expanded	Agreed
	Question 11	Performance Management process	Agreed		Question 42	Disaggregate the plans process	Agreed
	Question 12	Performance Management process / performed in each step	Not Agreed		Question 43	Disaggregate the plans process / differentiation of strategic and not strategic product families	Not Agreed
	Question 13	Strategic S&OP team (in a matrix approach)	Agreed		Question 44	Check orders and priorities process	Agreed
	Question 14	Financial Assessment team (in a matrix approach)	Agreed		Question 45	Receive data and information process	Agreed
	Question 15	Risk Assessment team (in a matrix approach)	Not Agreed		Question 46	Receive data and information process - with real-time data	Agreed
	Question 16	Cycle for the Strategic Perspective should be from 2 months to 6 months	Agreed		Question 47	Receive data and information process - social media and internet data	Agreed
	Question 17	Portfolio Review process	Agreed		Question 48	Event-driven meetings	Agreed
	Question 18	Demand Planning process	Agreed		Question 49	Financial Control process	Agreed

Chart 5.1 – Validation considering the crisp number (Z^*) – *Continuation*

Questions	Description	Result	Questions	Description	Result
Tactical	Question 19 Demand Planning process – participation of strategic customers	Agreed	Question 50	Financial Control process / performed in each step	Not Agreed
	Question 20 Supply Planning process	Agreed	Question 51	Risk Control process	Agreed
	Question 21 Supply Planning process – participation of strategic suppliers	Agreed	Question 52	Risk Control process / performed in each step	Not Agreed
	Question 22 Scenario Analysis process	Agreed	Question 53	Performance Management process	Agreed
	Question 23 Scenario Analysis process – utilization of simulation	Agreed	Question 54	Performance Management process / performed in each step	Agreed
	Question 24 Scenario Analysis process – utilization of what-if analyses	Agreed	Question 55	Order Fulfillment team	Agreed
	Question 25 Scenario Analysis process – utilization of mathematical algorithms	Agreed	Question 56	Sales and Marketing team	Agreed
	Question 26 Consensus Meeting process	Agreed	Question 57	Operations team	Agreed
	Question 27 Communicate the plans process	Agreed	Question 58	Financial Management team	Not Agreed
	Question 28 The Financial Management process	Agreed	Question 59	Risk Management team	Not Agreed
	Question 29 The Financial Management process / performed in each step	Agreed	Question 60	Cycle for the Operational Perspective should be daily or weekly	Agreed
	Question 30 Risk Management process	Agreed			
	Question 31 Risk Management process / performed in each step	Agreed	Governance	Question 61 Process governance	Agreed

Source: Prepared by the author

It was perceived that all the proposed processes were agreed by this approach, but the rules of execution of some processes and some teams proposals in the strategic and operational perspectives were not agreed by the experts, as detailed below:

- ✓ In the **strategic perspective** the execution of **the risk management process** and **performance management process** was not agreed to be performed in each step of this perspective. By the comments received from the experts, they pointed that, if such processes being performed in each step, could lead to slowness in the whole process and increasing of bureaucracy;
- ✓ In the **strategic perspective**, it was not agreed the participation of a **risk assessment team** (even if in a matrix approach). The risk assessment could be performed by the strategic DDS&OP team;
- ✓ In the **operational perspective**, the proposal of **differetiation between the strategic and not strategic product families during the disaggregation of the plan processes** was not agreed, concluding that all product families should have the same approach for disaggregation;
- ✓ Similar to the strategic perspective, in the **operational perspective**, the execution of **the risk management process** and **performance management process** was not agreed to be performed in each step of this perspective. The explanation for that is the same of the strategic perspective, being even more relevant because of the necessity of agility and velocity in the operational perspective; and
- ✓ In the **operational perspective**, it was not agreed the participation of a **risk management team** and **performance management team** (even if in a matrix approach). Such processes should be performed by the order fulfillment team, which is responsible for this perspective of the DDS&OP.

Another agreement rule was performed, using the approach proposed and utilized by Manakandan et al. (2017) and Yu-Feng and Hsiao-Lin (2008). For this approach, as previously cited, the $d_i(\bar{z}, \bar{n})_{ave}$ must be lower or equal than 0,2 and the consensus must be higher or equal than 75%. The results are shown in the Table J.4 (in Appendix J), where is presented the threshold value for each expert in each question, the $d_i(\bar{z}, \bar{n})_{ave}$ value for each questions, number of responses with threshold value lower than 0,2 for each question (#) and the percentage of consensus for each question (% C).

Considering the conditions to be respect (Manakandan et al. (2017) and Yu-Feng and Hsiao-Lin (2008) approach) in order to verify the response agreement in the questions, Chart 5.2 shows the questions agreed and not agreed.

By considering this approach, 65,57% of the questions was agreed among the experts. The non-agreement can be divided in three groups (34,43% of the questions):

- ✓ **Group 1:** the $d_i(\bar{z}, \bar{n})_{ave}$ is not equal or lower than 0,2, but consensus is equal or higher than 75% (0,02% of the responses are in this group);
- ✓ **Group 2:** the consensus is not equal or higher than 75%, but the $d_i(\bar{z}, \bar{n})_{ave}$ is lower than 0,2 (21,30% of the responses are in this group); and
- ✓ **Group 3:** the $d_i(\bar{z}, \bar{n})_{ave}$ is not equal or lower than 0,2 and the consensus is not equal or higher than 75% (13,11% of the responses are in this group).

Each non-agreement is discussed below:

- ✓ In the **strategic perspective**, the **communicate the plans process** was not agreed by the experts (Group 2). Notwithstanding 88% of the experts considered the process Very Important (35%) and Important (53%), this difference of responses led to a non-agreement. To contribute with this result, 12% of the experts considered Unimportant (6%) and Very Unimportant (6%);
- ✓ In the **strategic perspective**, the **financial management process** was not agreed by the experts (Group 2). Notwithstanding 100% of the experts considered the process Very Important (76%) and Important (24%), this difference of responses led to a non-agreement. It is important to notice that the consensus level was 71%, close to the expected value to validate;
- ✓ In the **strategic perspective**, the **financial management process being performed in each step** was not agreed by the experts (Group 2). Notwithstanding 94% of the experts considered the process Very Important (35%) and Important (59%), this difference of responses led to a non-agreement. To contribute with this result, 6% of the experts considered Very Unimportant;
- ✓ In the **strategic perspective**, the **risk management process** was not agreed by the experts (Group 2). Notwithstanding 94% of the experts considered the process Very Important (29%) and Important (65%), this difference of responses led to a non-agreement. To contribute with this result, 6% of the experts considered Unimportant Very Unimportant;

Chart 5.2 – Validation considering the $d_i(\bar{z}, \bar{n})_{ave}$ value and the percentage of consensus

Questions	Description	Result	Questions	Description	Result
Question 1	S&OP process should be strategically expanded	Agreed	Question 32	Performance Management process	Agreed
Question 2	The Strategy Review process	Agreed	Question 33	Performance Management process / performed in each step	Agreed
Question 3	The Product Portfolio Management process	Agreed	Question 34	Strategic S&OP team participation (in a matrix approach)	Not Agreed
Question 4	The Supply Chain Intelligence Activities process	Agreed	Question 35	Sales and Marketing team participation (in a matrix approach)	Agreed
Question 5	The Contingency Plans Elaboration process	Agreed	Question 36	Operations team participation (in a matrix approach)	Agreed
Question 6	The Communicate the plans process	Not Agreed	Question 37	Tactical S&OP team	Not Agreed
Question 7	The Financial Management process	Not Agreed	Question 38	Financial Assessment team	Agreed
Question 8	The Financial Management process / performed in each step	Not Agreed	Question 39	Risk Assessment team	Agreed
Question 9	Risk Management process	Not Agreed	Question 40	Tactical Perspective should be monthly	Agreed
Question 10	Risk Management process / performed in each step	Not Agreed	Question 41	S&OP process should be operationally expanded	Agreed
Question 11	Performance Management process	Agreed	Question 42	Disaggregate the plans process	Not Agreed
Question 12	Performance Management process / performed in each step	Not Agreed	Question 43	Disaggregate the plans process / differentiation of strategic and not strategic product families	Not Agreed
Question 13	Strategic S&OP team (in a matrix approach)	Agreed	Question 44	Check orders and priorities process	Agreed
Question 14	Financial Assessment team (in a matrix approach)	Agreed	Question 45	Receive data and information process	Agreed
Question 15	Risk Assessment team (in a matrix approach)	Agreed	Question 46	Receive data and information process - with real-time data	Agreed
Question 16	Cycle for the Strategic Perspective should be from 2 months to 6 months	Not Agreed	Question 47	Receive data and information process - social media and internet data	Not Agreed

Chart 5.2 – Validation considering the $d_i(\bar{z}, \bar{n})_{ave}$ value and the percentage of consensus - *Continuation*

	Questions	Description	Result	Questions	Description	Result
Tactical	Question 17	Portfolio Review process	Agreed	Question 48	Event-driven meetings	Agreed
	Question 18	Demand Planning process	Agreed	Question 49	Financial Control process	Not Agreed
	Question 19	Demand Planning process - participation of strategic customers	Agreed	Question 50	Financial Control process / performed in each step	Not Agreed
	Question 20	Supply Planning process	Agreed	Question 51	Risk Control process	Agreed
	Question 21	Supply Planning process - participation of strategic suppliers	Agreed	Question 52	Risk Control process / performed in each step	Not Agreed
	Question 22	Scenario Analysis process	Agreed	Question 53	Performance Management process	Agreed
	Question 23	Scenario Analysis process - utilization of simulation	Agreed	Question 54	Performance Management process / performed in each step	Agreed
	Question 24	Scenario Analysis process - utilization of what-if analyses	Agreed	Question 55	Order Fulfillment team	Agreed
	Question 25	Scenario Analysis process - utilization of mathematical algorithms	Not Agreed	Question 56	Sales and Marketing team	Agreed
	Question 26	Consensus Meeting process	Agreed	Question 57	Operations team	Not Agreed
	Question 27	Communicate the plans process	Agreed	Question 58	Financial Management team	Not Agreed
	Question 28	The Financial Management process	Agreed	Question 59	Risk Management team	Not Agreed
	Question 29	The Financial Management process / performed in each step	Not Agreed	Question 60	Cycle for the Operational Perspective should be daily or weekly	Agreed
	Question 30	Risk Management process	Agreed	Governance	Question 61 Process governance	Agreed
	Question 31	Risk Management process / performed in each step	Not Agreed			

Source: Prepared by the author

- ✓ In the **strategic perspective**, the **risk management process being performed in each step** was not agreed by the experts (Group 3). In this case, it was perceived great response differences among the participants, that's why it is in Group 3. Notwithstanding most of the experts (76%) considered the process Very Important (approximately 17%) and Important (approximately 58%), this difference of responses led to a non-agreement. To contribute with this result, 24% of the experts considered Unimportant (12%) and Very Unimportant (12%);
- ✓ In the **strategic perspective**, the **performance management process being performed in each step** was not agreed by the experts (Group 3). In this case, it was perceived great response differences among the participants, that's why it is in Group 3. Notwithstanding most of the experts (71%) considered the process Very Important (approximately 29%) and Important (approximately 41%), this difference of responses led to a non-agreement. To contribute with this result, 29% of the experts considered Unimportant (approximately 6%) and Very Unimportant (approximately 12%);
- ✓ In the **strategic perspective**, the **cycle for the strategic perspective should be from 2 months to 6 months** was not agreed by the experts (Group 3). In this case, it was perceived great response differences among the participants, that's why it is in Group 3. Notwithstanding most of the experts (71%) considered the process Very Important (approximately 35%) and Important (approximately 36%), this difference of responses led to a non-agreement. To contribute with this result, 29% of the experts considered Unimportant;
- ✓ In the **tactical perspective**, the **scenario analysis process with utilization of mathematical algorithms** was not agreed by the experts (Group 3). Notwithstanding most of the experts (76%) considered the process Very Important (approximately 59%) and Important (approximately 18%), this difference of responses led to a non-agreement. To contribute with this result, 24% of the experts considered Unimportant. It is important to notice that the $d_i(\bar{z}, \bar{n})_{ave}$ value was 0,232 and the consensus level was 71%, close to the expected values to validate;
- ✓ In the **tactical perspective**, the **financial management process being performed in each step** was not agreed by the experts (Group 2). Notwithstanding 82% of the experts considered the process Very Important

(41%) and Important (41%), this difference of responses led to a non-agreement. To contribute with this result, 18% of the experts considered Unimportant;

- ✓ In the **tactical perspective**, the **risk management process being performed in each step** was not agreed by the experts (Group 2). Notwithstanding 76% of the experts considered the process Very Important (approximately 24%) and Important (approximately 53%), this difference of responses led to a non-agreement. To contribute with this result, 24% of the experts considered Unimportant;
- ✓ In the **tactical perspective**, the **strategic DDS&OP team participation (in a matrix approach)** was not agreed by the experts (Group 3). Notwithstanding most of the experts (71%) considered the process Very Important (approximately 53%) and Important (approximately 18%), this difference of responses led to a non-agreement. To contribute with this result, 29% of the experts considered Unimportant;
- ✓ In the **tactical perspective**, the **tactical S&OP team definition** was not agreed by the experts (Group 2). Notwithstanding 100% of the experts considered the process Very Important (76%) and Important (24%), this difference of responses led to a non-agreement. It is important to notice that the consensus level was 71%, close to the expected value to validate;
- ✓ In the **operational perspective**, the **disaggregate the plans process** was not agreed by the experts (Group 3). Notwithstanding most of the experts (76%) considered the process Very Important (approximately 53%) and Important (approximately 24%), this difference of responses led to a non-agreement. To contribute with this result, 24% of the experts considered Unimportant. It is important to notice that the $d_i(\bar{z}, \bar{n})_{ave}$ value was 0,233 and the consensus level was 71%, close to the expected values to validate;
- ✓ In the **operational perspective**, the **disaggregate the plans process with differentiation of strategic and not strategic product families** was not agreed by the experts (Group 3). Notwithstanding most of the experts (65%) considered the process Very Important (approximately 29%) and Important (approximately 35%), this difference of responses led to a non-agreement. To

contribute with this result, 35% of the experts considered Unimportant, an expressive number;

- ✓ In the **operational perspective**, the **receive data and information from social media and internet process** was not agreed by the experts (Group 2). Notwithstanding 71% of the experts considered the process Very Important (approximately 29%) and Important (approximately 41%), this difference of responses led to a non-agreement. To contribute with this result, 29% of the experts considered Unimportant;
- ✓ In the **operational perspective**, the **financial control process** was not agreed by the experts (Group 2). Notwithstanding 82% of the experts considered the process Very Important (approximately 24%) and Important (approximately 59%), this difference of responses led to a non-agreement. To contribute with this result, 18% of the experts considered Unimportant;
- ✓ In the **operational perspective**, the **financial control process being performed in each step** was not agreed by the experts (Group 1). In this case, most of the experts (65%) considered this question Unimportant. Based on this, it is necessary to evaluate the pertinence of this process in the framework. Besides that, 24% considered Very Important and 12% considered Important;
- ✓ In the **operational perspective**, the **risk management process being performed in each step** was not agreed by the experts (Group 3). Notwithstanding most of the experts (59%) considered the process Very Important (approximately 24%) and Important (approximately 35%), this difference of responses led to a non-agreement. To contribute with this result, 41% of the experts considered Unimportant, an expressive number;
- ✓ In the **operational perspective**, the **operations team participation** was not agreed by the experts (Group 2). Notwithstanding 100% of the experts considered the process Very Important (76%) and Important (24%), this difference of responses led to a non-agreement. It is important to notice that the consensus level was 71%, close to the expected value to validate;
- ✓ In the **operational perspective**, the **financial management team participation** was not agreed by the experts (Group 2). Notwithstanding 76% of the experts considered the process Very Important (approximately 12%) and Important (approximately 65%), this difference of responses led to a non-

agreement. To contribute with this result, 24% of the experts considered Unimportant;

- ✓ In the **operational perspective**, the **risk management team participation** was not agreed by the experts (Group 2). Notwithstanding 59% of the experts considered the process Very Important (12%) and Important (47%), this difference of responses led to a non- agreement. To contribute with this result, 41% of the experts considered Unimportant, an expressive number.

5.4 Critical analysis of the Fuzzy-Delphi Method results and agreement level

As previously seen in the Section 5.3, the proposed framework for DDS&OP can be considered agreed among the experts. Two approaches were used to define the agreement level based on the results obtained with the Fuzzy-Delphi Method, one proposed by Habibi, Jahantigh and Sarafrazi (2015) and other proposed and used by Manakandan et al. (2017) and Yu-Feng and Hsiao-Lin (2008).

The method proposed by Habibi, Jahantigh and Sarafrazi (2015) considers a Crisp Number (Z^*), which can vary from 0 to 1. Because of the aim was to find the agreement level of proposed model, the higher the Crisp Number (Z^*) the higher is the level of agreement, that's why they propose that to validate an option is necessary that the Crisp Number (Z^*) be higher or equal to 0,7. This can be explained because of the fact during the fuzzy numbers attribution, when the responses are Important and Very Important, the fuzzy values are closer to 1; when the responses are Unimportant and Very Unimportant, the values are closer to 0. Thus, when the Crisp Number is closer to 1 (higher or equal to 0,7) means that for that option contributes for the framework or must be part of the framework. In this sense, this method is used to verify if the option must be included or not in the framework, based on the experts' responses.

On the other hand, the approach proposed and used by Manakandan et al. (2017) and Yu-Feng and Hsiao-Lin (2008) has the aim of verifying the consistency of the responses. The more the responses are equal the more the items of the framework were agreed among the experts. For that, it is necessary to calculate $d_i(\bar{z}, \bar{n})_{ave}$, which measures the distance among the responses (i.e., if the answers are mostly Very Important and solely few responses Important, they are concentrated in the Very Important part of the questionnaire and $d_i(\bar{z}, \bar{n})_{ave}$ value would be low, because the distance between the answers and the average are low; but, if the responses are part of Very Important and part of Very Unimportant, $d_i(\bar{z}, \bar{n})_{ave}$ value would be high, because the distance between the answers and the average are high). In this sense, they

propose that the $d_i(\bar{z}, \bar{n})_{ave}$ must be lower or equal to 0,2 to have a great level of agreement, because the distance among the answers are low and, therefore, the consistency of responses are guaranteed. To be more robust, they propose another condition to find the agreement level, i.e., the consensus level. The consensus level has the aim of verifying the percentage of experts that have the $d_i(\bar{z}, \bar{n})$ lower or equal to 0,2, showing if the experts have an agreement in the responses and ensuring consistency in the validation process. That's why, they proposed that the consensus level must be higher or equal to 75% to have an agreed perspective.

In this sense, it is possible to infer that both methods are complementary: the first one ensuring the pertinence of the option and the second ensuring the consistency of the responses. Based on this, both methods were compared to have a more robust analysis of the results and agreement level definition process. This comparison is shown in the Chart 5.3. In this Chart 5.3, it is also presented the percentage of responses considering the four option (Very Unimportant, Unimportant, Important and Very Important), the total of percentage considering the answer Important and Very Important (because this represents that the option contributes or must make part of the framework) and the authors that proposes such option/approach/step of the framework (based on the two systematic literature reviews conducted).

It is possible to infer that 63,93% of the questions were agreed considering both approaches. Thus, the processes/approaches considered by these questions should be part of the DD&SOP framework.

The percentage of agreement considering both methods could be considered low, but it is necessary to analyze carefully the results. 22,96% of the questions were solely agreed by the approach of Habibi, Jahantigh and Sarafrazi (2015). This can be explained by the fact that the consistency of responses was not achieved because the responses were Important or Very Important. When looking at the column Total of Very Important and Important of Chart 5.3, it is perceived that for these questions the values vary from 71% to 100%, thus the experts considered these processes/approaches bring benefits or must be considered in the framework. Furthermore, special attention should be considered to 13,11% of the questions that were not agreed.

Chart 5.3 – Comparison and Analysis between the validation approaches

Questions	Description	Results Crisp Number (Z*)	Results $d_i(\bar{z}, \bar{n})_{ave}$ and % of Consensus	Very Unimportant	Unimportant	Important	Very Important	Total of Very Important and Important	Authors
Question 1	S&OP process should be strategically expanded	Agreed	Agreed	0%	6%	29%	65%	94%	Based on the authors that contributed with approaches to expand strategically the S&OP process.
Question 2	The Strategy Review process	Agreed	Agreed	6%	12%	29%	53%	82%	Burrows III (2012); Caulfield (2013); Cecere (2012); Cecere, Barrett and Mooraj (2009); Danese, Molinaro and romano (2018); Esper et al. (2010); Godsell, Birtwistle and Van Hoek (2010); Gollamudi (2013); Kaipia et al. (2017); Li, Shakya and Owusu (2018); Ptak and Smith (2018); Ralston et al. (2015); Rokonzuzaman, (2018); Swaim et al. (2016) and Wilson and Raman (2017)
Question 3	The Product Portfolio Management process	Agreed	Agreed	0%	0%	65%	35%	100%	Bower (2017); Cecere (2012); Cecere, Barrett and Mooraj (2009); Goh and Eldridge (2015); Gollamudi (2013); Kaipia et al. (2017); Ptak and Smith (2018); Smith, Andraski and Fawcett (2011) and Tarafdar and Qrunfleh (2017)
Question 4	The Supply Chain Intelligence Activities process	Agreed	Agreed	0%	0%	41%	59%	100%	Baumann (2011); Bozutti and Esposto (2019); Danese, Molinaro and Romano (2018); Esper et al. (2010); Goh and Eldridge (2015); Goswami, Engel and Kremer (2013); Jonsson and Holmström (2016); Kruse (2004); Lapide (2005a); Lapide (2005b); Mello (2015); Nakano (2009); Nielsen, Nielsen and Steger-Jensen (2010); Noroozi and Wikner (2017); Plank and Hooker (2014); Ralston et al. (2015); Rokonzuzaman (2018); Smith, Andraski and Fawcett (2011); Storbacka (2011); Tarafdar and Qrunfleh (2017); Thomé et al., (2012b); Tuomikangas and Kaipia (2014); Turner, Aitken and Bozarth (2018); Wagner, Ullrich and Transchel (2014) and Walters (2008)

Chart 5.3 – Comparison and Analysis between the validation approaches - *Continuation*

Questions	Description	Results Crisp Number (Z*)	Results $d_i(\bar{z}, \bar{n})_{ave}$ and % of Consensus	Very Unimportant	Unimportant	Important	Very Important	Total of Very Important and Important	Authors
Question 5	The Contingency Plans Elaboration process	Agreed	Agreed	0%	12%	47%	41%	88%	Bozutti and Esposto (2019); Burrows III (2007); Dreyer et al. (2018); Ivert et al. (2015b); Ivert and Jonsson (2014); Jonsson and Holmström (2016); Larsson and Fredriksson (2019); Nucamendi-Guillén, Moreno and Mendoza (2018); Ross (2004); Singh and Lee (2013); Swaim et al. (2016); Wagner, Ullrich and Transchel (2014) and Warren (2012)
Question 6	The Communicate the plans process	Agreed	Not Agreed	6%	6%	53%	35%	88%	Cecere (2012); Cecere, Barrett and Mooraj (2009); Jung and Chung (2016); Ptak and Smith (2018); Wallace (2012) and Wallace; Stahl (2008)
Question 7	The Financial Management process	Agreed	Not Agreed	0%	0%	24%	76%	100%	Bozutti and Esposto (2019); Cecere (2012); Cecere, Barrett and Mooraj (2009); Gollamudi (2013); Noroozi and Wikner (2017); Ptak and Smith (2018); Ralston et al. (2015); Sorensen (2013) and Wagner, Ullrich and Transchel (2014)
Question 8	The Financial Management process / performed in each step	Agreed	Not Agreed	6%	0%	59%	35%	94%	Cecere (2012); Cecere, Barrett and Mooraj (2009); Gollamudi (2013); Sorensen (2013); Wagner, Ullrich and Transchel (2014)
Question 9	Risk Management process	Agreed	Not Agreed	6%	0%	65%	29%	94%	Bozutti and Esposto (2019); Cecere (2012); Cecere, Barrett and Mooraj (2009); Gollamudi (2013); Ptak and Smith (2018); Schlegel and Murray (2010); Suurmond (2016); Wagner, Ullrich and Transchel (2014)
Question 10	Risk Management process / performed in each step	Not Agreed	Not Agreed	12%	12%	59%	18%	76%	Cecere (2012); Cecere, Barrett and Mooraj (2009); Gollamudi (2013); Suurmond (2016); Wagner, Ullrich and Transchel (2014)
Question 11	Performance Management process	Agreed	Agreed	0%	18%	35%	47%	82%	Kristensen and Jonsson (2018); Ross (2004); Tarafdar and Qrunfleh (2017); Thomé et al. (2012b); Thomé, Sousa and Scavarda (2014)

Chart 5.3 – Comparison and Analysis between the validation approaches - *Continuation*

Questions	Description	Results Crisp Number (Z*)	Results $d_i(\bar{z}, \bar{n})_{ave}$ and % of Consensus	Very Unimportant	Unimportant	Important	Very Important	Total of Very Important and Important	Authors
Question 12	Performance Management process / performed in each step	Not Validated	Not Validated	6%	24%	41%	29%	71%	Kristensen and Jonsson (2018); Ross (2004); Tarafdar and Qrunfleh (2017)
Question 13	Strategic S&OP team (in a matrix approach)	Agreed	Agreed	0%	6%	71%	24%	94%	APICS (2006); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Ptak and Smith (2018); Wallace (2012); Wallace and Stahl (2008)
Question 14	Financial Assessment team (in a matrix approach)	Agreed	Agreed	0%	0%	65%	35%	100%	APICS (2006); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Ptak and Smith (2018); Wallace (2012); Wallace and Stahl (2008)
Question 15	Risk Assessment team (in a matrix approach)	Not Agreed	Agreed	0%	18%	71%	12%	82%	APICS (2006); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Ptak and Smith (2018); Wallace (2012); Wallace and Stahl (2008)
Question 16	Cycle for the Strategic Perspective should be from 2 months to 6 months	Agreed	Not Agreed	0%	29%	35%	35%	71%	Burrows III (2012); Caulfield (2013); Cecere (2012); Cecere, Barrett and Mooraj (2009); Danese, Molinaro and romano (2018); Esper et al. (2010); Godsell, Birtwistle and Van Hoek (2010); Gollamudi (2013); Kaipia et al. (2017); Li, Shakya and Owusu (2018); Ptak and Smith (2018); Ralston et al. (2015); Rokonzaman, (2018); Swaim et al. (2016) and Wilson and Raman (2017)
Tactical Question 17	Portfolio Review process	Agreed	Agreed	0%	12%	35%	53%	88%	Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009) and Ptak and Smith (2018)

Chart 5.3 – Comparison and Analysis between the validation approaches - *Continuation*

Questions	Description	Results Crisp Number (Z*)	Results $d_i(\bar{z}, \bar{n})_{ave}$ and % of Consensus	Very Unimportant	Unimportant	Important	Very Important	Total of Very Important and Important	Authors
Question 18	Demand Planning process	Agreed	Agreed	0%	0%	12%	88%	100%	APICS (2006); Wallace (2012); Wallace and Stahl (2008)
Question 19	Demand Planning process - participation of strategic customers	Agreed	Agreed	0%	12%	35%	53%	88%	Danese, Molinaro and Romano, (2018); Goh and Eldridge (2015); Kruse (2004); Lapide (2005a); Lapide (2005b); Ralston et al. (2015) and Thomé et al. (2012b)
Question 20	Supply Planning process	Agreed	Agreed	0%	0%	6%	94%	100%	APICS (2006); Wallace (2012); Wallace and Stahl (2008)
Question 21	Supply Planning process - participation of strategic suppliers	Agreed	Agreed	0%	12%	47%	41%	88%	Danese, Molinaro and Romano, (2018); Goh and Eldridge (2015); Kruse (2004); Lapide (2005a); Lapide (2005b); Ralston et al. (2015) and Thomé et al. (2012b)
Question 22	Scenario Analysis process	Agreed	Agreed	0%	6%	18%	76%	94%	APICS (2006); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Ptak and Smith (2018); Wallace (2012); Wallace and Stahl (2008)
Question 23	Scenario Analysis process - utilization of simulation	Agreed	Agreed	0%	12%	12%	76%	88%	Burrows III (2007); Ivert and Jonsson (2010) and Ivert et al. (2015b)

Chart 5.3 – Comparison and Analysis between the validation approaches - *Continuation*

Questions	Description	Results Crisp Number (Z*)	Results $d_i(\bar{z}, \bar{n})_{ave}$ and % of Consensus	Very Unimportant	Unimportant	Important	Very Important	Total of Very Important and Important	Authors
Question 24	Scenario Analysis process - utilization of what-if analyses	Agreed	Agreed	0%	0%	12%	88%	100%	Dreyer et al. (2018); Ivert and Jonsson (2010); Ivert and Jonsson (2014); Jonsson and Holmström (2016a); Ross (2004); Singh and Lee (2013) and Swaim et al. (2016)
Question 25	Scenario Analysis process - utilization of mathematical algorithms	Agreed	Not Agreed	0%	24%	18%	59%	76%	Schlegel and Murray (2010)
Question 26	Consensus Meeting process	Agreed	Agreed	0%	6%	12%	82%	94%	APICS (2006); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Ptak and Smith (2018); Wallace (2012); Wallace and Stahl (2008)
Question 27	Communicate the plans process	Agreed	Agreed	0%	6%	12%	82%	94%	Cecere (2012); Cecere, Barrett and Mooraj (2009); Jung and Chung (2016); Ptak and Smith (2018); Wallace (2012) and Wallace; Stahl (2008)
Question 28	The Financial Management process	Agreed	Agreed	0%	0%	29%	71%	100%	Bozutti and Esposto (2019); Cecere (2012); Cecere, Barrett and Mooraj (2009); Gollamudi (2013); Noroozi and Wikner (2017); Ptak and Smith (2018); Ralston et al. (2015); Sorensen (2013); Wagner, Ullrich and Transchel (2014)
Question 29	The Financial Management process / performed in each step	Agreed	Not Agreed	0%	18%	41%	41%	82%	Cecere (2012); Cecere, Barrett and Mooraj (2009); Gollamudi (2013); Sorensen (2013); Wagner, Ullrich and Transchel (2014)

Chart 5.3 – Comparison and Analysis between the validation approaches - *Continuation*

Questions	Description	Results Crisp Number (Z*)	Results $d_i(\bar{z}, \bar{n})_{ave}$ and % of Consensus	Very Unimportant	Unimportant	Important	Very Important	Total of Very Important and Important	Authors
Question 30	Risk Management process	Agreed	Agreed	0%	0%	53%	47%	100%	Bozutti and Esposto (2019); Cecere (2012); Cecere, Barrett and Mooraj (2009); Gollamudi (2013); Ptak and Smith (2018); Schlegel and Murray (2010); Suurmond (2016); Wagner, Ullrich and Transchel (2014)
Question 31	Risk Management process / performed in each step	Agreed	Not Agreed	0%	24%	53%	24%	76%	Cecere (2012); Cecere, Barrett and Mooraj (2009); Gollamudi (2013); Suurmond (2016); Wagner, Ullrich and Transchel (2014)
Question 32	Performance Management process	Agreed	Agreed	0%	0%	29%	71%	100%	Kristensen and Jonsson (2018); Ross (2004); Tarafdar and Qrunfleh (2017); Thomé et al. (2012b); Thomé, Sousa and Scavarda (2014)
Question 33	Performance Management process / performed in each step	Agreed	Agreed	6%	6%	35%	53%	88%	Kristensen and Jonsson (2018); Ross (2004); Tarafdar and Qrunfleh (2017)
Question 34	Strategic S&OP team participation (in a matrix approach)	Agreed	Not Agreed	0%	29%	18%	53%	71%	APICS (2006); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Ptak and Smith (2018); Wallace (2012); Wallace and Stahl (2008)
Question 35	Sales and Marketing team participation (in a matrix approach)	Agreed	Agreed	0%	0%	18%	82%	100%	APICS (2006); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Ptak and Smith (2018); Wallace (2012); Wallace and Stahl (2008)

Chart 5.3 – Comparison and Analysis between the validation approaches - *Continuation*

Questions	Description	Results Crisp Number (Z*)	Results $d_i(\bar{z}, \bar{n})_{ave}$ and % of Consensus	Very Unimportant	Unimportant	Important	Very Important	Total of Very Important and Important	Authors
Question 36	Operations team participation (in a matrix approach)	Agreed	Agreed	0%	0%	12%	88%	100%	APICS (2006); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Ptak and Smith (2018); Wallace (2012); Wallace and Stahl (2008)
Question 37	Tactical S&OP team	Agreed	Not Agreed	0%	0%	24%	76%	100%	APICS (2006); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Ptak and Smith (2018); Wallace (2012); Wallace and Stahl (2008)
Question 38	Financial Assessment team	Agreed	Agreed	0%	0%	35%	65%	100%	APICS (2006); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Ptak and Smith (2018); Wallace (2012); Wallace and Stahl (2008)
Question 39	Risk Assessment team	Agreed	Agreed	0%	0%	53%	47%	100%	APICS (2006); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Ptak and Smith (2018); Wallace (2012); Wallace and Stahl (2008)
Question 40	Tactical Perspective should be monthly	Agreed	Agreed	0%	12%	12%	76%	88%	APICS (2006); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Ptak and Smith (2018); Wallace (2012); Wallace and Stahl (2008)
Operational	Question 41	Agreed	Agreed	0%	12%	24%	65%	88%	Based on the authors that contributed with approaches to expand operationally the S&OP process.

Chart 5.3 – Comparison and Analysis between the validation approaches - *Continuation*

Questions	Description	Results Crisp Number (Z*)	Results $d_i(\bar{z}, \bar{n})_{ave}$ and % of Consensus	Very Unimportant	Unimportant	Important	Very Important	Total of Very Important and Important	Authors
Question 42	Disaggregate the plans process	Agreed	Not Agreed	0%	24%	24%	53%	76%	Biazzin, Tomaselli and Costa Pena (2017); Bower (2017); Bower (2018); Burrows III (2007); Caulfield (2013); Chae and Olson (2013); Covas (2016); Dreyer et al. (2018); Goh and Eldridge (2015); Grillo (2014); Grimson and Pyke (2007); Ivert et al. (2015a); Ivert et al. (2015b); Ivert and Jonsson (2014); Jonsson, Rudberg and Holmberg (2013); Jung and Chung (2016); Keal and Hebert (2010); Kelleher (2012); Kristensen and Jonsson (2018); Lee (2013); Li, Shakya and Owusu (2018); Nakano (2009); Noroozi and Wikner (2017); Nucamendi-Guillén, Moreno and Mendoza (2018); Oliva and Watson (2011); Ptak and Smith (2018); Singh and Lee (2013); Suurmond (2016); Thomé et al. (2012b) and Thomé, Sousa and Carmo (2014)
Question 43	Disaggregate the plans process / differentiation of strategic and not strategic product families	Not Agreed	Not Agreed	0%	35%	35%	29%	65%	Thomé et al. (2012b)
Question 44	Check orders and priorities process	Agreed	Agreed	0%	6%	29%	65%	94%	APICS (2006); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Ptak and Smith (2018); Wallace (2012); Wallace and Stahl (2008)

Chart 5.3 – Comparison and Analysis between the validation approaches - *Continuation*

Questions	Description	Results Crisp Number (Z*)	Results $d_i(\bar{z}, \bar{n})_{ave}$ and % of Consensus	Very Unimportant	Unimportant	Important	Very Important	Total of Very Important and Important	Authors
Question 45	Receive data and information process	Agreed	Agreed	0%	0%	29%	71%	100%	Boone, Ganeshan and Hicks (2015); Burrows III (2007); Chae and Olson (2013); Chase (2013); Covas (2016); Dreyer et al. (2018); Esper et al. (2010); Godsell, Birtwistle and Van Hoek (2010); Goswami, Engel and Krcmar (2013); Grimson and Pyke (2007); Ivert et al. (2015b); Ivert and Jonsson (2010); Kaipia et al. (2017); Kelleher (2012); Kristensen and Jonsson (2018); Kruse (2004); Lapide (2005a); Li, Shakya and Owusu (2018); Nucamendi-Guillén, Moreno and Mendoza (2018); Rokonzaman (2018); Singh and Lee (2013); Suurmond (2016); Swaim et al. (2016); Tuomikangas and Kaipia (2014) and Wilson and Raman (2017)
Question 46	Receive data and information process - with real-time data	Agreed	Agreed	0%	6%	24%	71%	94%	Boone, Ganeshan and Hicks (2015); Budd, Knizek and Tevelson (2012); Chase (2013a); Covas (2016); Grimson and Pyke (2007); Ivert et al. (2015b); Julianelli (2015); Rokonzaman (2018); Rutherford (2017); Synchrono (2018)
Question 47	Receive data and information process - social media and internet data	Agreed	Not Agreed	0%	29%	41%	29%	71%	Boone, Ganeshan and Hicks (2015) and Plank and Hooker (2014)

Chart 5.3 – Comparison and Analysis between the validation approaches - *Continuation*

Questions	Description	Results Crisp Number (Z*)	Results $d_i(\bar{z}, \bar{n})_{ave}$ and % of Consensus	Very Unimportant	Unimportant	Important	Very Important	Total of Very Important and Important	Authors
Question 48	Event-driven meetings	Agreed	Agreed	0%	6%	29%	65%	94%	Danese, Molinaro and Romano (2018); Goh and Eldridge (2015); Grimson and Pyke (2007); Ivert et al. (2015a); Ivert et al. (2015b); Lapide (2005a); Lapide (2005b); Larsson and Fredriksson (2019); Wagner, Ullrich and Transchel (2014)
Question 49	Financial Control process	Agreed	Not Agreed	0%	18%	59%	24%	82%	Bozutti and Esposto (2019); Cecere (2012); Cecere, Barrett and Mooraj (2009); Gollamudi (2013); Noroozi and Wikner (2017); Ptak and Smith (2018); Ralston et al. (2015); Sorensen (2013); Wagner, Ullrich and Transchel (2014)
Question 50	Financial Control process / performed in each step	Not Agreed	Not Agreed	0%	65%	12%	24%	35%	Cecere (2012); Cecere, Barrett and Mooraj (2009); Gollamudi (2013); Sorensen (2013); Wagner, Ullrich and Transchel (2014)
Question 51	Risk Control process	Agreed	Agreed	0%	24%	47%	29%	76%	Bozutti and Esposto (2019); Cecere (2012); Cecere, Barrett and Mooraj (2009); Gollamudi (2013); Ptak and Smith (2018); Schlegel and Murray (2010); Suurmond (2016); Wagner, Ullrich and Transchel (2014)
Question 52	Risk Control process / performed in each step	Not Agreed	Not Agreed	0%	41%	35%	24%	59%	Cecere (2012); Cecere, Barrett and Mooraj (2009); Gollamudi (2013); Suurmond (2016); Wagner, Ullrich and Transchel (2014)
Question 53	Performance Management process	Agreed	Agreed	0%	0%	35%	65%	100%	Kristensen and Jonsson (2018); Ross (2004); Tarafdar and Qrunfleh (2017); Thomé et al. (2012b); Thomé, Sousa and Scavarda (2014)
Question 54	Performance Management process / performed in each step	Agreed	Agreed	0%	12%	35%	53%	88%	Kristensen and Jonsson (2018); Ross (2004); Tarafdar and Qrunfleh (2017)

Chart 5.3 – Comparison and Analysis between the validation approaches - *Continuation*

Questions	Description	Results Crisp Number (Z*)	Results $d_i(\bar{z}, \bar{n})_{ave}$ and % of Consensus	Very Unimportant	Unimportant	Important	Very Important	Total of Very Important and Important	Authors
Question 55	Order Fulfillment team	Agreed	Agreed	0%	0%	41%	59%	100%	APICS (2006); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Ptak and Smith (2018); Wallace (2012); Wallace and Stahl (2008)
Question 56	Sales and Marketing team	Agreed	Agreed	0%	12%	41%	47%	88%	APICS (2006); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Ptak and Smith (2018); Wallace (2012); Wallace and Stahl (2008)
Question 57	Operations team	Agreed	Not Agreed	0%	0%	24%	76%	100%	APICS (2006); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Ptak and Smith (2018); Wallace (2012); Wallace and Stahl (2008)
Question 58	Financial Management team	Not Agreed	Not Agreed	0%	24%	65%	12%	76%	Bozutti and Esposto (2019); Cecere (2012); Cecere, Barrett and Mooraj (2009); Gollamudi (2013); Noroozi and Wikner (2017); Ptak and Smith (2018); Ralston et al. (2015); Sorensen (2013); Wagner, Ullrich and Transchel (2014)
Question 59	Risk Management team	Not Agreed	Not Agreed	0%	41%	47%	12%	59%	Bozutti and Esposto (2019); Cecere (2012); Cecere, Barrett and Mooraj (2009); Gollamudi (2013); Ptak and Smith (2018); Schlegel and Murray (2010); Suurmond (2016); Wagner, Ullrich and Transchel (2014)

Chart 5.3 – Comparison and Analysis between the validation approaches - *Continuation*

Questions	Description	Results Crisp Number (Z*)	Results $d_i(\bar{z}, \bar{n})_{ave}$ and % of Consensus	Very Unimportant	Unimportant	Important	Very Important	Total of Very Important and Important	Authors
Question 60	Cycle for the Operational Perspective should be daily or weekly	Agreed	Agreed	0%	0%	18%	82%	100%	Biazzin, Tomaselli and Costa Pena (2017); Bower (2017); Bower (2018); Burrows III (2007); Caulfield (2013); Chae and Olson (2013); Covas (2016); Dreyer et al. (2018); Goh and Eldridge (2015); Grillo (2014); Grimson and Pyke (2007); Ivert et al. (2015a); Ivert et al. (2015b); Ivert and Jonsson (2014); Jonsson, Rudberg and Holmberg (2013); Jung and Chung (2016); Keal and Hebert (2010); Kelleher (2012); Kristensen and Jonsson (2018); Lee (2013); Li, Shakya and Owusu (2018); Nakano (2009); Noroozi and Wikner (2017); Nucamendi-Guillén, Moreno and Mendoza (2018); Oliva and Watson (2011); Ptak and Smith (2018); Singh and Lee (2013); Suurmond (2016); Thomé et al. (2012b) and Thomé, Sousa and Carmo (2014
Governance Question 61	Process governance	Agreed	Agreed	0%	6%	6%	88%	94%	Based on the references considered in the S&OP Systematic Literature Review

Source: Prepared by the author

In the **strategic perspective**, the Risk Management process being performed in each step and Performance Management process being performed in each step were not agreed by both approaches. This happened because there was a great number of responses considering Very Unimportant and Unimportant and high distribution of responses among the four questionnaire options. By the comments received from the experts, they argued that if these processes be performed in each step, can cause slowness in the decision-making process. Also in the strategic perspective the Risk Assessment team (in a matrix approach) was not agreed by the approach of Habibi, Jahantigh and Sarafrazi (2015), thus the pertinency of this approach must be more investigated.

In the **operational perspective**, Disaggregate the plans process with differentiation of strategic and not strategic product families, Financial Control process being performed in each step, Risk Control process being performed in each step, Financial Management team and Risk Management team were not agreed. The reason was the same for the processes not agreed in the strategic perspective, i.e., because there was a great number of responses considering Very Unimportant and Unimportant and high distribution of responses among the four questionnaire options. By the comments received from the experts, the differentiation between strategic and not strategic product families during the disaggregation process, could bring complexity for the management and, thus, loss of agility in the operational perspective (the operational perspective must have agility and velocity). For the case of Financial Control process being performed in each step and Risk Control process being performed in each step, the explanation is the same for the strategic perspective, i.e., can cause slowness in the decision-making process. For the case of the Financial and Risk Management teams participation in the operational perspective, they argued that these teams should be in a tactical and strategical perspective because of the characteristics of their activities, thus it is not necessary to be part of the operational perspective, once it deals with daily or weekly activities.

With the aim of summarizing the agreement level analysis, three levels were defined: (i) high agreement level, (ii) medium agreement level and (iii) low agreement level. Processes/approaches within the group of high agreement level must be agreed by both approaches, i.e, Habibi, Jahantigh and Sarafrazi (2015) approach and Manakandan et al. (2017) and Yu-Feng and Hsiao-Lin (2008) approach. Processes/approaches within the group of medium agreement level were solely agreed by Habibi, Jahantigh and Sarafrazi (2015) approach (because most of the answers were Important or Very Important). Finally, processes/approaches within the group of low agreement level were not agreed by both Habibi,

Jahantigh and Sarafrazi (2015) approach and Manakandan et al. (2017) and Yu-Feng and Hsiao-Lin (2008) approach or not agreed by the Habibi, Jahantigh and Sarafrazi (2015) approach (because most of the answers were Unimportant or Very Unimportant).

Table 5.5 summarizes the number of processes/approaches and its percentage considering the total of processes, considering each group of agreement level.

Table 5.5 – Process and approaches agreement level

Level of Agreement	Number of processes/approaches	Percentage of processes/approaches
High	39	63,93%
Medium	14	22,96%
Low	8	13,11%
Total	61	100,00%

Source: Prepared by the author

It is possible to infer from Table 5.5 that most of the processes/approaches proposed in the framework had a great level of agreement (summing high and medium is obtained 86,69% of agreement level). Based on this, it is possible to conclude that the proposed framework is consistent, because it was validated theoretically (considering both systematic literature reviews conducted) and is adherent with the experts, considering the great agreement level.

To be more specific, Table 5.6 shows the agreement level divided by each perspective of the proposed framework.

Table 5.6 – Process and approaches agreement level by each perspective

Perspective	Level of Agreement	Number of processes/approaches	Percentage of processes/approaches into the perspective	Percentage of processes/approaches in the whole framework
Strategic	High	8	50,00%	13,11%
	Medium	5	31,25%	8,20%
	Low	3	18,75%	4,92%
	SubTotal	16	100,00%	26,23%
Tactical	High	19	79,17%	31,15%
	Medium	5	20,83%	8,20%
	Low	0	0,00%	0,00%
	SubTotal	24	100,00%	39,34%
Operational	High	11	55,00%	18,03%
	Medium	4	20,00%	6,56%
	Low	5	25,00%	8,20%
	SubTotal	20	100,00%	32,79%
Governance	High	1	100,00%	1,64%
	Medium	0	0,00%	0,00%
	Low	0	0,00%	0,00%
	SubTotal	1	100,00%	1,64%

Source: Prepared by the author

From Table 5.6 it is possible to infer that all processes/approaches in the tactical perspective reached a great level of agreement. This was expected, because these processes/approaches do not differ from the traditional approach for the S&OP, thus the experts were comfortable to validated them. Governance is also expected for all types of processes, that's why, it was also fully agreed. The strategical perspective had a percentage of non-agreement (low agreement level) smaller than the operational perspective. This was also expected, because in the traditional S&OP process some strategical data are used in the process, thus it was easier to validate this perspective. Although the operational perspective had the major number of non-agreements, the necessity of agility and velocity, the necessity of receive real-time data and the necessity of event-driven meetings were agreed, thus the perspective can be also considered validated.

Finally, Chart 5.3 presents in the last Column the authors whose were used as basis for the processes/approach's proposal. These authors were considered based on the two systematic literature reviews conducted, guaranteeing the academic rigor combined with the practical validation.

CHAPTER 6

CONCLUSIONS

Companies are facing a new environment of competitiveness and the core of the new competition and market environment, that can be named Demand-Driven (DD), is the customer. Focus on the customer will be the priority. To do so, many challenges will be met by companies in order to be successful and to survive in the market. Many of these challenges are concerned with the supply chain and operations practices; companies need to define and standardize processes to promote integration, collaboration, visibility, agility, flexibility and cost-savings among internal and external stakeholders. The use of technologies is also important to create visibility and knowledge about customers, operations and evolved partners; in this sense, Industry 4.0 concepts are adherent with this necessity. Traditional approaches, for instance, Lean Production, Theory of Constraints, Six Sigma and 4PL, can be used to support and combine to obtain better results.

The Sales and Operations Planning Process (S&OP), which helps companies to match demand and supply requirements, is a process that should be modified in order to meet with these new requirements. It was perceived that, to face the new turbulent, complex and volatile business environment, the traditional S&OP process needs the adoption of new practices, process, technologies and approaches.

To contribute with these new necessities, this thesis proposed a framework for the Demand-Driven Sales and Operations Planning (DDS&OP). The first contribution, and originality of the framework, was to expand the traditional S&OP beyond the limits of the tactical planning. The traditional S&OP, being solely in the tactical planning, faces difficulties to perform its activities, because, due to the current complexity in the competitive environment, the communication among the strategic, tactical and operational decisions needs to be clear and effective. A process dedicated to one perspective does not receive effectively the decisions from other perspectives, becoming a barrier to agility, velocity, responsiveness, flexibility and visibility and, of course, to the implementation and execution of the process itself. To cover this necessity, the proposed DDS&OP framework became more strategical and more operational.

In this sense, the DDS&OP, being more strategic, can receive information and decisions from the strategic side and translate them in a smother way to the tactical decisions

(because of that the first process in the strategic perspective is Strategy Review). With this smother translation of decisions, there is less noise and less mistakes, therefore less rework. With less rework, agility, velocity, responsiveness and flexibility in decisions are improved, being more adherent to the needs of the DD phenomenon. The same logic can be expanded to the operational side, in which more agility is required, thus, the DDS&OP being more operational aids to achieve such objective.

It is fundamental to understand and to respond effectively to customers' needs in the DD phenomenon. The bridge between the company and customer is the product (or service), thus through the product being offered in accordance with customers' need (time, quantity, quality and price), the perception of the company is set up. Based on this necessity, and on the importance of the product (or service) to the market, the second process in the strategic perspective and the first process in the tactical perspective is related to the product portfolio. Being aware and managing the products and services offered to the market make the companies able to improve their visibility of the real needs, so the companies will be more flexible and responsive to the market.

In order to improve agility, velocity, responsiveness and flexibility in case of issues, the operational perspective was proposed in the framework. This perspective has a short-term characteristic and it is responsible to guard daily activities in order to certify if the tactical decisions are being executed in the operational side. Considering the process of receiving data and information (including, if possible, real-time information and POS data), visibility is guaranteed and considering the event-driven meetings, flexibility, agility and velocity is guaranteed in the case of some problem during the order fulfillment process.

Based on the volatility present in the DD phenomenon, it is important to the companies having tools and approaches to face this new challenge. Considering this necessity, the proposed framework considered performance management, to guarantee visibility (but, it is important to define the right metrics and KPI's), and risk management to guarantee flexibility and responsiveness in the case of changes or problems.

Not less important and considering the necessity of a company to be profitable, it was proposed in the framework the process of Financial Management. This process needs to be executed in all perspective to guarantee cost-efficiency and, consequently, profitability.

It is important to have adherence and sustainability when implementing a new process. People responsible to execute the foreseen steps in a process need to understand and clearly see the value of changing, i.e., by executing the new activities their job will have better results. To achieve the objective of value perception from users, it is essential the process which is being

implemented be adherent to the companies' need. That's why, one reason of failure in the implementation of the traditional S&OP process is because this process does not respond effectively to the current needs of the market (because the traditional S&OP process, as current known, was established in the 1980's). Considering this, the chance of a successful implementation and perpetuation of the proposed DDS&OP framework is higher, because this framework was designed to respond effectively to the necessity of visibility, agility, velocity, responsiveness, flexibility and cost-efficiency, as prior described.

The proposed DDS&OP framework is not the unique available and designed, however, because of the two consistent and robust systematic literature reviews conducted, it covers gaps not explored by the prior models. Chart 6.1 summarizes this gaps coverage, presenting the considered approaches in each DDS&OP framework. Such approaches, taken in consideration to compare, were obtained from the two extensive conducted systematic literature reviews and detailed in Chart 4.3.

Chart 6.1 – Comparison among the DDS&OP frameworks

Necessary Approaches for DD phenomenon	Proposed DDS&OP Framework	Cecere, Barrett and Mooraj (2009) Framework	Burrows (2012) framework	Ptak and Smith (2018)
Strategy Review and Linkage	✓		✓	✓
Product Portfolio Management	✓			✓
Supply Chain Intelligence Activities	✓		✓	✓
Contingency Plans Elaboration	✓	✓	✓	✓
Financial Management	✓		✓	✓
Risk Management	✓		✓	✓
Performance Management	✓	✓	✓	✓
Short planning cycles / SKU-planning level	✓			✓
Timely data reception	✓			
Event-driven meetings	✓			

Source: Prepared by the author

It is important to cite that the proposed DDS&OP framework is robust, besides the gaps' coverage of prior DDS&OP frameworks, as shown in Chart 6.1. Such robustness is validated by the two systematic literature reviews conducted. Thus, based on the literature review, the framework is theoretically validated.

With the aim to check the practical side of the framework, it was conducted a valuation with the experts. The valuation considered a great variety of experts and it was used a robust method, called Fuzzy-Delphi Method. 63,94% of the processes/approaches had a high level of agreement, 22,96% of the processes/approaches had a medium level of agreement and 13,11% of the approaches had a low level of agreement. Considering these results, it is possible to infer that the framework has its value for the practical side and can be implemented in companies.

Considering the process/approaches with a high level of agreement, it is proposed to continue researches in lower levels of the framework, presented in the BPMN (Chapter 4). This can be proposed, because the macro processes/approaches were validated by theory and agreed among the experts, thus details can be explored.

Considering the process/approaches with a medium level of agreement, it is proposed to conduct a carefully analyses of them. The importance of these processes/approaches are guaranteed, because they were validated by theory and the experts considered them Important or Very Important. The medium level of agreement was obtained because there was a divergence of responses between Important and Very Important.

Finally, considering the process/approaches with a low level of agreement, it is proposed to verify the pertinence of such processes/approaches in the framework. Although these processes/approaches were validated by theory, experts did not agree that they could bring value in practice.

Finally, it can be concluded that the framework can be implemented in companies and could aid them to achieve better results in respond effectively to the market, by matching accordingly the demand and supply. There is no limitation related to the type of industry to implement, i.e., all companies currently are inserted in the DD phenomenon, thus they can obtain benefits from this framework.

The following item are concerned to conclude the research (as a scientific method). Thus, this thesis has considered four research questions:

- ✓ **RQ1:** What are the main characteristics (definition, processes, technologies and systems and approaches) of the DD phenomenon?
- ✓ **RQ2:** How can the concepts of the DD phenomenon be organized in a conceptual framework?
- ✓ **RQ3:** What are the characteristics, approaches, frameworks and models for the Sales and Operations Planning considering the new business environment requirements of flexibility, responsivity, adaptability, visibility, velocity, agility, demand variability, demand variety and customer centricity?

- ✓ **RQ4:** How can the concepts of the DD phenomenon and new characteristics and requirements for the S&OP be organized in a DDS&OP framework?

And the objective of this thesis was **to propose a framework for the Demand-Driven Sales and Operations Planning**.

The research can be considered successfully, because all research questions were answered and the objective was achieved. The RQ1 and RQ2 were answered in Chapter 2 of this thesis, based on the conducted systematic literature review for the DD phenomenon. The RQ3 was answered in Chapter 3 of this thesis, based on the conducted systematic literature review for the S&OP. Finally, RQ4 was answered in Chapter 4 (with the framework proposal and its modelation in BPMN) and in Chapter 5 (with its agreement with experts, through the Fuzzy-Delphi method).

The main limitations of this research were:

- ✓ Books were not considered in the systematic literature review for the DD phenomenon because of their costs and time to obtain them;
- ✓ The focus of the systematic literature review for the DD phenomenon was on processes and technologies;
- ✓ The systematic literature review for the S&OP did not consider papers with the quantitative approach;
- ✓ The proposed framework was focused on the processes, thus metrics, KPI's, organizational issues and technology were not deeply explored;
- ✓ The validation process considered solely the macro processes of the proposed framework for the S&OP and not all processes modelled in BPMN;
- ✓ Notwithstanding the number of participants for the Fuzzy-Delphi Method is in accordance with the methodology, it was a limited number (17);
- ✓ Notwithstanding it was covered both academics and practitioners (and practitioners from different industries), it could be more diversified; and
- ✓ It was used on type of Fuzzy Number (triangular), other types also exist and can be explored.

Based on the research and its limitations, it is possible to provide a list of future research:

- ✓ Conduct systematic literature reviews for DD phenomenon considering the dimensions not explored;

- ✓ Conduct systematic literature reviews for S&OP including papers with quantitative approach;
- ✓ Develop frameworks and approaches for metrics, KPI's, organizational issues and technologies for the DDS&OP;
- ✓ Find the agreement level for each considered process modeled in BPMN for the DDS&OP;
- ✓ Conduct case researches about the theme, with the aim of deeply understanding its application in the companies;
- ✓ Broaden the spectrum of industries and researchers that was considered in this research, with the aim obtaining complementary results;
- ✓ Broaden the number of participants in a Fuzzy-Delphi method, with the aim of obtaining complementary results;
- ✓ Use other types of Fuzzy Numbers, with the aim of obtaining complementary results;
- ✓ Conduct surveys to obtain new insights about the theme.

Finally, the main contributions of this thesis were:

- ✓ A broad and consistent characterization of the DD phenomenon;
- ✓ A definition for the DD phenomenon;
- ✓ An organizing conceptual framework for the DD phenomenon;
- ✓ A list of 20 identified approaches that contribute to S&OP improvement, with the aim of facing the new market requirements;
- ✓ The necessity of S&OP vertical and horizontal consistencies expansion;
- ✓ Identification of how each approach (based on the 20 found) contributes to vertical and/or horizontal expansion;
- ✓ A framework for the DDS&OP based on a robust systematic literature review and a robust agreement process (Fuzzy-Delphi method) with experts.

REFERENCES

- AKKERMANS, H.; BOGERD, P.; VOS, B. Virtuous and vicious cycles on the road towards international supply chain management. **International Journal of Operations & Production Management**, v. 19, n. 5/6, p. 565–582, maio 1999.
- AMBE, I. M.; BADENHORST-WEISS, J. A. An automotive supply chain model for a demand-driven environment. **Journal of Transport and Supply Chain Management**, v. 1, n. 1, p. 1–22, 2011.
- ANAND, M. C. J.; BHARATRAJ, J. **Theory of Triangular Fuzzy Number**. Proceedings of NCATM. **Anais...**2017
- APICS. **Master Planning of Resources**. 3th. ed. Virginia: APICS, 2006.
- APICS. **APICS Dictionary**. 15th. ed. Chicago: APICS, 2016.
- APICS. **Supply Chain Improvement and Best Practices**. 4.1 ed. [s.l.] APICS, 2017.
- APICS / ASCM. **Supply Chain Operations Reference Model - Version 12.0**. 12nd. ed. Chicago: APICS / Association for Supply Chain Management (ASCM), 2017.
- ASARE, A. K.; BRASHEAR-ALEJANDRO, T. G.; KANG, J. B2B technology adoption in customer driven supply chains. **Journal of Business and Industrial Marketing**, v. 31, n. 1, p. 1–12, 2016.
- AYERS, J. Demand-driven supply chain implementation. **Chemical Engineering Progress**, v. 102, n. 12, p. 21–23, 2006.
- AZEVEDO, S. G. et al. Ecosilient Index to assess the greenness and resilience of the upstream automotive supply chain. **Journal of Cleaner Production**, v. 56, p. 131–146, out. 2013.
- BANAEIAN, N. et al. Green Supplier Selection in Edible oil Production by a Hybrid Model Using Delphi Method and Green Data Envelopment Analysis (GDEA). **Management and Production Engineering Review**, v. 5, n. 4, p. 3–8, 10 dez. 2014.
- BARRATT, M.; CHOI, T. Y.; LI, M. Qualitative case studies in operations management: Trends, research outcomes, and future research implications. **Journal of Operations Management**, v. 29, n. 4, p. 329–342, maio 2011.
- BASAEZ, M. O. et al. The Role of CRM-SRM Bolt-ons in Enterprise Resource Planning System: Toward a Customer-Oriented Supply Chain. **Strategic Change: Briefings in Entrepreneurial Finance**, v. 23, p. 389–400, 2014.
- BAUMANN, F. The Shelf-Connected Supply Chain: Strategically Linking CPFR with S&OP at the Executive Level. **Journal of Business Forecasting**, v. 29, n. 4, p. 21–28, 2011.
- BAUMBUSCH, A.; CLOTHIER, R.; NOTARANGELI, M. **Five Key Factors to Creating a Demand-Driven Supply Chain**. Disponível em: <<http://www.maineptointe.com/practical-insights/five-key-factors-to-creating-a-demand-driven-supply-chain>>. Acesso em: 4 mar.

2019.

BELLMAN, E. A Decision-Making in a fuzzy environment. **Management Science**, v. 17, n. 4, p. 141–165, 1970.

BERTO, R. M. V. S.; NAKANO, D. N. A produção científica nos anais do Encontro Nacional de Engenharia de Produção: um levantamento de métodos e tipos de pesquisa. **Produção**, v. 9, n. 2, p. 65–76, 2000.

BIAZZIN, C.; TOMASELLI, F. C.; COSTA PENA, A. M. DA. Gestão de Projetos e a Ferramenta Sales and Operations Planning (S&OP): Projeto de Implementação em um Ambiente de Baixa Previsibilidade. **Revista Inovação, Projetos e Tecnologias**, v. 5, n. 2, p. 176–192, 1 dez. 2017.

BIGBANG ERP. **Demand Driven Technologies**. Disponível em: <https://www.bigbangerp.com/cloud-solutions/extenders/demanddriventechologies>. Acesso em: 4 mar. 2019.

BIGLIARDI, B.; BOTTANI, E. Performance measurement in the food supply chain: a balanced scorecard approach. **Facilities**, v. 28, n. 5/6, p. 249–260, 6 abr. 2010.

BJARTNES, R. et al. **Intelligent and demand driven manufacturing network control concepts**. Third World Conference on Production and Operations Management. **Anais...2008**

BOKRANTZ, J. et al. Maintenance in digitalised manufacturing: Delphi-based scenarios for 2030. **International Journal of Production Economics**, v. 191, p. 154–169, set. 2017.

BOONE, T.; GANESHAN, R.; HICKS, R. L. Incorporating Google trends data into sales forecasting. **The International Journal of Applied Forecasting**, v. Summer, n. 38, p. 9–14, 2015.

BOWER, P. The S&OP Elevator Pitch. **APICS Magazine**, v. 25, n. July/August, 2015a.

BOWER, P. Party Crasher? **APICS Magazine**, v. 25, n. September/October, 2015b.

BOWER, P. Planning to Plan. **APICS Magazine**, v. 26, n. September/October, 2016.

BOWER, P. Consumer Goods, Direct-to-Consumer and S&OP - A Doomed Marriage? **Journal of Business Forecasting**, v. 35, n. 4, p. 16–29, 2017.

BOWER, P. S&OP, Demand Control, and Quick Response Forecasting. **Journal of Business Forecasting**, v. 37, n. 2, p. 10–13, 2018.

BOZUTTI, D. F.; ESPOSTO, K. F. Sales and Operations Planning: a comparison between the demand-driven and traditional approaches. **International Journal of Production Management and Engineering**, v. 7, n. 1, p. 23, 31 jan. 2019.

BRAUN, V.; CLARKE, V. Using thematic analysis in psychology. **Qualitative Research in Psychology**, v. 3, n. 2, p. 77–101, jan. 2006.

BROWN, T. **Creating demand-driven supply chains with lean concepts & tools**. 62nd IIE Annual Conference and Expo 2012. **Anais...Orlando: 2012** Disponível em:

<<http://www.scopus.com/inward/record.url?eid=2-s2.0-84900346053&partnerID=40&md5=1783acac76166e894b116472468fc7ae>>

BUDD, J.; KNIZEK, C.; TEVELSON, B. **The Demand-Driven Supply Chain; Making It Work and Delivering Results**BCG perspectives. [s.l: s.n.].

BURNON, P. **Accenture offers up take on e-commerce supply chain challenges.**

Disponível em:

<https://www.logisticsmgmt.com/article/accenture_offers_up_take_on_e_commerce_supply_chain_challenges>. Acesso em: 4 mar. 2019.

BURROWS III, R. P. Demand Driven S&OP: A Sharp departure from the traditional ERP approach. **Journal of Business Forecasting**, v. 26, n. 3, p. 4,6-7,9-10,12-13, 2007.

BURROWS III, R. P. **The Market-Driven Supply Chain: a revolutionary model for sales and operations planning in the new on-demand economy.** New York: AMACOM - American Management Association, 2012.

BUSTAMANETE, A. N. The new adaptive enterprise: rethinking the way for not being precisely wrong. **Demand Driven Institute**, p. 1–5, 2017.

BVUCHETE, M.; GROBBELAAR, S. S.; VAN EEDEN, J. **A case of healthcare supply chain visibility in South Africa.** 2018 3rd Biennial South African Biomedical Engineering Conference, SAIBMEC 2018. **Anais...**Stellenbosch: IEEE, 2018

CAILLET, T.; XIONG, J. Y.; GORKEN, M. A holistic and transformative approach: demand-driven planning. **Ernst & Young**, 2017.

CAMELOT. **Your Journey to the World of Demand-Driven Adaptive Enterprises.**

Disponível em: <<https://www.camelot-mc.com/ae/your-journey-to-the-demand-driven-world/>>. Acesso em: 4 mar. 2019.

CAO, B. BIN; XIAO, Z. D.; SUN, J. N. A study of the bullwhip effect in supply- and demand-driven supply chain. **Journal of Industrial and Production Engineering**, v. 34, n. 2, p. 124–134, 2017.

CAPGEMINI. **Demand-Driven Supply Chain.** Disponível em:

<<https://www.capgemini.com/fr-fr/ressources/demand-driven-supply-chain>>. Acesso em: 4 mar. 2019.

CASSIVI, L. et al. The Impact of E-collaboration on Firms' Performance. **The International Journal of Logistics Management**, v. 15, n. 1, p. 91–112, 2004.

CAULFIELD, J. Blood Supply Management: Experience and recommendations from Australia. **ISBT Science Series**, v. 8, n. 1, p. 41–45, jun. 2013.

CECERE, L. Market-driven S&OP. **Supply Chain Insights LLC**, v. 1, n. July, p. 1–20, 2012.

CECERE, L.; BARRETT, J.; MOORAJ, H. Sales and Operations Planning: Transformation From Tradition. **Industry Value Chain Strategies**, n. May, p. 1–10, 2009.

- CEGIELSKI, C. G. et al. Adoption of cloud computing technologies in supply chains. **The International Journal of Logistics Management**, v. 23, n. 2, p. 184–211, 10 ago. 2012.
- CHAE, B. (KEVIN); OLSON, D. L. Business analytics for supply chain: a dynamic-capabilities framework. **International Journal of Information Technology & Decision Making**, v. 12, n. 01, p. 9–26, jan. 2013.
- CHAN, F. T. S.; CHUNG, S. H. A multi-criterion genetic algorithm for order distribution in a demand driven supply chain. **International Journal of Computer Integrated Manufacturing**, v. 17, n. 4, p. 339–351, 2004.
- CHASE, C. W. Putting “M”arketing back in S&OP. **Journal of Business Forecasting**, v. 32, n. 1, p. 4–7, 9-14, 2013a.
- CHASE, C. W. **Demand-Driven Forecasting: A structured approach to forecasting**. 2nd. ed. Hoboken, New Jersey: John Wiley & Sons, Inc., 2013b.
- CHATZOPOULOS, C. et al. **Demand-Driven Supply Chain using Lean & Agile Principles: A Culture for Business Excellence**. Proceedings of International Conference for Entrepreneurship, Innovation and Regional Development. **Anais...**2012
- CHEN, M.-K.; WANG, S.-C. The use of a hybrid fuzzy-Delphi-AHP approach to develop global business intelligence for information service firms. **Expert Systems with Applications**, v. 37, n. 11, p. 7394–7407, nov. 2010.
- CHEN, Y.-J. Structured methodology for supplier selection and evaluation in a supply chain. **Information Sciences**, v. 181, n. 9, p. 1651–1670, maio 2011.
- CHINOSI, M.; TROMBETTA, A. BPMN: An introduction to the standard. **Computer Standards & Interfaces**, v. 34, n. 1, p. 124–134, jan. 2012.
- CID YÁÑEZ, F. et al. Agent-based simulation and analysis of demand-driven production strategies in the timber industry. **International Journal of Production Research**, v. 47, n. 22, p. 6295–6319, 2009.
- CLOW, M. **Accenture – 10 Years After: How Close Are We to True Demand-Driven Supply Chains**. Disponível em: <<https://blog.kinaxis.com/2015/03/accenture-10-years-after-how-close-are-we-to-true-demand-driven-supply-chains-supplychainbrain-kinaxis-video-series/>>. Acesso em: 19 fev. 2019.
- COOPER, H. **Research synthesis and meta-analysis: a step-by-step approach**. 4th. ed. Thousand Oaks, CA, USA: Sage Publications Inc., 2010.
- CORRÊA, H. L.; CORRÊA, C. A. **Administração de Produção e Operações - Manufatura e Serviços: uma abordagem estratégica**. 4th. ed. São Paulo: Atlas, 2017.
- CORRÊA, H. L.; GIANESI, I. G. N.; CAON, M. **Planejamento, programação e controle da produção: MRP II/ERP : conceitos, uso e implantação**. 5a. ed. São Paulo: Atlas, 2007.
- COVAS, M. Five Trends That Will Impact S&OP Over the Next 10 Years. **Journal of Business Forecasting**, v. 35, n. 3, p. 4–7, 2016.

DANESE, P.; MOLINARO, M.; ROMANO, P. Managing evolutionary paths in Sales and Operations Planning: key dimensions and sequences of implementation. **International Journal of Production Research**, v. 56, n. 5, p. 2036–2053, 4 mar. 2018.

DANTAS, R. P. **Demand-Driven MRP – Part I: Introduction**. Disponível em: <<https://blogs.sap.com/2016/06/20/demand-driven-mrp-part-i-introduction/comment-page-1/#comment-73411>>. Acesso em: 1 mar. 2019a.

DANTAS, R. P. **Demand-Driven MRP – Part II: Why is DDMRP needed?**

DANTAS, R. P. **Demand-Driven MRP – Part III- Strategic Inventory Positioning**. Disponível em: <<https://blogs.sap.com/2016/08/22/demand-driven-mrp-part-iii-strategic-inventory-positioning/>>. Acesso em: 1 mar. 2019c.

DANTAS, R. P. **Demand-Driven MRP – Part IV: Buffers**. Disponível em: <<https://blogs.sap.com/2016/08/31/demand-driven-mrp-part-iv-buffers/>>. Acesso em: 1 mar. 2019d.

DANTAS, R. P. **Demand-Driven MRP – Part V- Buffer Adjustments**. Disponível em: <<https://blogs.sap.com/2016/09/12/demand-driven-mrp-part-v-buffer-adjustments/>>. Acesso em: 1 mar. 2019e.

DANTAS, R. P. **Demand-Driven MRP – Part VI- Planning**. Disponível em: <<https://blogs.sap.com/2017/01/16/demand-driven-mrp-part-vi-planning/>>. Acesso em: 1 mar. 2019.

DAVIES, B. **How to Integrate Demand-driven Planning with Maintenance**. Disponível em: <<https://www.reliableplant.com/Read/30973/demand-driven-planning>>. Acesso em: 4 mar. 2018a.

DAVIES, J. **Creating competitive advantage with demand-driven MRP**. Disponível em: <<http://www.winman.com/blog/creating-competitive-advantage-with-demand-driven-mrp>>. Acesso em: 3 abr. 2019b.

DAVIS, J. et al. Smart manufacturing, manufacturing intelligence and demand-dynamic performance. **Computers and Chemical Engineering**, v. 47, p. 145–156, 2012.

DAVIS, R. A. **Demand-Driven Inventory Optimization and Replenishment: Creating a More Efficient Supply Chain**. 2nd. ed. Hoboken, New Jersey: John Wiley & Sons, Inc., 2015.

DEMAND DRIVEN INSTITUTE. **DDMRP Compliant ERP Systems**. Disponível em: <<https://www.demanddriveninstitute.com/ddmrp-compliant-software>>. Acesso em: 7 mar. 2019a.

DEMAND DRIVEN INSTITUTE. **DDMRP Compliant Add-On Applications**. Disponível em: <<https://www.demanddriveninstitute.com/ddmrp-compliant-software>>. Acesso em: 7 mar. 2019b.

DENYER, D.; TRANFIELD, D. Producing a Systematic Review. In: BUCHANAN, D. A.; BRYMAN, A. (Eds.). **The SAGE Handbook of Organizational Research Methods**.

Thousand Oaks, CA: Sage Publications Inc., 2009. p. 671–689.

DEY, M. M.; ALAM, M. F.; BOSE, M. L. Demand for aquaculture development: Perspectives from Bangladesh for improved planning. **Reviews in Aquaculture**, v. 2, n. 1, p. 16–32, 2010.

DREYER, H. C. et al. **Real-time Supply Chain Planning and Control – A Case Study from the Norwegian Food Industry**. Innovations in Networks - Proceedings of the APMS 2008. **Anais...Espoo**: 2008

DREYER, H. C. et al. Principles for real-time, integrated supply chain control: An example from distribution of pharmaceuticals. **IFIP Advances in Information and Communication Technology**, v. 338 AICT, p. 187–194, 2010.

DREYER, H. C. et al. Proposals for enhancing tactical planning in grocery retailing with S&OP. **International Journal of Physical Distribution & Logistics Management**, v. 48, n. 2, p. 114–138, 5 mar. 2018.

DWEEKAT, A. J.; HWANG, G.; PARK, J. A supply chain performance measurement approach using the internet of things. **Industrial Management & Data Systems**, v. 117, n. 2, p. 267–286, 2017.

DYNASYS. **DynaSys Announces Demand Driven Material Requirements Planning (DDMRP) Certification**. Disponível em: <<https://www.dys.com/dynasys-announces-demand-driven-material-requirements-planning-ddmrp-certification>>. Acesso em: 4 mar. 2019.

EAGLE, S.; PACKOWSKI, J. **Why a paradigm shift in Supply Chain Management is necessary to become truly demand driven**. Disponível em: <<https://www.raconteur.net/SPONSORED/WHY-A-PARADIGM-SHIFT-IN-SUPPLY-CHAIN-MANAGEMENT-IS-NECESSARY-TO-BECOME-TRULY-DEMAND-DRIVEN>>. Acesso em: 4 mar. 2019.

EAGLES, S. **Demand-Driven Supply Chain Management: Transformational performance improvement**. New York: Kogan Page, Ltd, 2017.

ECONOMIST INTELLIGENCE UNIT. **The demand-driven supply chain : A holistic approach**Oracle. [s.l: s.n.].

ESPER, T. L. et al. Demand and supply integration: a conceptual framework of value creation through knowledge management. **Journal of the Academy of Marketing Science**, v. 38, n. 1, p. 5–18, 26 fev. 2010.

FARAHANI, P.; AKKERMAN, R.; WILKE, J. **A hierarchical demand-driven production planning and control framework for the FMCG industry: An SAP-based approach**. IEEE International Conference on Industrial Engineering and Engineering Management. **Anais...Malaysia**: IEEE, 2014

FENG, Y.; D'AMOURS, S.; 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**, v. 115, n. 1, p. 189–209, 2008.

FERNANDES, F. C. F.; GODINHO, M. **Planejamento e Controle da Produção: dos fundamentos ao essencial**. São Paulo: Atlas, 2010.

FILIPPINI, R. Operations management research: some reflections on evolution, models and empirical studies in OM. **International Journal of Operations and Production Management**, v. 17, n. 7, p. 655–670, 1997.

FULMER, I. S. Editor's comments: the craft of writing theory articles - Variety and Similarity in AMR. **Academy of Management Review**, v. 37, n. 3, p. 327–331, 2012.

GANJI, E. N.; SHAH, S.; COUTROUBIS, A. **The Role of Sustainable New Product Development in Demand Driven Chains**. 2017 International Conference on Industrial Engineering, Management Science and Application, ICIMSA 2017. **Anais...**Seoul: IEEE, 2017

GANJI, E. N.; SHAH, S.; COUTROUBIS, A. An examination of product development approaches within demand driven chains. **Asia Pacific Journal of Marketing and Logistics**, v. 30, n. 5, p. 1183–1199, 2018.

GARCIA REYES, H.; GIACHETTI, R. Using experts to develop a supply chain maturity model in Mexico. **Supply Chain Management: An International Journal**, v. 15, n. 6, p. 415–424, 28 set. 2010.

GARTNER. **Demand-Driven Value Network (DDVN)**. Disponível em: <<https://www.gartner.com/it-glossary/demand-driven-value-network-ddvn>>. Acesso em: 4 mar. 2019.

GODSELL, J. et al. Using project demand profiling to improve the effectiveness and efficiency of infrastructure projects. **International Journal of Operations & Production Management**, v. 38, n. 6, p. 1422–1442, 4 jun. 2018.

GODSELL, J.; BIRTWISTLE, A.; VAN HOEK, R. Building the supply chain to enable business alignment: lessons from British American Tobacco (BAT). **Supply Chain Management: An International Journal**, v. 15, n. 1, p. 10–15, 26 jan. 2010.

GOH, S. H.; ELDRIDGE, S. New product introduction and supplier integration in sales and operations planning: evidence from the Asia Pacific region. **International Journal of Physical Distribution & Logistics Management**, v. 45, n. 9/10, p. 861–886, 2015.

GOLLAMUDI, R. Demand Driven S&OP – Maximizing Output To Match Demand Variation. **BristleCone: Your Supply Chain Optimized**, p. 1–22, 2013.

GOSWAMI, S.; ENGEL, T.; KRCMAR, H. A comparative analysis of information visibility in two supply chain management information systems. **Journal of Enterprise Information Management**, v. 26, n. 3, p. 276–294, 12 abr. 2013.

GRANDZOL, C. J.; GRANDZOL, J. R. Chantey Castings: A Hands-On Simulation to Teach Constraint Management and Demand-Driven Supply Chain Approaches. **Decision Sciences Journal of Innovative Education**, v. 16, n. 1, p. 6–22, 2018.

GRAY, C.; DOUGHERTY, J. Misconceptions, Missteps, and Bad Practices in S&OP.

International Journal of Applied Forecasting, v. Summer, n. 46, p. 4–10, 2017.

GRILLO, V. Creating an Effective Integrated Business Planning Process: Clif Bar's Experience. **Journal of Business Forecasting**, v. 33, n. 8, p. 18–21, 2014.

GRIMSON, J. A.; PYKE, D. F. Sales and operations planning: an exploratory study and framework. **The International Journal of Logistics Management**, v. 18, n. 3, p. 322–346, 2007.

HABIBI, A.; JAHANTIGH, F. F.; SARAFRAZI, A. Fuzzy Delphi Technique for Forecasting and Screening Items. **Asian Journal of Research in Business Economics and Management**, v. 5, n. 2, p. 130, 2015.

HADAYA, P.; CASSIVI, L. The Role of Joint Collaboration Planning Actions in a Demand-driven Supply Chain. **Industrial Management & Data Systems**, v. 107, n. 7, p. 954–978, 2007a.

HADAYA, P.; CASSIVI, L. The Role of Joint Collaboration Planning Actions in a Demand-driven Supply Chain. **Industrial Management & Data Systems**, v. 107, n. 7, p. 954–978, 2007b.

HADAYA, P.; CASSIVI, L. Collaborative e-product development and product innovation in a demand-driven network: The moderating role of eCRM. **Electronic Markets**, v. 19, n. 2–3, p. 71–87, 2009.

HAMERI, A.; HINTSA, J. Assessing the drivers of change for cross-border supply chains. **International Journal of Physical Distribution & Logistics Management**, v. 39, n. 9, p. 741–761, 9 out. 2009.

HAO, H.; WU, X.; LI, H. **Research on the Collaborative Plan of Implementing High Efficient Supply Chain**. 2012 International Conference on Future Energy, Environment, and Materials. **Anais...Hong Kong: 2012**Disponível em:
<<http://dx.doi.org/10.1016/j.egypro.2012.01.178>>

HARRISON, S. W. The “softer” side of S&OP. **Journal of Business Forecasting**, v. 28, n. 1, p. 20–23, 2009.

HART, R. **Is your organisation ready to become demand-driven?** Disponível em:
<<https://traccsolution.com/blog/demand-driven/>>. Acesso em: 4 mar. 2019.

HE, T. et al. A fuzzy AHP based integer linear programming model for the multi-criteria transshipment problem. **International Journal of Logistics Management**, v. 23, n. 1, p. 159–179, 2012.

HERRERA, F.; MARTÍNEZ, L. A model based on linguistic 2-tuples for dealing with multigranular hierarchical linguistic contexts in multi-expert decision-making. **IEEE Transactions on Systems, Man, and Cybernetics, Part B: Cybernetics**, v. 31, n. 2, p. 227–234, abr. 2001.

HERRMANN, A. The Quantitative Estimation of IT-Related Risk Probabilities. **Risk Analysis**, v. 33, n. 8, p. 1510–1531, ago. 2013.

HILLETOFTH, P.; ERICSSON, D.; CHRISTOPHER, M. Demand chain management: A Swedish industrial case study. **Industrial Management and Data Systems**, v. 109, n. 9, p. 1179–1196, 2009.

HINES, T. **Supply Chain Strategies: Demand Driven and Customer Focused**. 2nd. ed. Oxon: Routledge: Taylor & Francis Group, 2015.

HO, W.; LEE, C. K. M.; HO, G. T. S. Optimization of the facility location-allocation problem in a customer-driven supply chain. **Operations Management Research**, v. 1, n. 1, p. 69–79, 2009.

HOCHFELDER, B. **The Growth of Demand-Driven Supply Chains**. Disponível em: <<https://www.sdcexec.com/sourcing-procurement/article/12379515/the-growth-of-demand-driven-supply-chains>>. Acesso em: 4 mar. 2019.

IHME, M.; STRATTON, R. **Evaluating Demand Driven MRP: a case based simulated study**. International Conference of the European Operations Management Association. **Anais...**Neuchatel: 2015

INEXMODA. **Demand-Driven Supply Chain**. Disponível em: <<https://www.inexmoda.org.co/en/demand-driven-supply-chain/>>. Acesso em: 4 mar. 2019.

INTUIFLOW. **What does it mean to be Demand Driven?** Disponível em: <<http://intuiflow.com/about-us/what-does-it-mean-to-be-demand-driven/>>. Acesso em: 4 mar. 2019.

IVERT, L. K. et al. Sales and operations planning: responding to the needs of industrial food producers. **Production Planning & Control**, v. 26, n. 4, p. 280–295, 14 abr. 2015a.

IVERT, L. K. et al. Contingency between S&OP design and planning environment. **International Journal of Physical Distribution & Logistics Management**, v. 45, n. 8, p. 747–773, 7 set. 2015b.

IVERT, L. K.; JONSSON, P. The potential benefits of advanced planning and scheduling systems in sales and operations planning. **Industrial Management & Data Systems**, v. 110, n. 5, p. 659–681, 25 maio 2010.

IVERT, L. K.; JONSSON, P. When should advanced planning and scheduling systems be used in sales and operations planning? **International Journal of Operations & Production Management**, v. 34, n. 10, p. 1338–1362, 30 set. 2014.

JABIL. **Understanding the Impact of the Demand Driven Supply Chain**. Disponível em: <<https://www.jabil.com/insights/blog-main/understanding-the-impact-of-the-demand-driven-supply-chain.html>>. Acesso em: 4 mar. 2019.

JAHANI, A. et al. **An intelligent case-based supplier selection framework: Customer knowledge management perspective**. Proceedings - 2012 International Conference on Information Retrieval and Knowledge Management, CAMP'12. **Anais...**Kuala Lumpur: IEEE, 2012

JONES, D. T.; CLARKE, P. Creating a customer-driven supply chain. **International**

Commerce Review: ECR Journal, v. 2, n. 2, p. 28–37, 2002.

JONSSON, P.; HOLMSTRÖM, J. Future of supply chain planning: closing the gaps between practice and promise. **International Journal of Physical Distribution & Logistics Management**, v. 46, n. 1, p. 62–81, 2016a.

JONSSON, P.; HOLMSTRÖM, J. Future of supply chain planning: closing the gaps between practice and promise. **International Journal of Physical Distribution & Logistics Management**, v. 46, n. 1, p. 62–81, 8 fev. 2016b.

JONSSON, P.; RUDBERG, M.; HOLMBERG, S. Centralised supply chain planning at IKEA. **Supply Chain Management: An International Journal**, v. 18, n. 3, p. 337–350, 24 abr. 2013.

JULIANELLI, L. **Demand Driven Supply Chain**. Disponível em: <<http://www.ilos.com.br/web/demand-driven-supply-chain/>>. Acesso em: 19 fev. 2019.

JUNG, U.; CHUNG, B. DO. Lessons from the history of Samsung's SCM innovations: focus on the TQM perspective. **Total Quality Management and Business Excellence**, v. 27, n. 7–8, p. 751–760, 2016.

KABIR, G.; HASIN, M. A. A. Integrating modified Delphi method with fuzzy AHP for optimal power substation location selection. **International Journal of Multicriteria Decision Making**, v. 3, n. 4, p. 381, 2013.

KACHE, F.; SEURING, S. Challenges and opportunities of digital information at the intersection of Big Data Analytics and supply chain management. **International Journal of Operations & Production Management**, v. 37, n. 1, p. 10–36, 3 jan. 2017.

KAIPIA, R. et al. Information sharing for sales and operations planning: contextualized solutions and mechanisms. **Journal of Operations Management**, v. 52, n. 1, p. 15–29, maio 2017.

KASH, R.; CALHOUN, D. **How Companies Win: Profiting from Demand-Driven Business Models No Matter What Business You're In**. [s.l.] Harper Collins, 2011.

KATHURIA, R.; JOSHI, M. P.; PORTH, S. J. Organizational alignment and performance: Past, present and future. **Management Decision**, v. 45, n. 3, p. 503–517, 2007.

KEAL, D. A.; HEBERT, P. Benefits to blood banks of a sales and operations planning process. **Transfusion**, v. 50, n. 12, p. 2785–2787, dez. 2010.

KELLEHER, M. How to Improve the Global S&OP Process: Hollister's Journey. **Journal of Business Forecasting**, v. 31, n. 1, p. 4–17, 2012.

KEMBRO, J.; NÄSLUND, D.; OLHAGER, J. Information sharing across multiple supply chain tiers: A Delphi study on antecedents. **International Journal of Production Economics**, v. 193, n. June, p. 77–86, nov. 2017.

KITCHENHAM, B. **Procedures for performing systematic reviews** Keele, UK, Keele University. Eversleigh: [s.n.]. Disponível em: <<http://csnotes.upm.edu.my/kelasmaya/pgkm20910.nsf/0/715071a8011d4c2f482577a700386>>

d3a/\$FILE/10.1.1.122.3308[1].pdf%5Cnhttp://tests-zingarelli.googlecode.com/svn-history/r336/trunk/2-Disciplinas/MetodPesquisa/kitchenham_2004.pdf>.

KOHLER, J.; PUKKILA, M. Assessing Your S&OP Process Maturity — The Why, Who and How to Realizing Greater Business Outcomes. **Gartner**, n. January, p. 1–12, 2016.

KPMG INTERNATIONAL. **Demand-Driven supply chain 2.0: a direct link to profitability**. [s.l: s.n.].

KRISTENSEN, J.; JONSSON, P. Context-based sales and operations planning (S&OP) research: a literature review and future agenda. **International Journal of Physical Distribution & Logistics Management**, v. 48, n. 1, p. 19–46, 2018.

KRUSE, G. New wine in old bottles. **Manufacturing Engineer**, v. 83, n. 3, p. 48–48, 1 jun. 2004.

KUO, Y.-F.; CHEN, P.-C. Constructing performance appraisal indicators for mobility of the service industries using Fuzzy Delphi Method. **Expert Systems with Applications**, v. 35, n. 4, p. 1930–1939, nov. 2008.

LAHY, A. **D2ID (Demand-Driven Inventory Dispositioning)**. Disponível em: <http://www.panalpina.com/WWW/GLOBAL/EN/HOME/PRODUCTS_SOLUTIONS/LOGISTICS/D2ID.HTML>. Acesso em: 4 mar. 2019.

LAKSHAM, N. Solve the Demand-Driven Supply Chain Problem. **Assembly**, p. 42–44, 2013.

LAMBERT, D.; COOPER, M. Issues in Supply Chain Management. **Industrial Marketing Management**, v. 29, n. 1, p. 65–83, 2000a.

LAMBERT, D. M. **Supply Chain Management: Processes, Partnerships, Performance**. Third ed. Jacksonville: Ther Hartley Press, 2008.

LAMBERT, D. M. Customer relationship management as a business process. **Journal of Business & Industrial Marketing**, v. 25, n. 1, p. 4–17, 22 dez. 2009.

LAMBERT, D. M.; COOPER, M. C. Issues in Supply Chain Management. **Industrial marketing management**, v. 29, n. 1, p. 65–83, 2000b.

LANGABEER, J.; ROSE, J. **Creating Demand Driven Supply Chains**. [s.l.] Spiro Press, 2003.

LANGELLA, I. M. **Planning Demand-Driven Disassembly for Remanufacturing**. Germany: Springer Science & Business Media, 2007.

LAPIDE, L. An S&OP Maturity Model. **Journal of Business Forecasting**, v. 24, n. 3, p. 15–19, 28, 2005a.

LAPIDE, L. Sales and operations planning Part III: a diagnostic model. **Journal of Business Forecasting**, v. 24, n. 1, p. 13–16, 2005b.

LAPIDE, L. The S&OP Rudder. **Supply Chain Management Review**, p. 4–6, 2009.

LAPIDE, L. Demand Planning Needs Customer Profitability. **Journal of Business Forecasting**, v. 32, n. 4, p. 17–19, 2014a.

LAPIDE, L. What About a Telescoping Planning Horizon? **Journal of Business Forecasting**, v. 33, n. 2, p. 19–22, 2014b.

LAPIDE, L. Execution needs the S&OP plans. **Journal of Business Forecasting**, v. 35, n. 1, p. 19–22, 2016.

LARSSON, A.; FREDRIKSSON, A. Tactical capacity planning in hospital departments. **International Journal of Health Care Quality Assurance**, v. 32, n. 1, p. 233–245, 11 fev. 2019.

LAU, H. C. .; LEE, W. B. On a responsive supply chain information system. **International Journal of Physical Distribution & Logistics Management**, v. 30, n. 3, p. 598–610, 2000.

LEAN AXIS. **Demand Driven Planning: A Better Alternative!** Disponível em: <<http://leanaxis.com/demand-driven-planning/>>. Acesso em: 4 mar. 2019.

LEE, J. B. The role of S&OP in a sluggish economy. **The International Journal of Applied Forecasting**, n. 28, p. 30–36, 2013.

LI, W.; ZUO, Y. **Customer-oriented supply chain integration in SMEs**. International Conference on Management and Service Science, MASS 2011. **Anais...** Wuhan: IEEE, 2011

LI, Y.; SHAKYA, S.; OWUSU, G. **Integrated forecasting & planning for strategic & operational telecom field service delivery**. 2017 Computing Conference. **Anais...**IEEE, jul. 2018 Disponível em: <<http://ieeexplore.ieee.org/document/8252212/>>

LIMA, F. R.; CARVALHO, G. M. R.; CARPINETTI, L. C. R. A methodology based on fuzzy inference and SCOR model for supplier performance evaluation. **Gestao e Producao**, v. 23, n. 3, p. 515–534, 2016.

LINSTONE, H. A.; TUROFF, M. **The Delphi Method: Techniques and Applications**. Michigan U ed. Michigan: Addison-Wesley Pub. Co., Advanced Book Program, 1975.

LIU, H.-T.; WANG, W.-K. An integrated fuzzy approach for provider evaluation and selection in third-party logistics. **Expert Systems with Applications**, v. 36, n. 3, p. 4387–4398, abr. 2009.

LIVEBLOG TEAM. **Demand-Driven MRP: A Competitive Edge for you in IFS Applications 10**.

LO, V. et al. Integrating customer expectations into the development of business strategies in a supply chain environment. **International Journal of Logistics: Research and Applications**, v. 8, n. 1, p. 37–50, 2005.

LUMMUS *, R. R.; VOKURKA, R. J.; DUCLOS, L. K. Delphi study on supply chain flexibility. **International Journal of Production Research**, v. 43, n. 13, p. 2687–2708, jul. 2005.

LUMMUS, R. R.; VOKURKA, R. J. Defining supply chain management : a historical

perspective and practical guidelines. **Industrial Management & Data Systems**, v. 99, n. 1, p. 11–17, 1999.

LYONS, A. C. et al. **Prototyping an information system's requirements architecture for customer-driven, supply-chain operations**. [s.l.: s.n.]. v. 43

MA, Z. et al. Constructing road safety performance indicators using Fuzzy Delphi Method and Grey Delphi Method. **Expert Systems with Applications**, v. 38, n. 3, p. 1509–1514, mar. 2011.

MACCARTHY, B. L.; ATTHIRAWONG, W. Factors affecting location decisions in international operations – a Delphi study. **International Journal of Operations & Production Management**, v. 23, n. 7, p. 794–818, jul. 2003.

MAKATSORIS, H. C.; CHANG, Y. S. Design of a demand-driven collaborative supply-chain planning and fulfilment system for distributed enterprises. **Production Planning & Control**, v. 15, n. 3, p. 292–302, 2004.

MANAKANDAN, S. K. et al. Pesticide applicators questionnaire content validation: A fuzzy delphi method. **Medical Journal of Malaysia**, v. 72, n. 4, p. 228–235, 2017.

MANNILA, T.; NYHOLM, K. **Demand Driven Innovation**. Disponível em: <<http://eciplatform.eu/project/demand-driven-innovation>>. Acesso em: 4 mar. 2019.

MANNING, B.; THORNE, C. **Demand Driven: Six Steps to Creating an Ecosystem of Demand for Your Business**. [s.l.] McGraw-Hill, 2003.

MARCONI, M. DE A.; LAKATOS, E. M. **Fundamentos de Metodologia Científica**. 8th. ed. São Paulo: Atlas, 2017.

MARDANI, A.; JUSOH, A.; ZAVADSKAS, E. K. Fuzzy multiple criteria decision-making techniques and applications – Two decades review from 1994 to 2014. **Expert Systems with Applications**, v. 42, n. 8, p. 4126–4148, maio 2015.

MARQUES, J. B. V.; FREITAS, D. DE. Método DELPHI: caracterização e potencialidades na pesquisa em Educação. **Pro-Posições**, v. 29, n. 2, p. 389–415, ago. 2018.

MARRELLA, A. **Modeling Business Processes with BPMN**RomaSapienza - Università di Roma - Dipartimento di Informatica e Sistemica Antonio Ruberti, , 2015. Disponível em: <http://knut.hinkelmann.ch/lectures/bpm2015-16/02%7B_%7DBPMN.pdf>

MARRIS CONSULTING. **Demand Driven MRP - The future of MRP**. Disponível em: <<https://www.marris-consulting.com/en/points-of-view/ddmrp>>. Acesso em: 4 mar. 2019.

MARTINELLI, E. M.; TUNISINI, A. Customer integration into supply chains: literature review and research propositions. **Journal of Business and Industrial Marketing**, 2018.

MARTINO, G. et al. Supply chain risk assessment in the fashion retail industry: An analytic network process approach. **International Journal of Applied Engineering Research**, v. 12, n. 2, p. 140–154, 2017.

MARTINS, R. A. Princípios da Pesquisa Científica. In: MIGUEL, P. A. C. (Ed.). .

Metodologia de Pesquisa em Engenharia de Produção e Gestão de Operações. 2nd. ed. Rio de Janeiro: Elsevier/ABEPRO, 2012a. p. 259.

MARTINS, R. A. Abordagens Quantitativa e Qualitativa. In: MIGUEL, P. A. C. (Ed.). . **Metodologia de Pesquisa em Engenharia de Produção e Gestão de Operações.** 2nd. ed. Rio de Janeiro: Elsevier/ABEPRO, 2012b. p. 259.

MASON, R.; LALWANI, C.; BOUGHTON, R. Combining vertical and horizontal collaboration for transport optimisation. **Supply Chain Management**, v. 12, n. 3, p. 187–199, 2007.

MCCOLLUM, B. Know Your S&OP. **APICS Magazine**, v. 21, n. January/February, 2011.

MCKEVITT, J. **Demand driven supply chain planning can lower costs, but transparency is key.** Disponível em: <<https://www.supplychaindive.com/news/demand-supply-chain-planning-effectiveness/433762/>>. Acesso em: 4 mar. 2019.

MELLO, J. Internal and External Collaboration: The Keys to Demand-Supply Integration. **The International Journal of Applied Forecasting**, n. 36, p. 16–20, 2015.

MELNYK, S. A. et al. Mapping the future of supply chain management: a Delphi study. **International Journal of Production Research**, v. 47, n. 16, p. 4629–4653, 15 ago. 2009.

MENDES, P. **Demand Driven Supply Chain: A Structured and Practical Roadmap to Increase Profitability.** New York: Springer, 2011.

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**, v. 179, p. 153–165, 2016.

MENTZER, J. T. et al. Defining Supply Chain Management. **Journal of Business Logistics**, v. 22, n. 2, p. 1–25, set. 2001.

MIKALSEN, M. M.; LARSEN, R. T. **Lift your operational planning with demand driven material requirement planning.** Disponível em: <<https://implementconsultinggroup.com/lift-your-operational-planning-with-ddmrp/>>. Acesso em: 4 mar. 2019.

MINKMAN, M. et al. A quality management model for integrated care: results of a Delphi and Concept Mapping study. **International Journal for Quality in Health Care**, v. 21, n. 1, p. 66–75, 1 fev. 2009.

MOHAMMADI, M.; MUKHTAR, M. B. Service Process Modeling for Demand-driven Supply Chain Based on SOA. **International Journal of Digital Content Technology and its Applications**, v. 6, n. 22, p. 21–32, 2012.

MONDON, C. **The Missing Links: A Demand Driven Supply Chain Detective Novel.** [s.l.] Industrial Press, Incorporated, 2016.

MOON, M.; ALLE, P. From Sales & Operations Planning to Business Integration. **The International Journal of Applied Forecasting**, n. 37, p. 5–12, 2015.

MOSHREF-JAVADI, M.; LEE, S. The Latency Location-Routing Problem. **European Journal of Operational Research**, v. 255, n. 2, p. 604–619, 2016.

MURRY, T. J.; PIPINO, L. L.; GIGCH, J. P. A pilot study of fuzzy set modification of Delphi. **Human Systems Management**, v. 5, p. 76–80, 1985.

MYERSON, P. **Lean Demand-Driven Procurement: How to Apply Lean Thinking to Your Supply Management Processes**. Oxon: CRC Press, 2018.

NAKANO, D. N. Métodos de Pesquisa Adotados na Engenharia de Produção e Gestão de Operações. In: MIGUEL, P. A. C. (Ed.). **Metodologia de Pesquisa em Engenharia de Produção e Gestão de Operações**. 2nd. ed. Rio de Janeiro: Elsevier/ABEPRO, 2012. p. 259.

NAKANO, M. Collaborative forecasting and planning in supply chains: The impact on performance in Japanese manufacturers. **International Journal of Physical Distribution & Logistics Management**, v. 39, n. 2, p. 84–105, 13 mar. 2009.

NEVES, M. F. **Demand driven strategic planning**. New York: Routledge: Taylor & Francis Group, 2013.

NIELSEN, P.; NIELSEN, I.; STEGER-JENSEN, K. Analyzing and evaluating product demand interdependencies. **Computers in Industry**, v. 61, n. 9, p. 869–876, dez. 2010.

NOROOZI, S.; WIKNER, J. Sales and operations planning in the process industry: A literature review. **International Journal of Production Economics**, v. 188, n. April 2016, p. 139–155, 2017.

NTTDATA. **Demand-driven Supply Chain with SAP IBP**. Disponível em: <<https://us.nttdata.com/en/blog/2018/january/demand-driven-supply-chain-with-sap-ibp>>. Acesso em: 4 mar. 2018.

NUCAMENDI-GUILLÉN, S.; MORENO, M. A.; MENDOZA, A. A methodology for increasing revenue in fashion retail industry: a case study of a Mexican company. **International Journal of Retail & Distribution Management**, v. 46, n. 8, p. 726–743, 13 ago. 2018.

OGDEN, J. A. et al. Supply Management Strategies for the Future: A Delphi Study. **The Journal of Supply Chain Management**, v. 41, n. 3, p. 29–48, ago. 2005.

OKOLI, C.; PWALOWSKI, S. D. The Delphi method as a research tool: An example, design considerations, and applications. **Information & Management**, v. 42, n. 1, p. 15–29, 2004.

OLIVA, R.; WATSON, N. Cross-functional alignment in supply chain planning: A case study of sales and operations planning. **Journal of Operations Management**, v. 29, n. 5, p. 434–448, 2011a.

OLIVA, R.; WATSON, N. Cross-functional alignment in supply chain planning: A case study of sales and operations planning. **Journal of Operations Management**, v. 29, n. 5, p. 434–448, jul. 2011b.

OMG. **Business Process Model and Notation**OMGOMG, , 2015. Disponível em: <<http://www.omg.org/spec/BPMN/2.0>>

ORCHESTR8. **Demand Driven MRP (DDMRP)**. Disponível em:

<<http://www.orchestr8.com/demand-driven-mrp-ddmrp>>. Acesso em: 4 mar. 2019.

PAGELL, M. Understanding the factors that enable and inhibit the integration of operations, purchasing and logistics. **Journal of Operations Management**, v. 22, n. 5, p. 459–487, 2004.

PARMAR, D. et al. A clustering algorithm for supplier base management. **International Journal of Production Research**, v. 48, n. 13, p. 3803–3821, 2010.

PAYNE, T. (GARTNER). Magic Quadrant for Sales and Operations Planning Systems of Differentiation. **Gartner**, n. April, p. 1–36, 2015.

PEDROSO, C. B.; SILVA, A. L. Dinâmica de implantação do Sales and Operations Planning: principais desafios. **Gestão & Produção**, v. 22, n. 3, p. 662–677, 2015.

PLANK, R. E.; HOOKER, R. Sales and operations planning: Using the internet and internet-based tools to further supply chain integration. **Journal of Research in Interactive Marketing**, v. 8, n. 1, p. 18–36, 4 mar. 2014.

POWELL, C. The Delphi technique: myths and realities. **Journal of Advanced Nursing**, v. 41, n. 4, p. 376–382, fev. 2003.

PTAK, C.; SMITH, C. **Demand Driven Material Requirements Planning**. South Norwalk, Connecticut: Industrial Press, Inc., 2016a.

PTAK, C.; SMITH, C. **Demand-Driven Material Requirements Planning**. South Norwalk, Connecticut: Industrial Press, Inc., 2016b.

PTAK, C.; SMITH, C. **The Demand Driven Adaptive Enterprise Model**. 1st Ed ed. [s.l.] Industrial Press, Inc., 2018.

QINGHUA, Z. et al. **Research on terminal market oriented supply chain integration system**. 2010 The 12th International Conference on Advanced Communication Technology (ICACT). **Anais...**Gangwon-Do: IEEE, 2010

QUEENSLAND GOVERNMENT. **What is demand-driven?** Disponível em:

<<https://www.arts.qld.gov.au/aq-blog/investment/what-is-demand-driven>>. Acesso em: 1 mar. 2019.

RALSTON, P. M. et al. A Structure-Conduct-Performance Perspective of How Strategic Supply Chain Integration Affects Firm Performance. **Journal of Supply Chain Management**, v. 51, n. 2, p. 47–64, abr. 2015.

REEFKKE, H.; SUNDARAM, D. Key themes and research opportunities in sustainable supply chain management – identification and evaluation. **Omega**, v. 66, p. 195–211, jan. 2017.

RIGNEL, D. G. DE S.; CHENCI, G. P.; LUCAS, C. A. Uma introdução a lógica fuzzy. **Revista Eletrônica de Sistemas de Informação e Gestão Tecnológica**, v. 1, n. 1, p. 17–28, 2011.

ROKONUZZAMAN, M. The Integration of Extended Supply Chain with Sales and Operation Planning: A Conceptual Framework. **Logistics**, v. 2, n. 2, p. 1–21, 21 mar. 2018.

ROSS, A. Creating Agile Supply. **IEEE Manufacturing Engineer**, p. 18–21, 2004.

ROTARU, K.; WILKIN, C.; CEGLOWSKI, A. Analysis of SCOR's approach to supply chain risk management. **International Journal of Operations & Production Management**, v. 34, n. 10, p. 1246–1268, 2014.

ROUSE, M. **Demand-Driven Manufacturing (DDM)**. Disponível em: <<https://searcherp.techtarget.com/definition/demand-driven-manufacturing-DDM>>. Acesso em: 4 mar. 2019.

ROUSSEAU, D. M.; MANNING, J.; DENYER, D. Evidence in Management and Organizational Science: Assembling the Field's Full Weight of Scientific Knowledge through Syntheses. **The Academy of Management Annals**, v. 2, n. 1, p. 475–515, 2008.

RUGGERI, R. **Customer Service** Milão Facoltà di Ingegneria dei Sistemi - Politecnico di Milano, , 2008.

RUTHERFORD, S. **A Demand-Driven Supply Chain - 4 Pillars for Success (Part 1)**. Disponível em: <<https://www.jumpstech.com/newsroom/blog/a-demand-driven-supply-chain-4-pillars-for-success-part-1/>>. Acesso em: 4 mar. 2019.

SAS. SAS for Demand-Driven Planning and Optimization Demand-Driven Forecasting. **SAS and all other SAS Institute Inc.**, 2014.

SAWIK, T. Coordinated supply chain scheduling. **International Journal of Production Economics**, v. 120, n. 2, p. 437–451, 2009a.

SAWIK, T. **Monolithic versus hierarchical approach to integrated scheduling in a supply chain**. [s.l.: s.n.]. v. 47

SAWIK, T. Supplier selection in make-to-order environment with risks. **Mathematical and Computer Modelling**, v. 53, n. 9–10, p. 1670–1679, 2011.

SAWIK, T. On the robust decision-making in a supply chain under disruption risks. **International Journal of Production Research**, v. 52, n. 22, p. 6760–6781, 2014.

SAWIK, T. Selection of Static Supply Portfolio. In: **Supply Chain Disruption Management Using Stochastic Mixed Integer Programming**. Internatio ed. Texas: [s.n.]. v. 256p. 15–42.

SCHLEGEL, G. L.; MURRAY, P. Next Generation of S&OP: Scenario Planning with Predictive Analytics & Digital Modeling. **Journal of Business Forecasting**, v. 29, n. 3, p. 20–23, 28–30, 2010.

SCHNEIDER, J. S&OP Step by Step. **APICS Magazine**, v. 23, n. September/October, 2013a.

SCHNEIDER, J. Getting Tough with S&OP. **APICS Magazine**, v. 23, n. November/December, 2013b.

SCHNEIDER, J. Seeing Your S&OP. **APICS Magazine**, v. 24, n. May/June, 2014.

SCOTTSDALE, A. **IDS Borjomi International Executes on Demand-Driven Supply**

Chain Strategy with JDA. Disponível em: <<https://jda.com/knowledge-center/press-release/ids-borjomi-international-executes-on-demand-driven-supply-chain-strategy-with-jda>>. Acesso em: 4 mar. 2019.

SELLITTO, M. A. et al. A SCOR-based model for supply chain performance measurement: application in the footwear industry. **International Journal of Production Research**, v. 53, n. 16, p. 4917–4926, 2015.

SHAPIRO, B. P. Can Marketing and Manufacturing Coexist? **Harvard Business Review**, v. 55, n. 5, p. 104–114, 1977.

SHAPIRO, R. et al. **BPMN 2.0 Handbook: Methods, Concepts, Case Studies and Standards in Business Process Modeling Notation (BPMN)**. Florida: WPMC - Workflow Management Coalition, 2012.

SHARMA, V. **The cloud-based demand-driven supply chain**. Hoboken, New Jersey: John Wiley & Sons, Inc., 2019.

SIMCHI-LEVI, D.; KAMINSKI, P.; SIMCHI-LEVI, E. Introduction to supply chain management. In: SIMCHI-LEVI, D.; KAMINSKI, P.; SIMCHI-LEVI, E. (Eds.). . **Designing and Managing the Supply Chain – concepts, strategies and case studies**. 2nd. ed. Boston: McGraw-Hill, 2003.

SINGH, B. S. K.; LEE, J. B. How to Use What-If Analysis in Sales and Operations Planning. **Journal of Business Forecasting**, v. 32, n. 3, p. 4–6, 9–12, 14, 2013.

SINGHAL, J.; SINGHAL, K. Holt, Modigliani, Muth, and Simon's work and its role in the renaissance and evolution of operations management. **Journal of Operations Management**, v. 25, n. 2, p. 300–309, mar. 2007.

SINGHAL, K. et al. Introduction to the Special Issue on Perspectives on Big Data. **Production and Operations Management**, v. 27, n. 9, p. 1639–1641, 2018.

SIRAJUDEEN, A. **What is a Demand-driven Supply Chain?** Disponível em: <<https://blog.arkieva.com/demand-driven-supply-chain/>>. Acesso em: 1 mar. 2019.

SLACK, N.; BRANDON-JONES, A.; JOHNSTON, R. **Administração da Produção**. 4th. ed. São Paulo: Atlas, 2015.

SMITH, C.; PTAK, C.; LING, D. The Demand Driven Adaptive Enterprise Model: The Case for a New System of Enterprise Management. **Demand Driven Institute**, p. 1–23, 2017.

SMITH, D.; SMITH, C. Becoming Demand Driven. **Strategic Finance**, p. 37–45, 2013a.

SMITH, D.; SMITH, C. Staying Demand Driven: How to sustain the Demand Driven operating model using smart metrics. **Strategic Finance**, p. 44–51, 2013b.

SMITH, D.; SMITH, C. What's wrong with Supply Chain Metrics. **Strategic Finance**, n. October, p. 27–33, 2013c.

SMITH, D.; SMITH, C. **Demand Driven Performance: using smart metrics**. New York: McGraw-Hill, 2014.

SMITH, L.; ANDRASKI, J.; FAWCETT, S. Integrated Business Planning: A Roadmap to Linking S&OP and CPFR. **Journal of Business Forecasting**, v. 29, n. 4, p. 4–7, 9–13, 2011.

SORENSEN, D. EPM in Manufacturing: Finally Coming of Age. **Strategic Finance**, n. September, p. 39–45, 2013.

STEFANO, N. M.; CASAROTTO FILHO, N.; DUARTE, M. DO C. F. PROPOSTA DE UM INSTRUMENTO DE PESQUISA PARA AVALIAR A GESTÃO DE PERIÓDICOS CIENTÍFICOS : UTILIZANDO O MÉTODO FUZZY DELPHI PROPOSAL OF A RESEARCH INSTRUMENT TO EVALUATE THE MANAGEMENT OF SCIENTIFIC JOURNALS : USING OF FUZZY. **Iberoamerican Journal of Project Management**, v. 5, n. 2, p. 39–69, 2014.

STORBACKA, K. A solution business model: Capabilities and management practices for integrated solutions. **Industrial Marketing Management**, v. 40, n. 5, p. 699–711, jul. 2011.

STORELLI, J. It's All S&OP to Me. **APICS Magazine**, v. 10, n. November/December, 2015.

SUURMOND, C. **Hard Problems and Soft Information**. Proceedings of the Sixth International Symposium on Business Modeling and Software Design. **Anais...SCITEPRESS - Science and Technology Publications**, 2016Disponível em: <<http://www.scitepress.org/DigitalLibrary/Link.aspx?doi=10.5220/0006221900320038>>

SWAIM, J. A. et al. Antecedents to effective sales and operations planning. **Industrial Management & Data Systems**, v. 116, n. 6, p. 1279–1294, 2016.

SYNCHRONO. **Top ten trends**. Disponível em: <<http://www.synchrono.com/resources/>>. Acesso em: 4 mar. 2019.

SYNCHRONO. **What is Demand-Driven Manufacturing?** Disponível em: <<http://www.synchrono.com/resources/demand-driven-manufacturing/>>. Acesso em: 4 mar. 2019.

SYSPRO. **Supply Chain Strategy with Demand Driven MRP (DDMRP)**. Disponível em: <<https://ca.syspro.com/supply-chain-strategy-demand-driven-mrp-ddmrp/>>. Acesso em: 4 mar. 2019.

TARAFDAR, M.; QRUNFLEH, S. Agile supply chain strategy and supply chain performance: complementary roles of supply chain practices and information systems capability for agility. **International Journal of Production Research**, v. 55, n. 4, p. 925–938, 16 fev. 2017.

TECHNOPEDIA. **Demand-Driven Value Network (DDVN)**. Disponível em: <<https://www.techopedia.com/definition/30942/demand-driven-value-network-ddvn>>. Acesso em: 4 mar. 2019.

THOMAS, R. W. et al. Assessing the managerial relevance of contemporary supply chain management research. **International Journal of Physical Distribution & Logistics Management**, v. 41, n. 7, p. 655–667, 9 ago. 2011.

THOMÉ, A. M. T. et al. Sales and operations planning and the firm performance.

International Journal of Productivity and Performance Management, v. 61, n. 4, p. 359–381, 2012a.

THOMÉ, A. M. T. et al. Sales and operations planning: A research synthesis. **International Journal of Production Economics**, v. 138, n. 1, p. 1–13, jul. 2012b.

THOMÉ, A. M. T.; SOUSA, R. S.; CARMO, L. F. R. R. S. DO. Complexity as Contingency in Sales and Operations Planning. **Industrial Management & Data Systems**, v. 114, n. 5, p. 1, 2014.

THOMÉ, A. M. T.; SOUSA, R. S.; SCAVARDA, L. F. R. R. The impact of sales and operations planning practices on manufacturing operational performance. **International Journal of Production Research**, v. 52, n. 7, p. 2108–2121, 3 abr. 2014.

TINHAM, B. Manufacturing to the pull of the customer. **Manufacturing Computer Solutions**, p. 12–15, 2006.

TSENG, M.; LIM, M.; WONG, W. P. Sustainable supply chain management. **Industrial Management & Data Systems**, v. 115, n. 3, p. 436–461, 13 abr. 2015.

TUOMIKANGAS, N.; KAIPIA, R. A coordination framework for sales and operations planning (S&OP): Synthesis from the literature. **International Journal of Production Economics**, v. 154, n. 1, p. 243–262, 2014a.

TUOMIKANGAS, N.; KAIPIA, R. A coordination framework for sales and operations planning (S&OP): Synthesis from the literature. **International Journal of Production Economics**, v. 154, p. 243–262, 2014b.

TURNER, N.; AITKEN, J.; BOZARTH, C. A framework for understanding managerial responses to supply chain complexity. **International Journal of Operations & Production Management**, v. 38, n. 6, p. 1433–1466, 4 jun. 2018.

TURRIONI, J. B.; MELLO, C. H. P. **Metodologia De Pesquisa Em Engenharia De Produção**. Itajubá: UNIFEI, 2012.

VENKATESH, V. G.; RATHI, S.; PATWA, S. Analysis on supply chain risks in Indian apparel retail chains and proposal of risk prioritization model using Interpretive structural modeling. **Journal of Retailing and Consumer Services**, v. 26, p. 153–167, set. 2015.

VERDOUW, C. N. et al. Process modelling in demand-driven supply chains: A reference model for the fruit industry. **Computers and Electronics in Agriculture**, v. 73, n. 2, p. 174–187, 2010.

VERDOUW, C. N. et al. A framework for modelling business processes in demand-driven supply chains. **Production Planning and Control**, v. 22, n. 4, p. 365–388, 2011.

VOLLMANN, T. E. et al. **Manufacturing Planning and Control Systems for Supply Chain**. New York: McGraw-Hill, 2005.

VON DER GRACHT, H. A.; DARKOW, I.-L. Scenarios for the logistics services industry: A Delphi-based analysis for 2025. **International Journal of Production Economics**, v. 127, n. 1, p. 46–59, set. 2010.

VOSS, C.; TSIKRIKTSIS, N.; FROHLICH, M. Case research in operations management. **International Journal of Operations & Production Management**, v. 22, n. 2, p. 195–219, 2002.

WAGNER, S. M.; ULLRICH, K. K. R.; TRANSCHEL, S. The game plan for aligning the organization. **Business Horizons**, v. 57, n. 2, p. 189–201, mar. 2014.

WALLACE, T. F. **S&OP (Sales and Operations Planning) - Planejamento de Vendas e Operações: guia prático**. 3rd. ed. São Paulo: IMAM, 2012.

WALLACE, T. F.; STAHL, R. A. **Sales & operations planning: the how-to handbook**. 3rd. ed. Cincinnati, Ohio: T.F. Wallace & Co., 2008.

WALLER, M. A.; DABHOLKAR, P. A.; GENTRY, J. J. Postponement, product customization, and market-oriented supply chain management. **Journal of Business Logistics**, v. 21, n. 2, p. 133–160, 2000.

WALTER, L.; KARTSOUNIS, G.-A.; CAROSIO, S. **Transforming Clothing Production into a Demand-driven, Knowledge-based, High-tech Industry: The Leapfrog Paradigm**. New York: Springer, 2009.

WALTERS, D. Demand chain management+response management=increased customer satisfaction. **International Journal of Physical Distribution & Logistics Management**, v. 38, n. 9, p. 699–725, 10 out. 2008.

WANG, W.-P. A fuzzy linguistic computing approach to supplier evaluation. **Applied Mathematical Modelling**, v. 34, n. 10, p. 3130–3141, out. 2010.

WANG, X. Y.; ZHANG, J. H. **Simulation research of the retailer's ordering strategy based on system dynamics**. 2010 International Conference on Management and Service Science, MASS 2010. **Anais...IEEE**, 2010

WARREN, L. Scenario Analysis for S&OP. **Journal of Business Forecasting**, v. 31, n. 1, p. 32–35, 2012.

WEINTRAUB, I. The impact of alternative presses on scientific communication. **International Journal on Grey Literature**, v. 1, n. 2, p. 54–59, 2000.

WESKE, M. **Business Process Management: Concepts, Languages and Architectures**. New York: Springer, 2007.

WFMC. **Workflow Management Coalition Terminology & Glossary**The Workflow Management Coalition Specification. Winchester: [s.n.]. Disponível em: <http://www.wfmc.org/docs/TC-1011_term_glossary_v3.pdf>.

WILSON, E.; RAMAN, S. Why Is the S&OP Process Stuck in Third Gear? **Journal of Business Forecasting**, v. 36, n. 3, p. 10–14, 2017.

XIE, X. et al. Arithmetic operations on triangular fuzzy numbers via credibility measures: An inverse distribution approach. **Journal of Intelligent & Fuzzy Systems**, v. 35, n. 3, p. 3359–3374, 1 out. 2018.

XU, X. et al. **Customer-oriented planning of distributed generations in an active distribution system**. IEEE Power and Energy Society General Meeting. **Anais...**Denver: IEEE, 2015

YIN, R. K. **Estudo de caso: planejamento e métodos**. Porto Alegre: Bookman, 2015.

YU-FENG, H.; HSIAO-LIN, W. **Applying fuzzy Delphi method to Select the Variables of a Sustainable Urban System Dynamics Model**, 2008. (Nota técnica).

ZADEH, L. A. Fuzzy sets. **Information and Control**, v. 8, p. 338–353, 1965.

APPENDIX A – PUBLICATIONS THAT CONSIDERED THE DELPHI-METHOD AS A METHODOLOGICAL APPROACH

Chart A.1 presents examples of publications that adopted the Delphi-method as a methodological approach in the field of operations management, production planning and control and supply chain management.

Chart A.1 – Delphi-method adoption in the fields of operations management, production planning and control and supply chain management

Title	Paper	Problem	Method Details	Authors
Virtuous and vicious cycles on the road towards international supply chain management	International Journal of Operations & Production Management	To understand the reasons why to achieve an effective supply chain is so difficult	Thirty supply chain managers of Netherlands have participated. The study considered two brainstorming exercises.	Akkermans, Bogerd and Vos (1999)
<i>Ecosilient</i> Index to assess the greenness and resilience of the upstream automotive supply chain	Journal of Cleaner Production	To verify the importance of considering green and resilient paradigms in the supply chain context	Eleven academics and eleven professionals have participated. Virtual (e-mail) interviews were considered. The Delphi approach has taken three rounds to achieve the results.	Azevedo et al. (2013)
Green supplier selection in edible oil production by a hybrid model using Delphi method and green data envelopment analysis (GDEA)	Management and Production Engineering Review	To identify the main criteria that influences the supplier selection, considering the green approach	A group of six experts was considered. There were both professionals and academics in the group. Two rounds were conducted to achieve the results.	Banaeian et al. (2014)
Performance measurement in the food supply chain: a balanced scorecard approach	Facilities	To develop a balanced scorecard model to performance measurement in the food supply chain	A multidisciplinary panel of twenty experts and fifteen managers were considered. Two rounds were conducted to achieve the results.	Bigliardi and Bottani (2010)
Adoption of cloud computing technologies in supply chains: An organizational information processing theory approach	The International Journal of Logistics Management	To examine how task, environmental and interorganizational uncertainties affect the adoption of cloud computing technology	It was considered a web-based survey sent to forty-four IT executives of manufacturing, retail and logistics firms. Three rounds were conducted to achieve the results.	Cegielski et al. (2012)
Structured methodology for supplier selection and evaluation in a supply chain	Information Sciences	To propose a structured methodology for supplier selection and evaluation based on supply chain integration	Five suppliers were considered to participate in the Delphi-method.	Chen (2011)

Chart A.1 – Delphi-method adoption in the fields of operations management, production planning and control and supply chain – *Continuation*

Using experts to develop a supply chain maturity model in Mexico	Supply Chain Management: An International Journal	To develop a supply chain maturity model to help Mexican firms to evaluate their operations	It was considered experts from twenty-two different firms and a total of eighty-three experts. Three rounds were conducted to achieve the results.	Garcia Reyes and Giachetti (2010)
Assessing the drivers of change for cross-border supply chains	International Journal of Physical Distribution & Logistics Management	To systematically document drivers of change and the implications they will have on international supply chain management	A total of forty-five experts was considered from industry, bank, organizations and universities. Two rounds were conducted to achieve the results.	Hameri and Hintsa (2009)
The Quantitative Estimation of IT-Related Risk Probabilities	Risk Analysis	To understand how people estimate IT-related risk	A total of thirty-six experts was considered from universities and companies. Two rounds were conducted to achieve the results.	Herrmann (2013)
Integrating modified Delphi method with fuzzy AHP for optimal power substation location selection	International Journal of Multicriteria Decision Making	To develop a more appropriate power substation location evaluation and selection model	A group of seventeen experts was considered. Three rounds were conducted to achieve the results.	Kabir and Hasin (2013)
Challenges and opportunities of digital information at the intersection of Big Data Analytics and supply chain management	International Journal of Operations & Production Management	To contribute with the SCM theory building about the use of Big Data Analytics	A group of twenty international experts was considered. Three rounds were conducted to achieve the results.	Kache and Seuring (2017)
Information sharing across multiple supply chain tiers: A Delphi study on antecedents	International Journal of Production Economics	To empirically explore antecedents associated with information sharing across the supply chain	A group of twenty-nine experts was considered. Three rounds were conducted to achieve the results.	Kembro, Näslund and Olhager (2017)
Delphi study on supply chain flexibility	International Journal of Production Research	To enumerate the characteristics, and their importance, in making supply chain more flexible	It was considered a group of one hundred participants. The group was formed by managers, directors and CEO from diverse companies. Three rounds were conducted to achieve the results.	Lummus, Vokurka and Duclos (2005)
Factors affecting location decisions in international operations – a Delphi study	International Journal of Operations & Production Management	To point the factors that influence the international location decisions for manufacturing operations	A group of twenty experts (academics and government officers) was considered. Two rounds were conducted to achieve the results.	Maccarthy and Atthirawong (2003)
Mapping the future of supply chain management: a Delphi study	International Journal of Production Research	To report issues and challenges of the supply chain management	A group of nineteen experts was considered. Two rounds were conducted to achieve the results.	Melnyk et al. (2009)

Chart A.1 – Delphi-method adoption in the fields of operations management, production planning and control and supply chain – *Continuation*

A quality management model for integrated care: results of a Delphi and Concept Mapping study	International Journal for Quality in Health Care	To identify the elements and clusters of quality management model for integrated care	A group of thirty-five experts was considered. Three rounds were conducted to achieve the results.	Minkman et al. (2009)
Supply Management Strategies for the Future: A Delphi Study	The Journal of Supply Chain Management: A Global Review of Purchasing and Supply	To understand which procurement and supply chain management may lead to improvements for the 5-10 years.	A group of one hundred experts from Fortune 1000 firms was considered. Three rounds were conducted to achieve the results.	Ogden et al. (2005)
Key themes and research opportunities in sustainable supply chain management – identification and evaluation	Omega	To obtain a better understanding about dynamics and influential themes in supply chain	A group of thirty-five experts was considered. Three rounds were conducted to achieve the results.	Reefke and Sundaram (2017)
Sustainable supply chain management: A closed-loop network hierarchical approach	Industrial Management & Data Systems	To evaluate sustainable supply chain management performance	The group was composed by five professors and six management professionals.	Tseng, Lim and Wong (2015)
Analysis on supply chain risks in Indian apparel retail chains and proposal of risk prioritization model using interpretive structural modeling	Journal of Retailing and Consumer Services	To discuss the selective risks associated with the apparel retail supply chains in India and to propose a new model for the Risk Priority Number	A group of twenty experts was considered. Two rounds were conducted to achieve the results.	Venkatesh, Rathi and Patwa (2015)
Scenarios for the logistics services industry: A Delphi-based analysis for 2025	International Journal of Production Economics	To present an understanding about the future of the logistics service industries in the year 2025	A group of thirty experts was considered. Two rounds were conducted to achieve the results.	von der Gracht and Darkow, (2010)

Source: Prepared by the author

APPENDIX B – INFORMATION TECHNOLOGIES AND SYSTEMS FOR DD PHENOMENON

Chart B.1 – Information Technologies and Systems for the DD phenomenon

Technology	Authors	Number of Publications	Main Contributions
Point-of-Sales (POS) data			Because of POS data comes from the end customer, it promotes collaboration because of visibility creation of customers' demand and behavioral tendencies. POS data shared among the partners also can improve the service level, enhancing the planning of sales and production and coordinating the demand information precedence. POS data can be the input of other technologies, such as the DRP/ERP, in order to make available current and real information of the customer.
Radio Frequency Identification (RFID)	Asare, Brashear-Alejandro and Kang (2016); Bvuchete, Grobbelaar and Van Eeden (2018); Hadaya and Cassivi (2007); Dreyer et al. (2008); Ganji, Shah and Coutroubis (2018); Jones and Clarke (2002); Li and Zuo, (2011); Mason, Lalwani and Boughton (2007); Verdouw et al. (2011)	9	RFID allows companies to minimize errors of getting product's information, make the information be available in a faster and more confident manner. It is an alternative to barcodes, and it may be considered more agile, because of the tags and antennas (collecting real-time data). RFID can be integrated with other technologies, such as sensors. RFID is an important technology to enhance supply chain visibility / collaboration and it also can be used to control the production. The use of RFID is increasing in industries, because of the technology development and more accessibility in terms of costs.
Sensor Technologies / Electronic Product Code Information Systems (EPCIS)			Sensor technologies can be used to online information of the products and give visibility to manufacture and resource and development areas to improve their processes. The same for EPCIS systems that enables to have real-time information from products
Barcode			Barcode enables the supply chain visibility. Considering the POS management, barcodes can provide detailed, accurate and current information, having a direct impact on the inventory management. Barcodes also contributes to visibility.
Enterprise Resource Planning (ERP) / SAP	Basaez et al. (2014); Bozutti and Esposto (2019); Brown (2012); Farahani, Akkerman and Wilke (2014a); Hao, Wu and Li (2012); Verdouw et al (2010)	6	ERP has essentially the goal to integrate processes among a company's areas. ERP may be customized to improve integration processes along the supply chain (i.e., customer relationship management and supply relationship management). Some ERP providers, such as SAP, has developed solution to integrate Kanban, supporting pull-based manufacturing. The companies' processes could be modelled in the ERP by standard solutions or customized, if applicable.
Cloud-based Systems, Big Data, Internet of Things (IoT), Internet and Web-bases and Smart Manufacturing	Davis et al. (2012); Ganji, Shah and Coutroubis (2017); Ganji, Shah and Coutroubis (2018); Makatsoris and Chang (2004); Martinelli and Tunisini (2018); Mohammadi and Mukhtar (2012)	6	These technologies and approaches permit cross-company data transactions and analysis, supported by web services; they make part of the Industry 4.0 emergent approach. They also allow to introduce intelligence throughout the manufacturing and supply chain, focusing on customers' needs. Cloud-based systems allows to a better storage and access of the information. Big Data and IoT make companies to be closer to the customer's needs, allowing a better manufacturing production and control and a better product development process (however, it is still a challenge for companies to use effectively these new technologies and tools).

Chart B.1 – Information Technologies and Systems for the DD phenomenon – *Continuation*

Electronic Data Interchange (EDI) / PTX (private trading exchange) / EAI (enterprise application integration)	Asare, Brashear-Alejandro and Kang (2016); Hadaya and Cassivi (2007), Jones and Clarke (2002); Lyons et al. (2005); Makatsoris and Chang (2004); Martino et al. (2017)	6	EDI allows to exchange information among partners in the supply chain. Because of costs, EDI is normally used among the main partners in the supply chain and also because of the particular architecture (expensive) of EDI, it is being changed to web-based technologies. Nonetheless, EDI brings the benefit of integration among key partners.
Development Languages / (Service-Oriented Architecture) SOA	Makatsoris and Chang (2004); Mohammadi and Mukhtar (2012); Verdouw et al., 2010)	3	Development languages allows companies to integrate their systems. SOA makes companies be able to minimize the silo's effects by breaking them into recyclable services (being or not being supported by web services). This increases integration, flexibility and agility in enterprises, because of a business process orientation during information modeling.
Advanced Planning Systems (APS)	Cid Yáñez et al. (2009); Tinham (2006)	2	APS can consider both forecasts and actual demand to optimize the production flow, having a positive impact on customers' satisfaction (improving the on time, in full metric) and to reduce overall inventory (but, the introduction of upstream demand is still a challenge for the companies).
3D printing			3D printing and collaboration allows to interlink part supplier and buyers, by sharing the same view in a virtual collaboration workspace. This approach also improves the democratization of the product, always to satisfy customers' needs. This technology is also in the context of the Industry 4.0
Computer-aided design (CAD) / Computer-assisted manufacturing (CAM) and prototyping	Hadaya and Cassivi (2007); Makatsoris and Chang (2004); Martinelli and Tunisini (2018)	3	CAD/CAM can improve the manufacturing execution. By using CAD and prototyping companies could be able to have automatic production without the use of shape-defining tooling.
Manufacturing Execution Systems (MES)	Li and Zuo (2011); Tinham (2006)	2	MES aids to develop and systemize the detailed production planning, by getting online information from the shop-floor. It also helps to account of availability of raw materials, assemblies and real-time constraints.
Business Intelligence (BI) / Data Mining	Dreyer et al. (2008); Qinghua et al. (2010)	2	BI helps companies to make decisions by providing information processing. It could work jointly with other technologies such as EPICS, RFID and advanced ERP-systems. Data mining that works jointly with BI, can also support the decision making, by working with the information.
Event Management Software (EMS)	Brown (2012)	1	EMS could help companies to have visibility through the supply chain by being a reliable technology that serves people and processes improvement.
Distribution Requirements Planning (DRP)	Li and Zuo (2011)	1	DRP obtains customer information to improve sales forecasts accuracy on customers' needs. This technology could help to have a better internal integration.
Electronic Kanban	Laksham (2013)	1	By using the electronic Kanban, companies could avoid the bullwhip effect. Kanban can also be implemented with the use of technology. An electronic dashboard can be used to create visibility.

Source: Prepared by the author

APPENDIX C – PROCESSES AND APPROACHES FOR DD PHENOMENON

Chart C.1 – Processes and Approaches for the DD phenomenon

Processes / Approaches	Authors	Number of Publications	Main Contributions
Collaborative Planning, Forecast and Replenishment (CPFR)	Asare, Brashear-Alejandro and Kang (2016); Bvuchete, Grobbelaar and Van Eeden (2018); Chan and Chung (2004); Dreyer et al. (2008); Hadaya and Cassivi (2007); Jones and Clarke (2002); Makatsoris and Chang (2004); Mendes, Leal and Thomé (2016)	8	CPFR is a concept that allows companies to be more collaborative in the supply chain by having unique and more accurate planning and forecasts (considering sales, procurement, replenishment, production and logistics) numbers, thus, the products replenishment across the supply chain tends to be more effective, while the total inventory is expected to be minimized and flexibility and agility is expected to be maximized. Technologies can be used to become the process more agile and confident. Considering the DD phenomenon, real-time information should be dealt to obtain proper results. A barrier for the CPFR implementation can be the information sharing itself among the partners (i.e., confidence among partners).
Vendor-Managed Inventory (VMI)	Asare, Brashear-Alejandro and Kang (2016); Bvuchete, Grobbelaar and Van Eeden (2018); Cid Yáñez et al. (2009); Dreyer et al. (2008); Ganji, Shah and Coutroubis (2017)	5	VMI allows the companies to rapidly respond to customer needs when well implemented and has proven positive results of its application. Some abilities are necessary to implement VMI, such as, manage consigned inventory, to be aligned with tributary issues and correctly replenish the inventory, in time, quantity and product type. VMI is an approach that move companies to be more collaborative in the supply chain phenomenon, thus, in accordance with DD phenomenon requirements.
Supply Chain Operations Reference (SCOR)	Cassivi et al. (2004); Lo et al. (2005); Mendes, Leal and Thomé (2016); Verdouw et al. (2010); Verdouw et al. (2011)	5	The Supply Chain Operations Reference (SCOR), established by Supply Chain Council in 1996 (SELLITTO et al., 2015) and endorsed by APICS Supply Chain Council (APICS SCC) (APICS, 2017) is hierarchical cross-functional processes reference model (ROTARU; WILKIN; CEGLOWSKI, 2014) developed (based on satisfying the customer's demand) to provide a structured framework to guide the supply chain management implementation, planning, control, evaluation and comparison (LIMA; CARVALHO; CARPINETTI, 2016). Dweekat, Hwang and Park (2017) cite that the SCOR is most widespread process-oriented for supply chain processes management. SCOR framework identifies the main process in a supply chain (plan, source, make, deliver, return and enable) (APICS / ASCM, 2017) and allows companies to measure their performance and compare in competitive phenomenon. This framework has been introduced in software which makes easier and faster the metrics measurement. SCOR framework does not provide guidelines to specificities of a company, but it is a recognized model that can support the DD process definitions. SCOR framework has more operational approach than the Global Supply Chain Forum framework.

Efficient Consumer Response (ECR)	Dreyer et al. (2008); Ganji, Shah and Coutroubis (2017); Ganji, Shah and Coutroubis (2018)	3	ECR allows companies to be more integrated in the supply chain based on real-time demand information. Industry 4.0 and other information technologies applications and approaches could make companies able to respond efficiently to their customers. Efficiently respond to the customer is a key driver for the DD phenomenon.
Customer Relationship Management (CRM)	Basaez et al. (2014); Hadaya and Cassivi (2009); Li and Zuo (2011)	3	CRM processes and bolt-ons in the standard ERPs could enhance companies to be more customer-oriented, particularly important for the DD phenomenon. “CRM is a customer-oriented business strategy focused on finding, obtaining, building up, and consolidating a strategic long-term relationship with key and profitable customers, principally using an information system to manage daily customer interactions between a company and its customers” (BASAEZ et al., 2014, p.391). CRM influences supply chain metrics and allows companies to be more effective in the DD phenomenon. CRM also can be an important process for product development, once it is a process which is in touch with customers and, thus, can recognize their preferences.
Lean Manufacturing and Six Sigma Approaches	Ayers, (2006); Brown (2012); Jones and Clarke (2002)	3	Lean approaches and tools are directly related with the DD phenomenon, because they focus on the customer and pursuit the waste elimination, i.e., what is not valuable in a customer view must be dropped-off. This makes companies be more flexible and cost-efficient. Six sigma approach can be applied jointly with lean practices; the focus on six sigma approach is to minimize the variability of products and processes, which is a waste elimination and makes companies be more efficient and cost-effective.
Product Life Cycle Management and Product Development	Ganji, Shah and Coutroubis (2017); Hilletoft, Ericsson and Christopher (2009); Tinhani (2006)	3	New products need to be aligned with production capabilities, workforce knowhow and customer’s expectation. The process of developing a new product must have the participation of the internal (financial, supply chain, marketing, not solely research and development) and, if possible, external stakeholders (key suppliers and/or key customers). Suppliers are very important in this process, because they should be aligned with the demand requirements. In a DD phenomenon the product life cycle should be managed, from cradle to the grave.
Logistics – third party-logistics (3PL), fourth party-logistics (4PL) and cross-docking	Bvuchete, Grobbelaar and Van Eeden (2018); Chan and Chung (2004)	2	“Strategies such as cross docking, optimized distribution through 3PL and responsive and flexible distribution systems are prerequisite requirements for DD Supply Chain Management” (BVUCHETE; GROBBELAAR; VAN EEDEN, 2018, p. 4). 4PL has a more strategic approach that provides integration throughout a framework to be more flexible, low cost and responsive for the market, necessary for the DD phenomenon.

Chart C.1 – Processes and Approaches for the DD phenomenon – *Continuation*

Supplier Relationship Management (SRM)	Basaez et al. (2014); Li and Zuo (2011)	2	SRM processes, such as CRM processes, and bolt-ons in the standard ERPs could enhance companies to be more customer-oriented in the supply chain, particularly important for the DD phenomenon. SRM is the “process involved in selecting, finding, obtaining, keeping track of, and managing important purchasing suppliers, principally using an information system and the Internet (World-Wide Web) to manage daily supplier interactions between a company and its suppliers” (BASAEZ et al., 2014, p. 391). SRM provides a framework to develop and maintain effective relationships with suppliers.
Capable-to-Promise (CTP) and Finite Capacity Scheduling (FCS)	Makatsoris and Chang (2004); Tinhaam (2006)	2	Once the tendency to the DD phenomenon is to be pull-based, the visibility and control of the capacity is essential. Companies has been using more FCS and APS to optimize, planning and control their operations.
Business Process Model and Notation (BPMN)	Mohammadi and Mukhtar (2012); Verdouw et al. (2010)	2	Process modeling in a DD phenomenon needs standard business process modeling. BPMN is an example of language that could be used. BPMN is specially used with SOA and web services execution languages to match with processes and necessities of technologies.
Material Requirements Planning (MRP)	Ayers (2006); Farahani, Akkerman and Wilke (2014)	2	MRP approach deserves special attention in the DD phenomenon. Other technologies could be used to improve MRP functions (such, as SAP/APO, in specific the SNP module) or a different MRP approach as provided empirically and published as book by Ptak and Smith (2016) and evaluated in a conference proceeding by Ihme and Stratton (2015).
Postponement	Farahani, Akkerman and Wilke (2014)	1	Identify, based on customers’ needs and operations capabilities, the products that should be included in a postponement strategy. Postponement may be considering a pull-based approach.
Dynamic Buffer Adjustment (DBA)	Farahani, Akkerman and Wilke (2014)	1	The buffers size should be adjusted dynamically considering the average demand consumption (ADC) and not forecasts, lead times, seasonality, promotions, etc. This is a rate-based approach.
Marketing Planning	Hilletoth, Ericsson and Christopher (2009)	1	The marketing planning has the role of demand creation. It should be included in a DD phenomenon, with other market aspects (research, segmentation, product development, commercialization, sale and life cycle management) to bring a fully understand of customers.

Chart C.1 – Processes and Approaches for the DD phenomenon – *Continuation*

Theory of Constraints (TOC)	Ayers (2006)	1	The author had utilized the TOC to define products types (V-type, A-type and T-type) and to address bottleneck in the manufacturing process. This knowledge of the processes and products is essential to become DD.
Earlier Supplier Involvement (ESI)	Ganji, Shah and Coutroubis (2017)	1	ESI by involving the customer in the initial steps of the product development could aid the company to respond more effectively to the DD phenomenon, because of the product would match with customer's expectations.
Manufacturing Intelligence	Davis et al. (2012)	1	Manufacturing Intelligence is a concept within the Smart Manufacturing which considers companies to lead and respond to a business transformation (with product information and ability to shape to customers' requirements) to demand-dynamic economic, DD supply chain services and workforce involvement and innovation. Smart manufacturing "comprises real-time understanding, reasoning, planning and management of all aspects of the enterprise" (DAVIS et al., 2012, p. 146) and has directly relation with the company's performance. Customization, flexibility and responsiveness should be considered to deliver right information, at the right time and to the right responsible.
Global Supply Chain Forum (GSCF) Framework	Verdouw et al. (2010)	1	The Global Supply Chain Forum Framework is presented on Lambert (2008) and it considers eight main processes to be managed in a supply chain (i.e., customer relationship management, customer service management, supplier relationship management, order fulfillment, manufacturing flow management, product development and commercialization, demand management and returns management). In a DD phenomenon such model, due to its strategical approach, could help companies to integrate internally and externally via relationship management.
Quick Response (QR) and Automated Replenishment Programs (ARP)	Dreyer et al. (2008)	1	QR and ARP are supply chain concepts being considered to move toward cross-company planning and control. To be effective is necessary to share real-time demand information. It is necessary to change from the plans based on the past to handle DD events.
Sales and Operations Planning (S&OP)	Bozutti and Esposto (2019)	1	The S&OP is a critical process to match the customers' demand with operations. In a DD phenomenon there is not an academic framework for S&OP, but the publications show that such framework is necessary.

Source: Prepared by the auth

APPENDIX D – PROBLEMS, CATEGORIES AND CONTRIBUTIONS OF DD’S PUBLICATIONS

Chart D.1 – Problems, Categories and Contributions of DD’s publications

Problem	Category	Number of Publications	Authors	Main Contributions	%
Development and/or improvement of an algorithm to improve or optimize a process or situation	Logistics, Transport and Distribution	5	Chan and Chung (2004); He et al. (2012); Moshref-Javadi and Lee (2016); Wang and Zhang (2010); Xu et al., (2015)	Goals of collaboration are to reduce costs and increase the customer service level (which is a goal for the DD phenomenon and could be considered in an optimized model) and, for that, supplier can interfere either positively or negatively. Qualitative and quantitative approaches can be used jointly (via fuzzy phenomenon) to improve analysis to obtain better customer services. Focusing on distribution, results show that increasing the number of open depots and the number of vehicles tend to reduce the total latency at the customer. It is important to consider, besides “real-time demand”, the “invisible inventory” which could be in-transit inventory. This will improve the results of the order fulfillment process.	27%
	Supplier Management	3	Parmar et al. (2010); Sawik, (2011); Sawik (2018)	The new complexity nature of the DD phenomenon requires a particular attention to the supplier base management. Risks of delay or delivery fault can be considered in the models to optimize the supplier selection. The risks can be represented in function of costs; thus, the minimization of risks minimizes the costs and the supplier base will be optimized.	
	Supply Chain Scheduling and Decisions	3	Sawik (2009a); Sawik (2009b); Sawik (2014)	Scheduling decisions has direct impact on the level of inventories (thus, in the costs of the companies and supply chain), that’s why algorithms should be developed to improve the scheduling in the supply chain. Such algorithms could consider risks (for instance, disruption risks).	
	Bullwhip effect	1	Cao, Xiao and Sun (2017)	Suppliers has an important and active role in reducing the bullwhip effect. For that, information must be available and shared with them, in order to improve the decision-making process.	
	Production and Planning	1	Cid Yáñez et al. (2009)	The information being promptly available to the production planning is critical to ensure customer service and low costs. Customer-actual-demand, instead of solely forecasting, should be included in the production planning.	
	Facility Location	1	Ho, Lee and Ho (2009)	Customer viewpoints should be considered and not solely supplier viewpoints. Costs should not be the only factor to be considered in facility location, but others like proximity to stakeholders, human resources, risks, flexibility of capacity and quality of life should be considered. The goal is making customers satisfied; thus, they will repeat orders.	

Chart D.1 – Problems, Categories and Contributions of DD’s publications - *Continuation*

Framework Development	Information systems and technologies support	6	Asare, Brashear-Alejandro and Kang (2016); Farahani, Akkerman and Wilke (2014); Lau and Lee (2000); Mohammadi and Mukhtar, (2012); Verdouw et al. (2010); Verdouw et al. (2011)	When implementing information systems and technologies some antecedents should be considered: characteristics of the technology, organizational factors, external factors and relationships. Since 2006 some companies, such as SAP, has implemented in their ERP’s features (for instance, electronic Kanban) that is in accordance with the DD phenomenon. Benefits from the developed frameworks is to contribute to vertical and horizontal integrations, flexibility, responsiveness and velocity of the supply chain network, by an efficient information sharing and being adherent with rapids changes in the supply network. SOA can be an approach to be used when modelling information systems; it requires the liking of the business process modeling and system implementation.	33%
	DD planning concept	3	Farahani, Akkerman and Wilke (2014); Hao, Wu and Li (2012); Verdouw et al. (2010)	By applying DD concepts, the companies become more responsive and are able to significantly reduce inventories. Customer service level is also increased. Cooperation is important and, for that, it is important to avoid “local thinking” through a harmonious atmosphere of common thinking. Efficiency and innovation are goals to be reached. Planning mistakes will always happen, but it is necessary to have lessons learned approach to not repeat the same mistakes. Information sharing is important, thus designed frameworks for the DD phenomenon should consider information systems development and adherence to the processes and people.	
	Product Development / Customization	1	Verdouw et al. (2011)	In engineering-to-order phenomenon is necessary a closer interaction between planning and production development process, once a high level of customization is required. Product development in a make-to-order process is important to be considered in the planning process, because interferes on customers’ expectations.	
	Maturity model	1	Mendes, Leal and Thomé (2016)	The main contribution of the paper is to present a maturity model to allow companies to assess the maturity of their DD processes. When knowing the maturity stage, guidelines to improvement may be suggested and if DD is not still implemented may be suggested guidelines for implementation.	
	Supplier Management	1	Jahani et al. (2012)	Provides an agent-based framework that enhances flexibility, reconfigurability and coordination in supplier selection. The customers’ preference must be taken in consideration when selecting suppliers. The use customers’ preferences historical data should be necessary.	

Chart D.1 – Problems, Categories and Contributions of DD’s publications - *Continuation*

	Order fulfillment	1	Makatsoris and Chang (2004)	The order fulfillment process can be support by e-operations and it has five potential opportunities: (i) automating administrative processes, (ii) new technology ability that can lead to review business’ infrastructure, (iii) supply chain reconfiguration and integration; (iv) intensified procurement processes by electronic buying; and (v) increasing cooperation among partners, increasing parenting value.	
	Visibility improvement	1	Bvuchete, Grobbelaar and Van Eeden (2018)	In the developed framework, it was suggested the utilization of RFId, Barcodes and sensors to enhance the supply chain visibility.	
	Strategy Development	1	Lo et al. (2005)	The strategy has an important role to narrow the gap between operation’s characteristics and constraints and the customer’s expectations. SCOR model can be an option to guideline process in the supply chain (the strategy is within the “plan” process). When focusing on customer is important to understand management philosophies, customer values and operational performance.	
	Logistics, Transport and Distribution	1	Qinghua et al. (2010)	The framework aids companies to face better the market volatility by enhancing the collaboration among partners on a terminal market. The framework, by information sharing (best products for an area, best products for customers, more profitable customers, more profitable products, etc.), also contributes to the business management strategy.	
	Risk Assessment	1	Martino et al. (2017)	To minimize risks, integration and cooperation among the partners in the supply chain are key elements to mitigate risks. Costs reduction and flow optimization are the key elements of risk management, in a fashion DD phenomenon. In the case of a fashion industry, that works with seasons, it important to identify and to define actions to mitigate risk in each season and its particularities.	
Critical Analysis	DD implementation	7	Ayers (2006); Davis et al. (2012); Hadaya and Cassivi (2009); Laksham (2013); Martinelli and Tunisini (2018); Singhal et al. (2018); Tinham (2006)	<p>To become DD (integrating the customer in the company’s decision) is necessary to have a training process to avoid the lack of knowledge of the personnel and to promote collaboration among the stakeholders.</p> <p>Much more attention is paid to capacity management, because of that replenishment is moving from forecast-based to demand-based. These characteristics should be combined with the necessity of responsiveness and velocity and an agile flow of materials.</p> <p>To improve collaboration CRM (or e-CRM) can be implemented. Such process also contributes to product development and innovation. The collaboration also requires real-time information sharing.</p>	51%

Chart D.1 – Problems, Categories and Contributions of DD's publications - *Continuation*

Integration / Collaboration	4	Cassivi et al. (2004); Hadaya and Cassivi (2007); Li and Zuo (2011); Martinelli and Tunisini (2018)	<p>In order to stay competitive in the market, companies should adopt supply strategies that are flexible and customer-oriented. Collaboration must begin inside the company by breaking down department silos. E-collaboration my help to achieve such objective by increasing visibility, velocity and improving data integrity and traceability among supply chain partners.</p> <p>CRM processes and technologies implementation contributes to collaboration among partners in the supply chain.</p> <p>Joint collaboration planning (and a better understand of the collaboration itself) positively affects the strength of relationships. Collaboration also enable partners to have a more successful information technology implementation.</p> <p>One of the main importance of collaboration and integration is the increase of flexibility. Integration must also consider the customer when defining processes and technologies.</p>
Marketing / Demand / Market	4	Dey, Alam and Bose (2010); Dreyer et al. (2008); Hilletoft, Ericsson and Christopher (2009); Waller Dabholkar and Gentry (2000)	<p>Qualitative information from the market should be converted in quantitative information to make easier the decisions. To understand the demand is necessary to be aware of social, economic, market and technological issues (for fast, updated, accurate and online information).</p> <p>To be successful in the marketplace, a synergy development between demand creation and demand fulfillment process is necessary. Companies should differentiate themselves not solely by providing innovative and differentiated products but also by providing innovative and differentiated delivers processes.</p> <p>Marketing also has the role to provide guidelines for product customization.</p>
Information systems and technologies support	3	Basaez et al. (2014); Dreyer et al. (2008); Lyons et al. (2005)	<p>Companies must pay attention to customer requirements to have business success. For that, it is important to have interfirm cooperation; CRM and SRM technologies can support such goal, by providing closer, faster and more efficient communication.</p> <p>Information should be continuously updated and accurate. If possible, companies should work with real-time information, thus new technologies platforms are required for supply chain planning and control in a DD phenomenon.</p>

Chart D.1 – Problems, Categories and Contributions of DD’s publications - *Continuation*

Product Development	2	Ganji, Shah and Coutroubis (2017); Hadaya and Cassivi (2009)	Functional products need an efficient (in terms of production, transport and inventories) supply chain network to be delivered to the customers. Innovative products need a flexible supply chain. To develop a sustainable product, marketing must be integrated in the process as well as manufacturing (and manufacturing and marketing should share information between them). The CRM (even e-CRM) should be one of the inputs for the product development, once this process makes the bridge between the company and the customers. CRM impacts directly on product innovation in a DD phenomenon.	
Lean Production and Six Sigma	2	Brown (2012); Jones and Clarke (2002)	DD phenomenon requires customer focus (mapping the value stream) and flexibility, which is adherent with the lean practices and tools, obtaining inventory optimization, continuous improvement and waste elimination.	
Logistics, Transport and Distribution	1	Mason, Lalwani and Boughton (2007)	Horizontal and vertical collaboration have positive effect on the transport and distribution systems (improving their performance). Transport collaboration is not just about costs minimization, but it is also about creation of value with improved customer service and improve visibility of the supply chain.	
Big data	1	Singhal et al. (2018)	Big data analysis can improve the quality of the decision-making process. This scenario brings the necessity of information systems scope’s enlargement and takes in consideration the use of real-time data. By sharing data, distribution process also tends to be improved.	
Smart Manufacturing	1	Davis et al. (2012)	This paper brings the concept of smart manufacturing, that integrates the intelligence of the customer in the manufacturing. This is in accordance with the needs of the DD phenomenon. Business, operations, management, workforce and manufacturing should be integrated with the support of information systems, i.e., smart manufacturing, in order to be competitive.	
S&OP	1	Bozutti and Esposto (2019)	S&OP is a critical process for the DD phenomenon, but framework development for the process and metrics are still required.	
Education	1	Grandzol and Grandzol (2018)	The paper presents an innovative and interactive manner to teach DD concepts, by using simulation and active participation of the students.	2%

Source: Prepared by the author

APPENDIX E – PUBLICATIONS GAPS AND FUTURE RESEARCH PROPOSALS FOR DD

Chart E.1 – Publications gaps and future research proposals for DD

Gap Category	Gap Subcategory	Gap Details	Future Research Proposals	Authors
Algorithms	Supplier Management	1- The developed algorithms do not consider uncertainty during the clustering process.	1- The model used to cluster considering uncertainty, solely used categorical data. Numerical data can be used. The same model can be test with more subjective stopping criteria and the use of a real-industry data to test the algorithm.	
		2- How to allocate orders for parts among various suppliers in order to fulfill customers' orders, improve service level and mitigate risks of supply chain disruptions.	2- To not consider that all suppliers are able to manufacture all required parts. To consider a discount phenomenon, in which the supplier offers discounts based on quantity of purchased parts. To assess a practical application of the algorithm.	1- Parmar et al. (2010) 2- Sawik (2018)
		3- Few studies about supplier selection in a make-to-order manufacturing phenomenon and do not consider precisely the risk of disruptions.	3- Further studies are necessary to estimate the probabilities of the risks and the associated costs with delay risks. To combine scenarios of disruptions considering natural or man-made disasters. To select a dynamic, multi-period supply portfolio with joint decisions (what, where and when to order, for instance).	3- Sawik (2011) 4- Jahani et al. (2012)
		4- Abstinance of a framework that considers multidimensional information to select a supplier.	4- To develop a prototype and improve the proposed framework.	

Chart E.1 – Publications gaps and future research proposals for DD– *Continuation*

Logistics / Distribution and Inventory	<ol style="list-style-type: none"> 1- The literature of disaster relief location-routing does not consider the total latency minimization. The literature solely considers the maximization of the satisfied demand. 2- Researches have been considering operations indices, but customer's expectations have not been considered. 3- The majority of related research on supply chain coordination to define economic lot sizes considers simplified scenarios, i.e., a single finished product or a linear demand pattern. The models cannot be applied in complex scenarios, i.e., multi-product, make-to-order and arbitrary demand pattern. 4- Prevalent cost-based or precision-based optimization techniques have not considered quantitative and qualitative factors. 	<ol style="list-style-type: none"> 1- To consider capacitated depots and limited resources (thus, all of the demands are not satisfied) and analyze the scenarios. 2- To test the provided proposition and to extend the proposition by adding additional constructs 3- Additional features can be considered in the approach, i.e., manufacturing and supply of both specific and common parts, when products contain different parts or manufacturing and supply by different suppliers with different locations, shipping capacity limits, transportation time and other features. 4- To consider more case researches in different industries in order to create the possibility of the model generalization. 	<ol style="list-style-type: none"> 1- Moshref-Javadi and Lee (2016) 2- Xu et al. (2015) 3- Sawik (2009a) 4- He et al. (2012)
Manufacturing	<ol style="list-style-type: none"> 1- Most of the optimization tools for a multi-criterion genetic algorithm can only optimize one single factor. 2- Most of the existing supply-production-distribution models do not consider complex, multi-product, maker-to-order and arbitrary demand-pattern. 3- Lack of studies to define a manufacture that can work with time, synchronization, integrated performance metrics and cyber-physical-workforce requirements. 	<ol style="list-style-type: none"> 1- To compare the algorithm with other functions of the supply chain. 2- To analyze scenarios in which suppliers are not able to provide all part types. To enhance the model to simultaneously consider the single and multi-period orders. 3- To improve the findings of risks and uncertainty of the phenomenon and their impact on the social and business phenomenon. To improve the findings and concepts of smart manufacturing related to IoT and Big Data. 	<ol style="list-style-type: none"> 1- Chan and Chung (2004) 2- Sawik (2009b) 3- Davis et al. (2012)

Chart E.1 – Publications gaps and future research proposals for DD– *Continuation*

Bullwhip effect	1- Lack of studies considering simulation approaches to study the bullwhip effect on retailer's ordering.	1- Consider other approaches, besides simulation, to analyze the bullwhip effect. And consider other participants of the supply chain.	1- Wang and Zhang (2010)
	2- The bullwhip effect would be different in a DD supply chain, and this needs further studies.	2- To expand the study for more than one supplier. To consider other variables than price and demand.	2- Cao, Xiao and Sun (2017)
Planning process	1- The impact of the product availability and inventory management in the fast-moving consumer goods (FMCG) industry.	1- To improve the simulation model by using mathematical and statistical algorithms to consider demand patterns and offer appropriate revisions.	1- Farahani, Akkerman and Wilke (2014)
Facility Location	1- In previous studies only quantifiable data have been considered. Previous researches tended to make mathematical formulation and apply exact algorithms or heuristics methods.	1- To conduct cases researches in order to validate the approach	1- Ho, Lee and Ho (2009)
Supply Chain Management	1- Supplier selection considering disruption risks are limited, considering the risks of disruptions in the supply network.	1- To consider on equitably efficiency considering simultaneously service level improvement and costs minimization. Other dimensions should be also considered, such as responsiveness and supplier capacities.	1- Sawik (2014)

Chart E.1 – Publications gaps and future research proposals for DD – *Continuation*

Analysis	System implementation and technologies			
		1- To obtain the information from a terminal market in real-time and adjust the business strategy and the impacts of the real-time data in the supply chain	1- To make more tests about the proposed system and to have a deeper understanding about the related processes. To have a better understand of the impact of the real-time information is necessary to develop new control concepts, principles and algorithms, a unified control model for the supply chain, new collaborative models and contract types, new working phenomenon.	1- Qinghua et al. (2010); Dreyer et al. (2008)
		2- Lack of visibility and how information can support.	2- Besides the role of the visibility, manufactures activities, forecasting tools, auto-ID data, consumption patterns and plans can be analyzed.	2- Bvuchete, Grobbelaar and Van Eeden (2018)
		3- The impact of Big Data.	3- To conduct cases researches and/or surveys to provide improvements to the proposed framework.	3- Asare; Brashear-Alejandro and Kang (2016)
		4- Few literatures of supply chain or inter-firm technology adoption, considering the B2B scenario and the necessity of collaboration and visibility.	4- To conduct cases researches and/or surveys to a better understanding of the Big Data influence on DD Phenomenon	4- Singhal et al. (2018)
		5- Lack of research references considering an architectural framework for formulate data interchange among partners in a supply chain phenomenon	5- To analyze other technologies besides the considered. To conduct cases researches and/or surveys to provide improvements to the proposed model.	5- Lau and Lee (2000)
		6- How web-services and Internet compared to EDI influence the customer-driven supply chain operations.	6- To test the schedule and/or forecast stability. To analyze a complete explosion of the bill of materials (BOM) and the influence in the system.	6- Lyons et al. (2005)
		7- Improvements in the modeling processes of DD supply chains and the impact of the SOA.	7- Improvements and impacts of other perspectives to collect business process. Better approaches to improve the interaction and communication between services and business processes. To consider aleatorily events in the modeling process.	7- Mohammadi and Mukhtar, (2012)
		8- Lack of studies considering the impacts of bolt-on in the ERP to customize business functions	8- To conduct more cases researches and/or surveys in order to validate the findings.	8- Basaez et al. (2014)

Chart E.1 – Publications gaps and future research proposals for DD – *Continuation*

DD implementation	1-	Analysis of the difficulties to implement the DD approach and to integrate the customer's expectations into the business strategies.	1-	More practical and empirical evidences to improve and validate the findings.	1-	Laksham (2013); Tingham (2006), Lo et al. (2005); Ayers (2006)
	2-	To implement DD strategy in an aquaculture phenomenon.	2-	Apply the studies to other industries and sectors.	2-	Dey, Alam and Bose (2010)
	3-	Abstinance of studies proposing coordination among marketing and supply chain management activities, in order to demand creation being aligned with demand fulfillment process.	3-	To study the relationship between product development and supply chain management. To propose a framework to design, develop and manage responsive supply chains with the development and function as a critical starting point.	3-	Hilletoft, Ericsson and Christopher (2009)
	4-	Linkages between DD phenomenon and lean production approaches	4-	More practical and empirical evidences to improve and validate the findings.	4-	Brown (2012); Jones; Clarke (2002)
Concepts	1-	Abstinance of a framework for the DDS&OP	1-	Final framework development for the demand- driven S&OP. Cases researches of applications of the demand- driven presented approaches. Performance implications of the DDS&OP. Development of a performance framework for the DDS&OP.	1-	Bozutti and Esposto (2019)
	2-	No clear difference between customer-driven supply chains and customer centric supply chains.	2-	To reformulate queries with different keywords for the systematic literature review. Practical and empirical evidences to improve and validate the framework.	2-	Martinelli and Tunisini (2018)
	3-	No clear definition of the term integration.	3-	More practical and empirical evidences to improve and validate the findings.	3-	Li and Zuo (2011)
	4-	Abstinance of discussion of collaboration.	4-	More practical and empirical evidences to improve and validate the findings.	4-	Hao, Wu and Li (2012)
	5-	Lack of literature considering the trade-offs between market-oriented strategies, supply chain costs and innovative solutions.	5-	The effects of upstream postponement on supplier relationships. The effects of distribution postponement on customers and distributors.	5-	Waller. Dabholkar and Gentry (2000)

Chart E.1 – Publications gaps and future research proposals for DD – *Continuation*

Supply Chain Management (Collaboration / Integration)	<ol style="list-style-type: none"> 1- Very little researches have focused on the preparation for collaboration between partners. 2- Few studies tried to assess the impact of collaboration tools on the performance of the supply chain. 	<ol style="list-style-type: none"> 1- To investigate the impact of joint collaboration planning actions. To test the model on different supply chains. Test the model on both first- and second-tiers suppliers. Test the model on supplier/manufacturer relationships. 2- To perform the research in other types of supply chains. To evolve the approach to more precise performance measuring manners. 	<ol style="list-style-type: none"> 1- Hadaya and Cassivi (2007) 2- Cassivi et al. (2004)
Product Development	<ol style="list-style-type: none"> 1- Lack of studies considering the DD phenomenon and the new product development, considering the use of Big Data and IoT. Lack of DD frameworks. 	<ol style="list-style-type: none"> 1- Improve the discussion of the impacts about bolt-on extensions (for instance, CRM and SRM) to support the product development. To conduct more case researches and/or survey about the theme. To understand the cross-organizational association with the product development and the DD. Create a framework to provide integration and minimize risks. 	<ol style="list-style-type: none"> 1- Ganji, Shah and Coutroubis (2017); Ganji, Shah and Coutroubis (2018)
Logistics/ Distribution	<ol style="list-style-type: none"> 1- The management of freight transport in a phenomenon of collaboration, considering a reengineer of the supply chain to be responsive to customer's need. 	<ol style="list-style-type: none"> 1- To conduct more case researches. To study how change management can contribute with the process of moving from silos to a process-oriented approach in order to contribute to logistics collaboration. Further studies considering automation of administrative jobs are also recommended 	<ol style="list-style-type: none"> 1- Makatsoris and Chang (2004); Mason, Lalwani and Boughton (2007)

Chart E.1 – Publications gaps and future research proposals for DD – *Continuation*

Modeling	Supplier and/or Customer Relationship Management	1- Few studies have addressed and studied the importance of integration between e-CRM and others firm's information system.	1- To expand the study to other sectors (it was considered wireless communication equipment). Diverse case studies should be conducted. To expand the study considering all stages of the e-CRM. To assess the e-CRM role in the organizational product development process considering different types of supply chain.	1- Hadaya and Cassivi (2009)
	Risk Assessment	1- There is not a detailed and structure analysis of all-risks' factors connect to each supply chain process.	1- The paper has focused on the fashion companies. Studies in other industries are recommended to improve and validate the findings.	1- Martino et al. (2017)
	DD supply chain	1- No applications of supply chain modelling considering the combination of high-level models to more detailed models 2- Abstinance of a maturity model for DD supply chains 3- No reference model for fruit supply chains. The models were used in the design of software application, and not to guide workflow in run-time.	1- To test and to implement the proposed framework to validate and improve it. Implementation in SOA platforms should be also further researched. 2- To use a simplified AHP model to weight the different categories and components of the DD supply chain model. Application of the maturity model in other industries and countries. 3- To embed the reference model in order that the business-driven development is ensured, and model be manageable and robust. The model should be detailed for specificities of the companies. Adapt the model to other industries (extension of the model's scope)	1- Verdouw et al. (2011) 2- Mendes, Leal and Thomé (2016) 3- Verdouw et al. (2010)

Chart E.1 – Publications gaps and future research proposals for DD – *Continuation*

Teaching	Manufacturing	1- No previous studies have covered a price-based push strategy to meet the market needs in a timber industry.	1- The evaluation of the trade-off between premium value and the contract level, considering the profit maximization context	1- Cid Yáñez et al. (2009)
	Active teaching-learning methodology	1- Abstinance of tools and approaches to actively teach the DD concepts.	1- To test the simulation-teaching approach and give contributions either for DD or for supply chain topics.	1- Grandzol and Grandzol (2018)

Source: Prepared by the author

APPENDIX F – PROBLEMS, CATEGORIES AND CONTRIBUTIONS OF S&OP PUBLICATIONS

Chart F.1 – Problems, Categories and Contributions of S&OP publications

Problem	Category	Number of Publications	Authors	Main Contributions	%
S&OP Process	Process change/ design assessment	19	Bower (2018); Chase (2013); Covas (2016); Dreyer et al. (2018); Gray and Dougherty (2017); Grillo (2014); Ivert et al. (2015b); Jonsson, Rudberg and Holmberg (2013); Kelleher (2012); Kruse (2004); Lapide (2014b); Lapide (2016); Larsson and Fredriksson (2019); Lee (2013); Moon and Alle (2015); Noroozi and Wikner (2017); Sorensen (2013); Walters (2008); Wilson and Raman (2017)	<p>The S&OP process assumes a more strategic perspective with integration with customers and suppliers. A case research conduct at IKEA showed a centralized supply chain planning, in which the S&OP had a more strategic approach to plan supply and demand (this can be achieved by supply chain integration, standardization, specialization and learning effects); the results were low-cost production and efficiency. On the other hands, the S&OP can assume a more operational approach in order to be able to respond quickly to demand and/or supply variations during the monthly cycle.</p> <p>It is important to notice that S&OP should be adapted depending on the applicable environment; thus, the “one-size-fits-all” approach cannot be applied (a case research conducted at Hollister suggested a matrix comparing product volume and variability with the S&OP planning frequency). This is in accordance with the previous described characteristics, once the S&OP can be applied in retails, service industries and hospitals, beside manufacturer companies. Additionally, the S&OP process cannot be static and should always being improved.</p> <p>The technology began to have a more critical participation in the S&OP process (use of APS, POS data, internet data, business analytics and mathematical modeling); thus, the traditional spreadsheets may not contribute solely and effectively to the S&OP goals. The S&OP must be proactive and work with data-driven events. Considering events, event-driven meetings can be conducted to fill gaps that could occur during the monthly cycle.</p> <p>Product portfolio review and product life cycle, financial management, what-if and scenario analysis, demand sensing, demand shaping, and risk management gained importance in the S&OP process.</p> <p>The main obstacle to process changes or design normally are cultural and organizational. In this sense, management has an important role to contribute to the value generation during the meetings and value deliver to the customers.</p>	77%
	Demand-driven approach	9	Bozutti and Esposto (2019); Burrows III (2007); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Gollamudi (2013); Kohler and Pukkila (2016); Payne (2015); Ptak and Smith (2018)	<p>The demand-driven approach has becoming a reality to the competitiveness environment. Thus, new models for the S&OP be were provided. The main differences, comparing to the traditional S&OP process, is the improvement of steps in the S&OP process, with the aim to obtain a more strategic approach (through an increased intimacy among S&OP and product development areas, financial areas and market intelligence areas) and a more operational approach (through event-driven meetings, misalignments identification during the month, what-if and scenario analysis and shorter planning cycles during the monthly S&OP process).</p>	

Chart F.1 – Problems, Categories and Contributions of the publications - *Continuation*

Maturity model assessment / S&OP effectiveness	8	Caulfield (2013); Danese, Molinaro and Romano (2018); Dantas (2016); Godsell, Birtwistle and Van Hoek (2010); Grimson and Pyke (2007); Keal and Hebert (2010); Lapide (2005b); Swaim et al. (2016)	<p>Lapide (2005) provided a 4-stage maturity model, that describes from marginal S&OP process to an ideal S&OP process. On the other side, Grimson and Pyke (2007) considers a 5-stage maturity model, that describes from a non-S&OP stage to a proactive-S&OP stage. The maturity models normally consider the degree of organizational integration, standardization of the S&OP process, how S&OP decisions have priorities in the company and how the organization has engagement to conduct the S&OP activities.</p> <p>When the S&OP has a high level of maturity, it reacts quickly to misalignments between supply and demand, it has a high level of internal and external collaboration, high involvement of people, it contributes to drive decision making in a shorter time horizon and it has an ideal use of technology. With this high maturity level, companies will have a more accurate demand and supply forecasting and matching and improvements in production and order fulfillment.</p> <p>To evolve from a stage to another is important to consider some key dimensions: people and organization, process and methodologies, information technology and performance measurement.</p>
Coordination Mechanisms / Integrated solutions	7	Esper et al. (2010); Li, Shakya and Owusu (2018); Oliva and Watson (2011); Ralston et al. (2015); Storbacka (2011); Tuomikangas and Kaipia (2014); Wagner, Ullrich and Transchel (2014)	<p>Coordination mechanisms can help managers to have a better understanding to enhance cross-functional planning and decision making and this should be considered in the S&OP process (and this is an organization-wide process that transverses the company politics and functional domains, providing a more effective e efficient business running). Some mechanisms and found integration solutions are: for commercialization (value research, value proposition, value qualification and value verification), for industrialization (solutions development, solutions availability, solution configuration and solution delivery), for solution platform (strategy planning, management system, infrastructure support and human resources management). In this sense, such decisions should have a strategical approach. Thus, a coordinate S&OP process do more than simply coordinate information, it solves requirements of simultaneous demand and supply management.</p>
Collaborative Forecasting Process and Demand Planning	5	Baumann (2011); Lapide (2014a); Nakano (2009); Smith, Andraski and Fawcett (2011); Suurmond (2016)	<p>The collaboration among suppliers and customers to develop the forecasts, normally, has an effective effect on the supply chain companies. To have a collaborative forecast is important to integrate various elements: sharing operational information, joint planning, joint establishment of objectives and redesign work routines and processes).</p> <p>CPFR is an approach that have being integrated to the S&OP process in order to obtain a more collaborative process.</p>

Chart F.1 – Problems, Categories and Contributions of S&OP publications - *Continuation*

Collaboration and Information Sharing	3	Kaipia et al. (2017); Mello (2015); Plank and Hooker (2014)	<p>One important aspect for the companies is to obtain visibility, thus sharing information (with POS data, for instance) and collaborating with supply chain partners during the S&OP cycle can bring some benefits, such as reduced lead time to product introduction and performance in operations. With information sharing and collaborative S&OP, the production can timely perform changes in order to respond adequately to demand variations (these changes are supported by the S&OP team, so mistakes can be avoided).</p> <p>Some technologies and approaches can be used to improve collaboration: VIM, CPFR, ECR, Retail Event Collaboration, Profile Replenishment, Distribution Center Replenishment and Store Replenishment. If used, such approaches should be integrated with the S&OP process. From customer's side, with a marketing perspective, internet tools (Facebook, LinkedIn, Twitter, Instagram and website-visiting behavior) can be used to obtain information from customers (not solely to B2C marketing but also to B2B marketing) and be considered in the S&OP forums.</p>
S&OP implementation	3	Biazzin, Tomaselli and Costa Pena (2017); Goh and Eldridge (2015); Ivert et al. (2015a)	<p>The studies found five key factors to have a successful S&OP implementation: information technology, inter-functional integration, senior management participant, the understand of the operations and creation of a S&OP area in the company. These factors allow companies to respond effectively to demand and/or supply changes and contribute to the broadness of S&OP (both more strategic and operational).</p> <p>It is also critical to S&OP implementation to consider the new product introduction. Once predictably is low during the new product introduction, it is important to consider shorter planning cycle to sense the demand variation and take corrective actions (SKU planning level and POS data can also be considered to improve the visibility). The process should begin with a portfolio review. Additionally, services levels definition and actions for demand and supply uncertainty should be defined.</p>
Inventory replenishment methodology / Resource Allocation	2	Nielsen, Nielsen and Steger-Jensen (2010); Nucamendi-Guillén, Moreno and Mendoza (2018)	<p>The inventory policies can consider the product's behavior in the marketplace, so the company become able to avoid shortages or excess of inventory. The proposed methodology for inventory replenishment considers two phases: first to obtain an aggregate plan, supported by statistics analysis and tools and the second to obtain the real demand behavior to guide actions to resolve misalignments, if necessary.</p> <p>Another possibility to understand demand independencies, and allocate the right resource at the right time, is to look at the demand as a pull rate instead of volumes and units; for that, it is necessary to establish customer-order decoupling points along the production steps and to have an efficient collaboration with the main suppliers to avoid supply shortages.</p>

Chart F.1 – Problems, Categories and Contributions of S&OP publications - *Continuation*

Information System Assessment	What-if analysis / Scenario Analysis	2	Singh and Lee (2013); Warren (2012)	<p>The what-if and scenario analysis should be executed during the monthly S&OP planning cycle; thus, the S&OP is no longer a once-a-month exercise. Once a misalignment is detected (with the aim of the technology, if necessary), these analyses should be conducted to support the decisions. The analyses may consider, besides volume and units considered in the traditional S&OP process, financial and risk assessments.</p> <p>With both what-if and scenario analyses, companies improve their visibility (strategic, tactical and operational) and could take more effective decisions.</p>
	S&OP for direct-to-consumer case	1	Bower (2017)	<p>This paper contributes with the expansion of the S&OP role, once it can be used by companies that fulfill final customers' orders; but some changes are necessary. The process should begin with a portfolio review meeting, once a combination of SKU's can create a new product for the market. It also necessary shorter cycles to continuously check the issues that can occur during the monthly planning process. It is also important to consider internet-behavior habits and social media inputs.</p>
	Business Analytics	3	Boone, Ganeshan and Hicks (2015); Chae and Olson (2013); Schlegel and Murray (2010)	<p>The companies should be able to integrate information from a variety of places, so data warehouses began to be important to support the report formulation. For that, descriptive statistics, series analysis and advanced analytics are approaches that can be used to support S&OP decisions. Metrics definitions is critical to provide visibility and the development of dashboards can help to aggregate all the necessary information. In this sense, the company should have the information technology necessary to support this data storage and manipulation and should develop analytical dynamic capabilities.</p> <p>The source of the data can vary, and some studies have begun to verify how to use Google Trend Data to support Sales Forecasting (which is an activity of the S&OP process). Trends of economy and risk management approach should also be considered.</p>
	Use of APS for S&OP process	2	Ivert and Jonsson (2010); Ivert and Jonsson (2014)	<p>The APS can help the S&OP by providing: decision support (visualization of information, easy access to information, quantifiable what-if analysis and gives an optimal supply plan, for instance), planning efficiency (focus on data quality and simplifies planning activities, for instance) and learning effects (makes planning activities important and results in a good knowledge about planning process, for instance).</p> <p>The studies also explain how APS can support the S&OP processes, considering the individual, technological and organizational dimensions. The effectiveness of the APS usage depends on the extent of complexity within the planning process. A matrix was provided with the aim to support a correct evaluation of the possibility to use the APS in the S&OP process or not.</p>

9%

Chart F.1 – Problems, Categories and Contributions of S&OP publications - *Continuation*

Influences on Performance	Visibility improvement	1	Goswami, Engel and Krcmar (2013)	The proposed framework was based on the major dimensions of visibility to provide scholars and practitioners guidelines to compare two Supply Chain Information Systems: SAP-APO and SupplyOn systems.	6%
	Extended Supply Chain and Firm Performance	1	Rokonuzzaman (2018)	Some key determinants were found to have an effective S&OP and Supply Chain Integration: (i) need of an open-flow information; (ii) changed marketing plans with the S&OP and supply chain synchronization; and (iii) consider the key relational and procedural functionalities in the entire S&OP and supply chain processes. The proposed conceptual model considered information systems (including web-based services), environmental analysis (economic, new entrants, technological and demand shifts) and customer relations (with the support of the customer service). It is expected that the proposed model affects positively the operational and financial performance of the focal firms.	
	Agile approach affecting the supply chain performance and practices	2	Ross (2004); Tarafdar and Qrunfleh (2017)	It was perceived that agility allows companies to respond quickly to the demand changes and it is critical to a quick new product introduction in the market. It depends on strategy (flexible people, alliances and responsive logistics, for instance), systems (e-commerce, ERP and CAD/CAE, for instance), people (knowledge workers, top management support and empowered workers, for instance) and technologies (rapid hardware and graphical simulator, for instance). The combination with JIT techniques allows the S&OP decisions gain agility as well as supply chain optimization software.	
	S&OP practices affecting firms' performance	2	Thomé et al. (2012b); Thomé, Sousa and Scavarda (2014)	Internal integration (that can be enhanced by the S&OP process) seems to make easier the integration among suppliers and customers. It is also concluded that cross-functional planning process could minimize the negative effect of problems with incentives and misaligned organizational structures. Mathematical modeling, APS, information systems and the presence of financial plans can help to improve the firm performance.	
	S&OP literature affecting S&OP design and performance	1	Kristensen and Jonsson (2018)	The main contribution was to present a future agenda of how context influences the S&OP performance variables. The performance depends on the maturity of the S&OP process. Another important contribution is that the concept of "one-size-fits-all" design approach is no longer applicable for the S&OP process design and improvement; thus, the performance can be affected considering the S&OP context application.	

Chart F.1 – Problems, Categories and Contributions of S&OP publications - *Continuation*

Organizational issues	Managers' influences on a better complexity management	2	Harrison (2009); Turner, Aitken and Bozarth (2018)	A framework was provided with the aim to guide scholars and practitioners to classify complexity and, then, obtaining better decisions taken. This framework can be applied in a Supply Chain context and can interfere in the S&OP activities. Such framework is important because managers have a critical importance in participating, motivating and help the team to take the right decisions to match the supply and demand. Risk management should be applied to manage and change control processes.	4%
	S&OP studies helping managers	1	Thomas et al. (2011)	It was perceived that the most impactful issues for management are regarding the companies' internal supply chain structure, communication and informal exchange, information technology, forecasting and sales and operations planning and leadership from a strategic perspective.	
Supply Chain Management	Supply Chain Practices on S&OP	3	Godsell et al. (2018); Jonsson and Holmström (2016); Jung and Chung (2016)	High maturity levels of S&OP implementation are difficult to be found in practice, considering the Supply Chain Management perspective, thus a future agenda for studies is presented in order to guide research that can have positive practical impacts. The S&OP, Supply Chain Management and Total Quality Management can be combined in order to obtain superior results for the S&OP process and, obviously, for the firm and supply chain performance. Another important point discussed is about "project demand profiling"; with this concept the strategic portfolio planning can be used by the S&OP forums in order to replicate lessons learned and obtain "economies of recombination" in the field of project management.	4%

Source: Prepared by the author

APPENDIX G – PUBLICATIONS GAPS AND FUTURE RESEARCH PROPOSAL FOR S&OP

Chart G.1 – Publications gaps and future research proposals for S&OP

Gap Category	Gap Subcategory	Gap Details	Future Research Proposals	Authors
S&OP	Inventory	1- There are opportunities to study improvements in inventory, demand and transportation management and S&OP in the fashion retail industry.	1- To incorporate efficient methods for determining the initial classification of items. To analyze the effect of ordering policies in costs. To develop a pilot program to assess the proposed methodology.	1-Nucamendi-Guillén, Moreno and Mendoza, (2018)
	Coordination / Integration	<p>1- Literature provides limited understanding of how S&OP can improve firm performance. The understanding of coordination mechanisms is low. Lack of studies considering both internal and external integration in the supply chain.</p> <p>2- Lack of studies considering an integrated vision considering individual processes, organizational aspects and information technology influences. It was also perceived little empirical research in such situations. It is also missing how physical operations can use POS data to take advantage of market visibility.</p> <p>3- Lack of detailed frameworks for cross-functional integration and detailed understanding of interdepartmental integration based on micro-level data.</p>	<p>1- Expand the papers selection about the theme, once it was limited. To study a wide variety of coordination mechanisms to better understand how S&OP needs to implement. Understand the coordination relationship with culture and leadership subjects. Necessity of understanding how firms can improve both forecasting and planning process by collaboration. Further studies to examine collaborative forecasting influences on logistics and production performance. Further studies considering the integration between CPFR and S&OP and information technologies. Necessity of further empirical studies.</p> <p>2- To establish a generally valid framework for centralized supply chain planning. Future case-based researches are also required, considering implementation and change process concepts. To understand the participation of technology, outcomes of S&OP and supply chain implementation and to identify enabling mechanisms for implementation.</p> <p>3- To explore the findings in different case researches. To assess the effectiveness of the processes approaches and their significance on the information-processing framework (information quality, procedural quality and alignment) and the relationship with organizational integration.</p>	<p>1-Baumann (2011); Mello (2015); Nakano (2009); Smith Andraski and Fawcett (2011); Rokonuzzaman (2018); and Tuomikangas and Kaipia (2014)</p> <p>2-Covas (2016); Jonsson and Holmström (2016); Jonsson, Rudberg and Holmberg (2013); Moon and Alle (2015); and Wagner, Ullrich and Transchel (2014)</p> <p>3-Oliva and Watson (2011)</p>

Chart G.1 – Publications gaps and future research proposals for S&OP - *Continuation*

1- Abstinance of how the strategic integration affects the firm performance and lack of empirical tests of the developed solutions.	1- To look into dyadic data or gathering data from the focal firm, suppliers and customers to expand the analysis to a supply chain view. To analyze the relationship between operational and financial performance. To collect longitudinal data to see results of integration and performance over the time. To understand how focal firm can respond more effectively to rivals with the integration efforts.	
2- Despite the conducted researches about interfirm supply chain integration, there is a lack of studies considering intrafirm integration. Abstinance of studies considering the intermediary necessary processes to promote integration.	2- Necessity of empirical studies. To assess specific organizational roles to distinguish how participants view S&OP antecedents, depending on their responsibilities. To benchmark S&OP best practices by segmenting respond firms by S&OP maturity, allowing deeper analyses. To collect secondary data for objective performance measures to solidify the model and incorporate decision biases that lead to S&OP inefficiencies. To understand how data sharing can be fully exploited in the S&OP meetings and forums with the aim of reducing lead time and improving flexibility.	1-Ralston et al. (2015)
3- Lack of studies considering the mismatch between strategic goals and supply chain practices. It is necessary to understand the lessons learnt and practices that improve the business alignment.	3- To perform case researches and surveys to validate and contribute empirically with the findings. To understand how Financial Planning and Analysis and Product Life Cycle can work together with S&OP to obtain strategic alignment.	2-Kaipia et al. (2017) and Swaim et al. (2016)
4- Strategically saying, there is a lack of understanding about the integration among marketing, demand and supply.	4- To expand the finding to integration among partners in the supply chain (customers and suppliers). Further researches should be conducted to describe the nature of demand and supply integration phenomenon, expand the nature of solely demand-side or supply-side integration to a demand-supply integration and explore the role of managers to contribute to obtain high level of integration.	3-Godsell, Birtwistle and Van Hoek (2010) and Wilson and Raman (2017)
		4-Esper et al. (2010)

Chart G.1 – Publications gaps and future research proposals for S&OP - *Continuation*

Business Solutions / Processes design	1- Little research that provides frameworks to aid companies to design business solutions to match customers' requirements with industrialization's requirements.	1- To identify elements in the model that drive configurational fits. To compare how the solution differs from different firms and different business logics. To evaluate how which capabilities or management practices have the biggest impact on firm performance.	1-Kelleher (2012) and Storbacka (2011)
	2- Lack of studies about S&OP considering the service companies, retails, health sector, such as blood banks and hospitals. There are still gaps between theory and practices in such cases.	2- To improve studies about system integration with processes, considering the case of the Australian blood sector. To understanding the lack of cohesion about information in the case of blood banks. To study the logistic and their influence in the S&OP. In the case of the Swedish hospital, the authors consider the necessity to assess other hospitals and, if possible, in different nationalities in order to evaluate the potential of the provided framework. To understand the role of the management, information technology and organization. Further studies are also necessary in other service companies.	2-Caulfield (2013); Dreyer et al. (2018); Keal and Hebert (2010); Grillo (2014); and Larsson and Fredriksson (2019)
	3- Abstinance of a discussion about how S&OP could be adapted in the case of companies that fulfill end-consumer-orders.	3- To perform case researches and surveys to validate and contribute empirically with the findings.	3-Bower (2017)
	4- How to use response management models to respond to market and customer expectations and how to understand the role of the marketing in the S&OP process.	4- Studies of new approaches to strategy, structure and operational implementation of business plan.	4-Chase (2013) and Walters (2008)
	5- Lack of understanding of the demand-driven S&OP.	5- To develop models, metrics and to conduct case researches and surveys to validate and contribute empirically with the findings.	5-Bozutti and Esposto (2019); Burrows III (2007); Burrows III (2012); Cecere (2012); Cecere, Barrett and Mooraj (2009); Gollamudi (2013); Kohler and Pukkila (2016); Li, Shakya and Owusu (2018); Payne (2015); and Ptak and Smith (2018)
	6- Lack of understanding and scarce literature and software solutions regarding terminologies, planning time horizon and no attention to day-to-day work and challenges, considering the S&OP perspective.	6- To develop models, metrics and to conduct case researches and surveys to validate and contribute empirically with the findings.	6-Bower (2018); Kruse (2004); Lapide (2016); Lee (2013); and Suurmond (2016)
	7- Incomplete understanding of the S&OP foundations for the food industry.	7- To perform case researches and surveys to validate and contribute empirically with the findings. To link planning environments variables to different S&OP elements. The contingency role of complexity for S&OP should also be explored. Mathematical modeling is also suggested to be explored in order to have a deep understand about the	7-Ivert et al. (2015a) and Noroozi and Wikner (2017)
			8-Gray and Dougherty (2017); Grimson and Pyke (2007); and Thomé et al. (2012b)
			9-Jung and Chung (2016)

Chart G.1 – Publications gaps and future research proposals for S&OP - *Continuation*

	<p>8- Lack of understanding of the state of the art for S&OP research are limited.</p> <p>9- To find the relationship between S&OP (and other supply chain management practices) and the Total Quality Management (TQM)</p>	<p>explored scenario, as well as the leadership capabilities influences.</p> <p>8- To have a better understanding about S&OP and the firm performance. Lack of studies documenting the S&OP applied and comparing it in different countries, cultures and industries. To develop models, metrics and to conduct case researches and surveys to validate and contribute empirically with the findings. Mathematical modeling is also suggested to be explored in order to have a deep understand about the explored scenario, as well as the leadership capabilities influences.</p> <p>9- It was just analyzed the Samsung's case, so further and different cases should be verified in order to generalize the findings. Solely four kinds of TQM practices were studied, so the other practices should be also studied. To verify the sustainability of the implemented practices at Samsung.</p>	
Environment Complexity	<p>1- Scarce literature considering how S&OP design could face specific uncertainty variables and how it can be integrated with scenario analysis (if possible, with digital modeling and predictive analytics), what-if analysis and risk management activities. The literature is limited considered such supply chain complexity and how interfaces activities (strategic and short-term) should be integrated in the S&OP design.</p> <p>2- Adjustments in the S&OP process to be adherent with a specific planning environment of a company was not been very explored and there is a lack of empirical case researches about the theme.</p>	<p>1- Future case researches and surveys should be conducted in order to assess and to explore how the various effects of context variable affects the S&OP. Thus, companies with a high maturity level of the S&OP should be studied. The contextual, response and performance variable deserve more research considering them integrated. Organization issues should be deeply studied. To perform case researches and surveys to validate and contribute empirically with the findings.</p> <p>2- Future research about the dynamic nature of the S&OP process, considering the enablers, i.e., POS data, information technology systems and short supply lead times for instance. Further case researches in a more variety of companies and surveys are also recommended.</p>	<p>1-Kristensen and Jonsson (2018); Lapide (2014b); Schlegel and Murray (2010); Singh and Lee (2013); and Warren (2012)</p> <p>2-Ivert et al. (2015b)</p>

Chart G.1 – Publications gaps and future research proposals for S&OP- *Continuation*

Project Management	1- Implementation and assessment of S&OP in a project management environment.	1- To perform case researches and surveys to validate and contribute empirically with the findings.	1-Biazzin, Tomaselli and Costa Pena (2017)
Demand Management and Forecasting	1- Abstinance of the proposed method to assess product demand interdependencies. 2- How to use project demand profiling to obtain an initial screening, selection and prioritization of proposals in the context of portfolio management. 3- How to use demand shaping and the importance of demand planning in customer profitability.	1- With the provided results of the demand profile, to translate them in capacity profiles. To develop a quantitative method for the research theme. To assess the demand planning performance by the benchmarking of the planning systems using the time independent demand rate profiles. 2- To perform case researches and surveys to validate and contribute empirically with the findings, including other type of companies. To identify other manners to segment the demand. 3- To perform case researches and surveys to validate and contribute empirically with the findings.	1-Nielsen, Nielsen and Steger-Jensen (2010) 2-Godsell et al. (2018) 3-Lapide (2014a)
Maturity Model	1- Lack of a whole understanding to guide companies to a better understanding of the S&OP process and to guide to an evolutionary path.	1- To conduct case researches and surveys in order to evaluate and analyze the provided maturity model.	1-Lapide (2005a); and Lapide (2005b)
Implementation	1- There is a lack of studies considering the S&OP implementation in the Asia Pacific Region. 2- It is necessary to explore some guidelines to understand the temporal sequence to improve the S&OP, considering the dimensions of the maturity models.	1- To perform case researches and surveys to validate and contribute empirically with the findings, once solely two companies were studied. To expand the studies to other types of SKU. To verify the results in smaller companies. 2- It is recommended further studies in similar and different context in order to corroborate or complement the findings. It is necessary to understand which the influences of growth patterns are considering the context and companies' planning environment. To identify contingency variables to distinguish between contexts in order to create groups of most effective S&OP in each group.	1-Goh and Eldridge (2015) 2-Danese, Molinaro and Romano (2018)

Information Systems	APS	<p>1- Few APS implemented to support the S&OP process and few studies of these implementations and factors that affect APS system to support S&OP process. No studies explored the type of complexity requiring APS system support.</p> <p>2- Many studied considered the design of advanced algorithms to solve planning and scheduling problems, but there is scarcity of studies considering a descriptive nature, with the aim to understand how APS is really used in practice and the benefits of APS for the S&OP process.</p>	<p>1- To evaluate the level of complexity of an organization in which an APS can contribute to the S&OP process. To explore further functionalities of the APS to support the planning process. To perform case researches and surveys to validate and contribute empirically with the findings.</p> <p>2- Considering the finding, the potential benefits and its antecedents were not deeply explored. To evaluate if the APS performance results are valuable compared to its cost. To explore the use of APS considering other process than the S&OP. Finally, to perform case researches and surveys to validate and contribute empirically with the findings.</p>	<p>1-Ivert and Jonsson (2014)</p> <p>2-Ivert and Jonsson (2010)</p>
	Internet-based	<p>1- Lack of studies considering the internet and internet-based tools to support the S&OP process.</p>	<p>1- To understand how interactive marketing tools, make possible to customer participate in the planning process and product development. How internet-based tools can improve the integration in the supply chain. To identify and categorize the best practices considering internet and interactive tools. What practices, concerning the studied theme, can contribute to the ROI enhancement of a company.</p>	<p>1-Plank and Hooker (2014)</p>
	Capabilities	<p>1- Lack of systematic investigation to identify how supply chain systems satisfy the information need of the supply chain participants and scarcity of studies assessing the capabilities of the information systems at a network level.</p>	<p>1- The research solely considered two different types of information system; thus, it is important to evaluate other systems. To perform case studies and investigate how information visibility enhances coordination, decision making and performance gains.</p>	<p>1-Goswami, Engel and Krcmar (2013)</p>
	Business Analytics	<p>1- How to incorporate google trends in the Sales Forecasting</p> <p>2- There is a lack of an adequate framework for the use of Business Analytics in the supply chain practices and processes</p>	<p>1- To perform case researches and surveys to validate and contribute empirically with the findings.</p> <p>2- To perform case researches and surveys to validate and contribute empirically with the findings.</p>	<p>1-Boone Ganeshan and Hicks (2015)</p> <p>2-Chae and Olson (2013)</p>

Software Structures		1- What functionalities the software should have to support the new necessities of the S&OP process.	1- To perform case researches and surveys to validate and contribute empirically with the findings.	1-Sorensen (2013)
S&OP and the firm performance		1- Lack of rigorous and large-scale empirical work relating the S&OP practices and the manufacturing performance.	1- To develop scales for measuring the S&OP process. To perform other cases researches and surveys to make the findings more generic. To understand the impact of supply chain collaboration and integration on the S&OP process and manufacturing performance. To consider contingencies in further studies.	1-Thomé, Sousa and Scavarda (2014)
Performance				
Agility effects		1- Lack of studies explaining how agile supply chains can improve the supply chain performance and their impacts on S&OP process.	1- To examine supply chain practices and strategies, such as lean production, can interfere in supply chain performance. To identify additional conditions to a better customer relationship practice. To conduct case researches in different sector, such as retail or healthcare, for instance.	1-Ross (2004) and Tarafdar and Qrunfleh (2017)
Organization Management issues		1- Lack of understanding about how managers respond to supply chain complexity, considering organization processes and tools. 2- Discrepancy in the understanding of S&OP and supply chain researches are tied with companies' practices or still there is a gap between scholars and practices.	1- To conduct case researches at larger organizations and to examine specific sectors in which there are significant contextual factors which influence a firm's ability to utilize ambidexterity in managing supply chain complexity 2- To continues studies considering a broader view of the supply chain management, if researches want that the researches be considered by managers. Such studies may consider: structure, accountability, ownership, metrics alignment and empowerment.	1-Harrison (2009) and Turner, Aitken and Bozarth (2018) 2-Thomas et al. (2011)

Source: Prepared by the author

APPENDIX H – SURVEY QUESTIONNAIRE

Dear Participant,

We are currently undertaking a research project to develop a framework for the Demand-Driven Sales and Operations Planning (DDS&OP). This project aims to contribute to have a more robust and adherent Sales and Operations Planning (S&OP) process for practitioners and an updated version for academics in the new demand-driven context.

As of part of this research, we are conducting a Fuzzy Delphi Method with experts. This method consists of conducting rounds of a questionnaire answering until an agreement among the participants is reached; it is also supported by the Fuzzy Methodology with the aim of improving the agreement robustness assessment.

During our broad research, it was perceived that the S&OP horizontal and vertical consistencies, previously focused and positioned at the tactical level in the organizations, should be expanded to have more adherence and better results. Thus, according to the references, S&OP should be both more strategic and operational and it should be expanded considering strategic players in the supply chain.

In the following pages, we would like to obtain your opinion as an expert in Demand-Driven Concepts, Sales and Operations Planning, Supply Chain Management, Materials Planning, Production Planning and Control and correlated areas through a survey questionnaire, in which you will be requested to evaluate the importance of the considered processes in the proposed framework (considering a four-point Likert scale).

The information you will provide is valuable for this research and we thank you in advance.

Daniel Fernando Bozutti
PhD Candidate
São Carlos School of Engineering
University of São Paulo

Prof. Dr. Kleber Francisco Espôsto
Advisor of PhD Research
São Carlos School of Engineering
University of São Paulo

Researcher: Daniel Fernando Bozutti, PhD Candidate

Advisor: Prof. Dr. Kleber Francisco Espôsto, Professor at São Carlos School of Engineering – University of São Paulo

INFORMED CONSENT FORM

You are being asked to participate in a research study regarding the Demand-Driven Sales and Operations Planning (DDS&OP). Researcher Daniel Fernando Bozutti is conducting this research under the supervision of Prof. Dr. Kleber Francisco Espôsto. Please, read the information provided in Sections A and B carefully. You should ask the researcher Daniel Fernando Bozutti to explain any sections that are unclear to you and to answer any questions that you may have. If, after deciding to participate in this study, you find you have more questions, you should contact the researcher at the phone number or email given at the end of this form. If you decide to participate in this research, please complete the survey and return it directly to the researcher through email (daniel.bozutti@usp.br or daniel.bozutti@gmail.com) which are also available at the end of this form. Please, keep a copy of this consent form for your records as it contains important information, including names and telephone numbers that you may wish to have in the future. By completing and returning the attached survey, you are consenting to participate in this research. All the information provided by the respondents will not be disclosed and will only be known by the researcher. The individual answers, if published on the study, will not disclose the name of the respondent. Care will be taken with the reported information to make impossible to any reader to identify the identity of the information source.

SECTION A – INFORMATION FOR THE PARTICIPANTS

Participants

Experts include those identified as having an extensive knowledge of, or ability in Demand-Driven Concepts, Sales and Operations Planning, Supply Chain Management, Materials Planning, Production Planning and Control and correlated areas. Experts are expected to include university academics, professional engineers, planners and practitioners.

Participants' Right to Decline

Your participation is voluntary, and you can decline to participate from the survey after having agreed to participate. You are free to refuse to answer any question that is being asked in the questionnaire. The researcher may contact you in case of any missing answer in order to elicit any errors in the survey responses. If, after returning the questionnaire, you decide that you no longer want to participate in this research, you should inform the researcher Daniel Fernando Bozutti by email or telephone. Your answers will be removed from the research and the questionnaire will be deleted if the study is not finished by the time you warn the researcher.

Time to Complete Survey

The survey will take approximately 50 minutes to complete.

Conducting Survey

The survey will be conducted by mailing the questionnaire directly to the participant in the provided email and asking the respondent to mail the survey back when completed. Each interested participant will be provided with a cover letter, informed consent form, processes description, questionnaire and a summary of the used terms to facilitate the weighting of the questions.

Confidentiality

The information provided by participants will not be disclosed. Only participant's name and current position will be asked, and it will not be known to any other person than the researcher.

The individual answers, if published on the study, will not disclose the name of the respondent. The answers given by respondents will be only used for research purposed and for writing a report. Care will be taken in report information so as to make impossible to any reader to identify the identity of the information source.

Use of Information

The information and findings obtained will be used for writing a thesis as one of the requirements to obtain the Doctor of Science Degree. In addition, they may be used in seminars, conference presentations and research publications always respecting the data confidentiality.

Availability of Results

A summary of the results is expected to be available by May of 2020. Participants wanting a copy of the full study should inform the researcher by email.

Contact Information

If you have any questions or if you have a problem you think may be related to your participation in this research study, or if you would like to withdraw, you may communicate with the researcher responsible for this research study or with someone on the research team at the following numbers and/or emails:

Daniel Fernando Bozutti: +55 16 9 8152-1395 – daniel.bozutti@usp.br / daniel.bozutti@gmail.com

Kleber Francisco Espôsto: +1 (865) 249-4927 – kleberespосто@usp.br

Participant Statement

I have read this consent form. I have been given the opportunity to ask questions and my questions were answered to my satisfaction. I understand that I may refuse to participate in this study and that if I refuse to participate this will not result in the loss of any benefits or services to which I am otherwise entitled. I agree to participate in this study and understand that if, for any reason, I wish to stop participating, I will be free to do so, and this will have no effect on me. I have been given a copy of this consent form for my records.

Name	
Current Position	
Date	

SECTION B – THE DEMAND-DRIVEN SALES AND OPERATIONS PLANNING

During our research, we have conducted an intensive systematic literature review with the aim of obtaining the state-of-art regarding the considered research theme. For that, we have considered 121 publications for the demand-driven concept (from scholars and practitioners) and 77 publications for the S&OP process (considering the following research databases: EBSCO host, Emerald, Scopus, Science Direct, Web of Science, ABI/Inform (ProQuest) and Google Scholar).

As result of our research, one important finding was the adherence of the current S&OP requirements and the demand-driven concept. Based on this, we have the aim of contributing with the body-of-knowledge by proposing and formalize a framework for the Demand-Driven Sales and Operations Planning (DDS&OP). It was perceived the necessity of the S&OP vertical and horizontal consistencies expansion. Thus, S&OP should be covering both more strategic and operation level, and it should be also expanded beyond company's borders, considering strategic players in the supply chain. Our framework is represented in the Figure 1.

Figure 1 – The DDS&OP framework

Source: Prepared by the author

This framework and its processes were proposed based on the considered references obtained with the conducted systematic literature reviews for Demand-Driven Phenomenon and Sales and Operations Planning. The objective was to consolidate in a unique framework the individuals and separated proposals which were found during the research.

Following, you can find a description of each perspective and their processes.

In the **strategic perspective**, the role of the DDS&OP is to make the link between the strategic decisions and the tactical decisions. That's why, in this perspective, it is not necessary to have monthly meetings, once strategic decisions have the characteristics of long-term decisions. It was proposed that the process should be performed each two, four or six months, depending on the company's necessity,

its sector and the production lead time. At this level, the strategic DDS&OP process is composed by eight processes: (i) strategy review; (ii) product portfolio review; (iii) supply chain intelligence activities;

(iv) contingency plans elaboration; (v) communicate the plans; (vi) financial management; (vii) risk management; and (viii) performance management. The three last described processes should be executed on an ongoing basis with the other processes, as suggested by the conducted systematic literature review.

The first process is **the strategy review**. This process checks, analyzes and makes decisions considering company's internal and external perspectives. The aim is, based on company's strategy and market responses, guide the company to a better fulfillment of customers' requirements.

Once the purpose of a company is to deliver to market a set of products and services, the second process is the **product portfolio management**. Considering the inputs of the strategy review, it is analyzed if the portfolio served to the market is still adequate. This process also has the characteristic of company's internal and external perspectives, once it receives feedbacks of how the product/service is performing in the market and it receives feedback of the supply/manufacturing to offer the product/service to the market.

The third process is the **supply chain intelligence activities**. This process has the aim of evaluating how the products/services is being delivered to the market based on company's strategy and considering logistics, production, sales, marketing channels and market intelligence.

After the three first defined processes, it is important to define **contingency plans**. This process has the aim of creating visibility to the supply chain and to guide the decision-making process if any issues appear. This process promotes agility to decisions, provides directions to delegate decisions and creates responsiveness, linked with the company's strategy.

After the execution of each of the four processes described above, it is foreseen that the outputs of each described process be assessed considering financials, risks and performance (metrics and KPI's). The assessments are evaluated by the strategic DDS&OP team, and if there is any issue, should be taken in consideration, and the process with the issue should be executed again.

The last process is to **communicate plans**. This process was defined to guarantee that the information flow be respected and followed. If the decisions be not adequately communicated to the other processes and teams, their effectiveness will not be reached. In this process, it can be used the information technology, in order to deliver the right information to the right team at the right time and keep its traceability.

The strategic perspective should be performed by a strategic DDS&OP team, a financial assessment team and a risk assessment team. The financial assessment and risk assessment team should be the same for the other perspectives (tactical and operational) in order to have a holistic view of the process. The Chart 1 describes the suggested participants of the strategic DDS&OP team, financial assessment team and risk assessment team to conduct the strategic perspective of the DDS&OP.

It is important to notice that these teams have a matrix organizational characteristic, i.e., they are not strictly dedicated to the process, but they have to participate when defined; exception to this, it is recommended that the senior analysts of financial and risk assessment be exclusively dedicated to the process.

Chart 1 – Strategic perspective team

Perspective	Team	Participants
Strategic Perspective	Strategic S&OP team	<ul style="list-style-type: none"> ✓ Director/Vice-president of operations ✓ Director/Vice-president of sales and marketing ✓ Senior management of operations ✓ Senior management of sales and marketing ✓ Senior management of product development ✓ Senior analysts of operations, sales, marketing, product development and performance management
	Financial Assessment Team	<ul style="list-style-type: none"> ✓ Director/Vice-president of financials ✓ Senior management of financials ✓ Senior analysts of financials
	Risk Assessment Team	<ul style="list-style-type: none"> ✓ Senior management of risk management ✓ Senior analysts of risk management

Source: Prepared by the author

The **tactical perspective** should be performed by a tactical DDS&OP team, a marketing and sales team, an operations team, a financial assessment team, a risk assessment team and a final participation of the strategic DDS&OP team. The financial and risk assessment team is the same of the considered in the strategic perspective. The tactical DDS&OP team should be fixed and exclusively for this activity. The strategic DDS&OP team, marketing and sales team and operations team can be considered with the matrix organizational approach. It just recommended that the analysts from the financial and risk assessment team be exclusively dedicated to the process. The Chart 2 describes the suggested participants of the tactical DDS&OP team, sales and marketing team, operations team, financial assessment team, risk assessment team and strategic DDS&OP team to conduct the tactical perspective of the DDS&OP.

The tactical perspective for the DDS&OP has a great similarity with the traditional S&OP process. It is a mid-term planning process with a planning horizon from 2 to 18 months and should be conducted in a monthly basis. However, some changes had to be done to make this process more adherent with the demand-driven phenomenon.

The first difference appears in the first step. In order be closer to the customers' requirements, the first process is the **portfolio review**. This process has not the aim of assessing the offering matching of products/services; this is the aim of the product portfolio management presented in the strategic perspective. The objective of this process is to assess and to control if the decisions made in the strategic perspective are being followed in the tactical planning horizon. If issues are found, the solutions should

be presented and be evaluated by operations, marketing and sales, financial, risks and performance teams.

The second process, **demand planning**, comprises the first two processes of the traditional S&OP process, i.e., data collection and forecasting and demand planning. Once these two activities have the same objective of an unrestricted demand plan generation, they were considered in the same process. As an evolution from the traditional S&OP process, it is the possibility of strategic customers participation in this process with the aim of having a closer relationship and a better understand of their requirements. Another difference is the inclusion of demand sensing and demand shaping in the process. After the execution of the process, the decisions should be assessed by financial, risks and performance teams.

Chart 2 – Tactical perspective team

Perspective	Team	Participants
Tactical Perspective	Tactical S&OP team	✓ Tactical S&OP manager
		✓ Operations analysts
		✓ Sales and Marketing analysts
		✓ Product Developments analysts
		✓ Performance management analysts
	Sales and Marketing Team	✓ Sales and marketing managers
		✓ Junior to Senior Analysts of sales and marketing
	Operations Team	✓ Operations managers
		✓ Junior to Senior Analysts of operations
	Financial Assessment Team	✓ Senior management of financials
		✓ From Junior to Senior analysts of financials
	Risk Assessment Team	✓ Senior management of risk management
		✓ From Junior to Senior analysts of risk management
	Strategic S&OP team	✓ Director/Vice-president of operations
		✓ Director/Vice-president of sales and marketing
		✓ Director/Vice-president of financials
		✓ Senior management of operations
		✓ Senior management of sales and marketing
		✓ Senior management of product development

Source: Prepared by the author

The **third process** is the supply planning and this process is very similar with the traditional S&OP process. Supply constraints should be found in order to generate a restricted demand plan. The main difference compared with the traditional S&OP process is the participation of strategic suppliers and other supply chain partners that can be considered important for the decision-making process and can present constraints to the demand fulfillment process. After the execution of the process, the decisions should be assessed by financial, risks and performance teams.

The fourth step is the **scenario analysis**. This process has the aim of being more robust than the pre-S&OP meeting foreseen in the traditional S&OP process. This robustness is achieved by the use of information technology and software, in order to support simulation, what-if analysis and

mathematical algorithms. After the execution of the process, the decisions should be assessed by operations, marketing and sales, financial, risks and performance teams.

The **consensus meeting** is the fifth process of the tactical perspective of the DDS&OP. This meeting is equal of the executive S&OP meeting foreseen in the traditional S&OP process. The strategic S&OP team must attend to this meeting in order to understand, agree and sponsor the decisions.

Finally, the last process is to **communicate plans**. This process was defined to guarantee that the information flow be respected and followed. If the decisions be not adequately communicated to the other process and teams, their effectiveness will not be reached. In this process, it can be used the information technology, in order to deliver the right information to the right team at the right time and keep traceability of it.

While the strategic perspective covers the need of demand and customer understanding and make the company able to promptly respond to these requirements, the **operational perspective** has the role to promote agility and velocity in case of problems, new customers' requirements and mismatch between the demand and supply in the short-term. That's why the operational perspective should be conducted on daily or weekly basis, considering the company's requirement. With these two added perspectives, the DD&OP responds effectively to the Demand-Driven phenomenon requirements.

Finally, the operational perspective is composed by nine processes: (i) disaggregate the plans; (ii) check orders and priorities; (iii) receive data and information; (iv) solve issues; (v) communicate decisions; (vi) financial control; (vii) risk control; (viii) performance management; and (ix) event-driven meetings. The four last described processes should be executed on an ongoing basis with the other processes, as suggested by the conducted systematic literature review.

The first process is to **Disaggregate the Plans**. This process provides SKU's visibility to the order fulfillment team. At this point a choice can be made for disaggregation, i.e., it can be conducted a disaggregation of all families or solely the disaggregation of the strategic families. If there are products' families that were not disaggregated, this should be a responsibility of the operations team. The trade-off to be dealt to this decision is between complexity and visibility. After the process the operations team of production and planning control runs the MRP and define the order scheduling. These activities are not executed by the order fulfillment S&OP team.

The second process is to **Check Orders and Priorities**. Considering the production planning and control activities of order generation and scheduling, the order fulfillment team assesses such orders and their priorities, to make sure that is in accordance with decisions previously defined in the tactical perspective of the DDS&OP. This process provides a proactiveness to the process in order to avoid misalignments issues between sales and marketing decisions and operations decisions.

The third process, to **Receive Data and Information**, can be considered an ongoing process. The objective is to receive data and information from the supply chain that can result in problems to the demand fulfillment. With the data and information analyzed, Event-Driven Meetings can be held. The

event-driven meeting does not have previously defined date, time or attendants, once it will depend upon the problem or issue to be dealt. If no problems or issues are identified, no meeting is necessary to be conducted. If a problem or issue is identified, it will verify the applicable personnel to solve the issue and a meeting is scheduled. This approach is important to have the right people to solve the problem, providing visibility to the involved persons and do not have isolated solutions.

After the execution of each process is foreseen the analysis and control from the operations, sales and marketing, performance, financial and risk teams. The aim is to provide robustness to the decision-making process. At the end, the plans should be communicated to the involved teams.

The **operational perspective** should be performed by the order fulfillment team, operations team, sales and marketing team, financial assessment team and risk assessment team. These teams should be organized considering the matrix approach (exception to the financial and risk assessment team). It is important to not limit this process to an order fulfillment process; it is more than that. Once there is a direct link with operations and sales and marketing teams, the issues could be easily and quickly solved (and validated by these teams). The process considers the financial and risk control, and these processes are performed by the same team that performed the strategic and tactical activities, this guarantee an alignment of the decision-making process with the medium and long-terms directions. Besides of that, it is foreseen event-driven meetings in case of issues; these meetings should be performed if a problem appears and the participants convocation will depend on the issue characteristics (the decisions will be visible to all involved and will be made in consensus, thus, leading to a minimization of mistakes). The Chart 3 described the suggested participants of the order fulfillment team, sales and marketing team, operations team, financial assessment team and risk assessment team to conduct the operational perspective of the DDS&OP.

Chart 3 – Operational perspective team

Perspective	Team	Participants
Operational Perspective	Order Fulfillment Team	✓ Order fulfillment manager ✓ Order fulfillment analysts
	Sales and Marketing Team	✓ Sales and marketing supervisor ✓ Sales and marketing analysts
	Operations Team	✓ Operations supervisor ✓ Operations analysts
	Financial Management Team	✓ Financial analysts
	Risk Management Team	✓ Risk analysts

Source: Prepared by the author

Besides the three perspectives for the S&OP process, it was considered another ongoing process named Process Governance. The objective of this process is to promote a continuous improvement for the company considering the output of the DDS&OP process and to promote the improvement of the DDS&OP itself.

SECTION C – SURVEY APPLICATION TO ASSESS THE PROPOSED PROCESSES FOR THE DEMAND-DRIVEN SALES AND OPERATIONS PLANNING

In this section, we would like to elicit your opinion about the relevance of the considered processes and approaches considered for the DDS&OP framework design. For that, we appreciate you to evaluate each question considering:

- ✓ **Very unimportant:** the process/approach must not be considered in the framework.
- ✓ **Unimportant:** the process/approach does not bring any advantage to the S&OP process.
- ✓ **Important:** the process/approach brings advantages to the S&OP process.
- ✓ **Very important:** the process/approach must be considered in the framework.

Filling Example:

Just one alternative must be assigned.

Question 1: S&OP process should be strategically expanded.

☐ ☐ ☒ ☐
 Very Unimportant Unimportant Important Very Important

Obs.: just select the option that better fits to your opinion.

Please, note that, after you have filled the survey, you should save the file in order to keep your answers.

REGARDING THE STRATEGIC PERSPECTIVE

Question 1: S&OP process should be strategically expanded.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 2: The **Strategy Review** process should be considered in the DDS&OP strategic perspective.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 3: The **Product Portfolio Management** process should be considered in the DDS&OP strategic perspective.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 4: The **Supply Chain Intelligence Activities** process should be considered in the DDS&OP strategic perspective.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 5: The **Contingency Plans Elaboration** process should be considered in the DDS&OP strategic perspective.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 6: The **Communicate the plans** process should be considered in the DDS&OP strategic perspective.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 7: The **Financial Management** process should be considered in the DDS&OP strategic perspective.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 8: The **Financial Management** process should be considered in the DDS&OP strategic perspective and **should be performed in each step.**

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 9: The **Risk Management** process should be considered in the DDS&OP strategic perspective.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 10: The **Risk Management** process should be considered in the DDS&OP strategic perspective and **should be performed in each step.**

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 11: The **Performance Management** process should be considered in the DDS&OP strategic perspective.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 12: The **Performance Management** process should be considered in the DDS&OP strategic perspective and **should be performed in each step.**

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 13: It should be considered a Strategic S&OP team (in a matrix approach) in the strategic S&OP perspective.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 14: It should be considered a Financial Assessment team (in a matrix approach) in the strategic S&OP perspective.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 15: It should be considered a Risk Assessment team (in a matrix approach) in the strategic S&OP perspective.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 16: The cycle for the Strategic Perspective should be from 2 months to 6 months (once the manufacturing lead time is included in this horizon).

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

REGARDING THE TACTICAL PERSPECTIVE

Question 17 The **Portfolio Review** process should be considered in the DDS&OP tactical perspective.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 18: The **Demand Planning** process should be considered in the DDS&OP tactical perspective.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 19: In the **Demand Planning** process should be considered the participation of strategic customers.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 20: The **Supply Planning** process should be considered in the DDS&OP tactical perspective.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 21: In the **Supply Planning** process should be considered the participation of strategic suppliers.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 22: The **Scenario Analysis** process should be considered in the DDS&OP tactical perspective.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 23: In the **Scenario Analysis** process should be considered the utilization of simulation.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 24: In the **Scenario Analysis** process should be considered the utilization of what-if analyses.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 25: In the **Scenario Analysis** process should be considered the utilization of mathematical algorithms.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 26: The **Consensus Meeting** process should be considered in the DDS&OP tactical perspective.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 27: The **Communicate the plans** process should be considered in the DDS&OP tactical perspective.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 28: The **Financial Management** process should be considered in the DDS&OP tactical perspective.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 29: The **Financial Management** process should be considered in the DDS&OP tactical perspective and **should be performed in each step.**

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 30: The **Risk Management** process should be considered in the DDS&OP tactical perspective.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 31: The **Risk Management** process should be considered in the DDS&OP tactical perspective and **should be performed in each step.**

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 32: The **Performance Management** process should be considered in the DDS&OP tactical perspective.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 33: The **Performance Management** process should be considered in the DDS&OP tactical perspective and **should be performed in each step.**

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 34: It should be considered a Strategic S&OP team participation (in a matrix approach) in the tactical S&OP perspective.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 35: It should be considered a Sales and Marketing team participation (in a matrix approach) in the tactical S&OP perspective.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 36: It should be considered an Operations team participation (in a matrix approach) in the tactical S&OP perspective.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 37: It should be considered a Tactical S&OP team in the tactical S&OP perspective.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 38: It should be considered a Financial Assessment team in the tactical S&OP perspective.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 39: It should be considered a Risk Assessment team in the tactical S&OP perspective.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 40: The cycle for the Tactical Perspective should be monthly (once the manufacturing lead time is included in this horizon).

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

REGARDING THE OPERATIONAL PERSPECTIVE

Question 41: S&OP process should be operationally expanded.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 42: The **Disaggregate the plans** process should be considered in the DDS&OP operational perspective.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 43: In the **Disaggregate the plans** process should be considered a differentiation of strategic and not strategic product families in order to guide the disaggregation process.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 44: The **Check orders and priorities** process should be considered in the DDS&OP operational perspective.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 45: The **Receive data and information** process should be considered in the DDS&OP operational perspective.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 46: In the **Receive data and information** process should be considered real-time data, if applicable.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 47: In the **Receive data and information** process should be considered social media and internet data, if applicable.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 48: **Event-driven meetings** should be conducted in the DDS&OP operational perspective, in case of issues during the order fulfillment.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 49: The **Financial Control** process should be considered in the DDS&OP operational perspective.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 50: The **Financial Control** process should be considered in the DDS&OP operational perspective and **should be performed in each step.**

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 51: The **Risk Control** process should be considered in the DDS&OP operational perspective.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 52: The **Risk Control** process should be considered in the DDS&OP operational perspective and **should be performed in each step.**

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 53: The **Performance Management** process should be considered in the DDS&OP operational perspective.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 54: The **Performance Management** process should be considered in the DDS&OP operational perspective and **should be performed in each step.**

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 55: It should be considered an Order Fulfillment team in the operational S&OP perspective.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 56: It should be considered a Sales and Marketing team in the operational S&OP perspective.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 57: It should be considered an Operations team in the operational S&OP perspective.

☐	☐	☐	☐
Very Unimportant	Unimportant	Important	Very Important

Question 58: It should be considered a Financial Management team in the operational S&OP perspective.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 59: It should be considered a Risk Management team in the operational S&OP perspective.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

Question 60: The cycle for the Operational Perspective should be daily or weekly.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

REGARDING THE PROCESS GOVERNANCE

Question 61: It should be considered a process governance with the aim to contribute with a continuous improvement of the DDS&OP process.

☐ ☐ ☐ ☐
 Very Unimportant Unimportant Important Very Important

APPENDIX I – PARTICIPANTS’ RESPONSES

Chart I.1 shows the responses from Expert 1 to Expert 5.

Chart I.1 – Questionnaire Responses from Expert 1 to Expert 5

	Expert 1				Expert 2				Expert 3				Expert 4				Expert 5			
	Questionnaire Response	a	m	b	Questionnaire Response	a	m	b	Questionnaire Response	a	m	b	Questionnaire Response	a	m	b	Questionnaire Response	a	m	b
Question 1	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 2	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 3	Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 4	Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 5	Unimportant	0	0,33	0,67	Important	0,33	0,67	1	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 6	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 7	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 8	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 9	Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 10	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 11	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Unimportant	0	0,33	0,67
Question 12	Unimportant	0	0,33	0,67	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Unimportant	0	0,33	0,67
Question 13	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 14	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 15	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 16	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Unimportant	0	0,33	0,67
Question 17	Important	0,33	0,67	1	Unimportant	0	0,33	0,67	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 18	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 19	Important	0,33	0,67	1	Important	0,33	0,67	1	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 20	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 21	Important	0,33	0,67	1	Important	0,33	0,67	1	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 22	Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 23	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 24	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 25	Unimportant	0	0,33	0,67	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Unimportant	0	0,33	0,67

Chart I.1 – Questionnaire Responses from Expert 1 to 5 - *Continuation*

[illegible]

Chart I.1 – Questionnaire Responses from Expert 1to Expert 5 - *Continuation*

Question 58	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Unimportant	0	0,33	0,67
Question 59	Unimportant	0	0,33	0,67	Unimportant	0	0,33	0,67	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Unimportant	0	0,33	0,67
Question 60	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 61	Very Important	0,67	1	1	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1

Source: Prepared by the author

Chart I.2 presents the responses from Expert 6 to Expert 10.

Chart I.2 – Questionnaire Responses from Expert 6 to Expert 10

	Expert 6				Expert 7				Expert 8				Expert 9				Expert 10			
	Questionnaire Response	a	m	b	Questionnaire Response	a	m	b	Questionnaire Response	a	m	b	Questionnaire Response	a	m	b	Questionnaire Response	a	m	b
Question 1	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 2	Very Important	0,67	1	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 3	Very Important	0,67	1	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 4	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 5	Important Very	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 6	Unimportant	0	0	0,33	Very Important	0,67	1	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 7	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 8	Very Important Very	0,67	1	1	Unimportant	0	0	0,33	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 9	Unimportant Very	0	0	0,33	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 10	Unimportant	0	0	0,33	Unimportant	0	0	0,33	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 11	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 12	Unimportant	0	0,33	0,67	Unimportant	0	0	0,33	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 13	Very Important	0,67	1	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1

Chart I.2 – Questionnaire Responses from Expert 6 to Expert 10 - *Continuation*

Question 14	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 15	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 16	Important	0,33	0,67	1	Important	0,33	0,67	1	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 17	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 18	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 19	Unimportant	0	0,33	0,67	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 20	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 21	Unimportant	0	0,33	0,67	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 22	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 23	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Unimportant	0	0,33	0,67	Very Important	0,67	1	1
Question 24	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 25	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 26	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 27	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 28	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 29	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 30	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 31	Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 32	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 33	Important	0,33	0,67	1	Very Unimportant	0	0	0,33	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 34	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Unimportant	0	0,33	0,67
Question 35	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 36	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 37	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1

Chart I.2 – Questionnaire Responses from Expert 6 to Expert 10 - *Continuation*

Question 38	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 39	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 40	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 41	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 42	Very Important	0,67	1	1	Unimportant	0	0,33	0,67	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 43	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 44	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 45	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 46	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 47	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Unimportant	0	0,33	0,67	Unimportant	0	0,33	0,67
Question 48	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 49	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 50	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Unimportant	0	0,33	0,67
Question 51	Very Important	0,67	1	1	Very Important	0,67	1	1	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 52	Very Important	0,67	1	1	Very Important	0,67	1	1	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Unimportant	0	0,33	0,67
Question 53	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 54	Very Important	0,67	1	1	Very Important	0,67	1	1	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 55	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 56	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 57	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 58	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 59	Unimportant	0	0,33	0,67	Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 60	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 61	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1

Source: Prepared by the author

Chart I.3 presents the responses from Expert 11 to Expert 15.

Chart I.3 – Questionnaire Responses from Expert 11 to Expert 15

	Expert 11				Expert 12				Expert 13				Expert 14				Expert 15			
	Questionnaire Response	a	m	b	Questionnaire Response	a	m	b	Questionnaire Response	a	m	b	Questionnaire Response	a	m	b	Questionnaire Response	a	m	b
Question 1	Very Important	0,67	1	1	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 2	Very Important	0,67	1	1	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Unimportant	0	0	0,33
Question 3	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 4	Very Important	0,67	1	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 5	Very Important	0,67	1	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 6	Very Important	0,67	1	1	Unimportant	0	0,33	0,67	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 7	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 8	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 9	Very Important	0,67	1	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 10	Very Important	0,67	1	1	Important	0,33	0,67	1	Unimportant	0	0,33	0,67	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 11	Very Important	0,67	1	1	Important	0,33	0,67	1	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 12	Very Important	0,67	1	1	Important	0,33	0,67	1	Unimportant	0	0,33	0,67	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 13	Very Important	0,33	0,67	1	Unimportant	0	0,33	0,67	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 14	Very Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 15	Very Important	0,33	0,67	1	Unimportant	0	0,33	0,67	Important	0,33	0,67	1	Important	0,33	0,67	1	Unimportant	0	0,33	0,67
Question 16	Very Important	0,33	0,67	1	Unimportant	0	0,33	0,67	Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 17	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 18	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 19	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1

Chart I.3 – Questionnaire Responses from Expert 11 to Expert 15 - *Continuation*

Question 20	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 21	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 22	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 23	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 24	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 25	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 26	Very Important	0,67	1	1	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 27	Very Important	0,67	1	1	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 28	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 29	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 30	Very Important	0,67	1	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 31	Very Important	0,67	1	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Unimportant	0	0,33	0,67
Question 32	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 33	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 34	Very Important	0,67	1	1	Unimportant	0	0,33	0,67	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 35	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 36	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 37	Very Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 38	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 39	Very Important	0,67	1	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 40	Unimportant	0	0,33	0,67	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 41	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1

Chart I.3 – Questionnaire Responses from Expert 11 to Expert 15 - *Continuation*

Question 42	Important	0,33	0,67	1	Unimportant	0	0,33	0,67	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 43	Unimportant	0	0,33	0,67	Important	0,33	0,67	1	Very Important	0,67	1	1	Unimportant	0	0,33	0,67	Important	0,33	0,67	1
Question 44	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 45	Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 46	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 47	Important	0,67	1	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 48	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 49	Important	0,67	1	1	Unimportant	0	0,33	0,67	Unimportant	0	0,33	0,67	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 50	Very Important	0,67	1	1	Unimportant	0	0,33	0,67	Unimportant	0	0,33	0,67	Important	0,33	0,67	1	Unimportant	0	0,33	0,67
Question 51	Important	0,67	1	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Unimportant	0	0,33	0,67
Question 52	Very Important	0,67	1	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Important	0,33	0,67	1	Unimportant	0	0,33	0,67
Question 53	Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 54	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 55	Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 56	Important	0,33	0,67	1	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 57	Important	0,33	0,67	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 58	Important	0,33	0,67	1	Important	0,33	0,67	1	Unimportant	0	0,33	0,67	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 59	Very Important	0,67	1	1	Important	0,33	0,67	1	Unimportant	0	0,33	0,67	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 60	Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 61	Very Important	0,67	1	1	Important	0,33	0,67	1	Very Important	0,67	1	1	Very Important	0,67	1	1	Very Important	0,67	1	1

Source: Prepared by the author

Chart I.4 presents the responses from Expert 16 to Expert 17.

Chart I.4 – Questionnaire Responses from Expert 16 to Expert 17

	Expert 16				Expert 17			
	Questionnaire Response	a	m	b	Questionnaire Response	a	m	b
Question 1	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 2	Unimportant	0	0,33	0,67	Very Important	0,67	1	1
Question 3	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 4	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 5	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 6	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 7	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 8	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 9	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 10	Very Important	0,67	1	1	Important	0,33	0,67	1
Question 11	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 12	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 13	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 14	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 15	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 16	Unimportant	0	0,33	0,67	Very Important	0,67	1	1
Question 17	Unimportant	0	0,33	0,67	Important	0,33	0,67	1
Question 18	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 19	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 20	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 21	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 22	Unimportant	0	0,33	0,67	Very Important	0,67	1	1

Chart I.4 – Questionnaire Responses from Expert 16 to Expert 17 - *Continuation*

Question 23	Unimportant	0	0,33	0,67	Very Important	0,67	1	1
Question 24	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 25	Unimportant	0	0,33	0,67	Very Important	0,67	1	1
Question 26	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 27	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 28	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 29	Unimportant	0	0,33	0,67	Important	0,33	0,67	1
Question 30	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 31	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 32	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 33	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 34	Unimportant	0	0,33	0,67	Important	0,33	0,67	1
Question 35	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 36	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 37	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 38	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 39	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 40	Very Important	0,67	1	1	Very Important	0,67	1	1
Question 41	Unimportant	0	0,33	0,67	Very Important	0,67	1	1
Question 42	Unimportant	0	0,33	0,67	Unimportant	0	0,33	0,67
Question 43	Important	0,33	0,67	1	Unimportant	0	0,33	0,67
Question 44	Unimportant	0	0,33	0,67	Important	0,33	0,67	1
Question 45	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 46	Unimportant	0	0,33	0,67	Very Important	0,67	1	1

Chart I.4 – Questionnaire Responses from Expert 16 to Expert 17 - *Continuation*

Question 47	Unimportant	0	0,33	0,67	Very Important	0,67	1	1
Question 48	Unimportant	0	0,33	0,67	Very Important	0,67	1	1
Question 49	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 50	Unimportant	0	0,33	0,67	Very Important	0,67	1	1
Question 51	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 52	Important Very	0,33	0,67	1	Important	0,33	0,67	1
Question 53	Important	0,67	1	1	Very Important	0,67	1	1
Question 54	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 55	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 56	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 57	Important	0,33	0,67	1	Very Important	0,67	1	1
Question 58	Important	0,33	0,67	1	Important	0,33	0,67	1
Question 59	Unimportant	0	0,33	0,67	Important	0,33	0,67	1
Question 60	Important Very	0,33	0,67	1	Very Important	0,67	1	1
Question 61	Important	0,67	1	1	Very Important	0,67	1	1

Source: Prepared by the author

APPENDIX J – FUZZY-DELPHI RESULTS

Table J.1 – Frequency of answers

	Very Unimportant Frequency	Unimportant Frequency	Important Frequency	Very Important Frequency	Answer with higher frequency percentage	Important and Very Important frequency percentage
Question 1	0	1	5	11	65%	94%
Question 2	1	2	5	9	53%	82%
Question 3	0	0	11	6	65%	100%
Question 4	0	0	7	10	59%	100%
Question 5	0	2	8	7	47%	88%
Question 6	1	1	9	6	53%	88%
Question 7	0	0	4	13	76%	100%
Question 8	1	0	10	6	59%	94%
Question 9	1	0	11	5	65%	94%
Question 10	2	2	10	3	59%	76%
Question 11	0	3	6	8	47%	82%
Question 12	1	4	7	5	41%	71%
Question 13	0	1	12	4	71%	94%
Question 14	0	0	11	6	65%	100%
Question 15	0	3	12	2	71%	82%
Question 16	0	5	6	6	35%	71%
Question 17	0	2	6	9	53%	88%
Question 18	0	0	2	15	88%	100%
Question 19	0	2	6	9	53%	88%
Question 20	0	0	1	16	94%	100%
Question 21	0	2	8	7	47%	88%
Question 22	0	1	3	13	76%	94%
Question 23	0	2	2	13	76%	88%
Question 24	0	0	2	15	88%	100%
Question 25	0	4	3	10	59%	76%
Question 26	0	1	2	14	82%	94%
Question 27	0	1	2	14	82%	94%
Question 28	0	0	5	12	71%	100%
Question 29	0	3	7	7	41%	82%
Question 30	0	0	9	8	53%	100%
Question 31	0	4	9	4	53%	76%
Question 32	0	0	5	12	71%	100%
Question 33	1	1	6	9	53%	88%
Question 34	0	5	3	9	53%	71%

Table J.1 – Frequency of answers – *Continuation*

Question 35	0	0	3	14	82%	100%
Question 36	0	0	2	15	88%	100%
Question 37	0	0	4	13	76%	100%
Question 38	0	0	6	11	65%	100%
Question 39	0	0	9	8	53%	100%
Question 40	0	2	2	13	76%	88%
Question 41	0	2	4	11	65%	88%
Question 42	0	4	4	9	53%	76%
Question 43	0	6	6	5	35%	65%
Question 44	0	1	5	11	65%	94%
Question 45	0	0	5	12	71%	100%
Question 46	0	1	4	12	71%	94%
Question 47	0	5	7	5	41%	71%
Question 48	0	1	5	11	65%	94%
Question 49	0	3	10	4	59%	82%
Question 50	0	11	2	4	65%	35%
Question 51	0	4	8	5	47%	76%
Question 52	0	7	6	4	41%	59%
Question 53	0	0	6	11	65%	100%
Question 54	0	2	6	9	53%	88%
Question 55	0	0	7	10	59%	100%
Question 56	0	2	7	8	47%	88%
Question 57	0	0	4	13	76%	100%
Question 58	0	4	11	2	65%	76%
Question 59	0	7	8	2	47%	59%
Question 60	0	0	3	14	82%	100%
Question 61	0	1	1	15	88%	94%

Source: Prepared by the author

Table J.2 – Aggregation of the fuzzy values

	A_i	M_i	B_i	F_i (aggregated fuzzy value)
Question 1	0,530	0,863	0,981	$F_1 = (0,530, 0,863, 0,981)$
Question 2	0,451	0,765	0,922	$F_2 = (0,451, 0,765, 0,922)$
Question 3	0,451	0,785	1,000	$F_3 = (0,451, 0,785, 1,000)$
Question 4	0,530	0,863	1,000	$F_4 = (0,530, 0,863, 1,000)$
Question 5	0,432	0,765	0,961	$F_5 = (0,432, 0,765, 0,961)$
Question 6	0,412	0,726	0,942	$F_6 = (0,412, 0,726, 0,942)$
Question 7	0,589	0,922	1,000	$F_7 = (0,589, 0,922, 1,000)$
Question 8	0,432	0,746	0,961	$F_8 = (0,432, 0,746, 0,961)$
Question 9	0,412	0,726	0,961	$F_9 = (0,412, 0,726, 0,961)$
Question 10	0,314	0,608	0,883	$F_{10} = (0,314, 0,608, 0,883)$
Question 11	0,432	0,765	0,942	$F_{11} = (0,432, 0,765, 0,942)$
Question 12	0,334	0,648	0,883	$F_{12} = (0,334, 0,648, 0,883)$
Question 13	0,393	0,726	0,981	$F_{13} = (0,393, 0,726, 0,981)$
Question 14	0,451	0,785	1,000	$F_{14} = (0,451, 0,785, 1,000)$
Question 15	0,314	0,648	0,942	$F_{15} = (0,314, 0,648, 0,942)$
Question 16	0,353	0,687	0,902	$F_{16} = (0,353, 0,687, 0,902)$
Question 17	0,471	0,804	0,961	$F_{17} = (0,471, 0,804, 0,961)$
Question 18	0,628	0,961	1,000	$F_{18} = (0,628, 0,961, 1,000)$
Question 19	0,471	0,804	0,961	$F_{19} = (0,471, 0,804, 0,961)$
Question 20	0,648	0,981	1,000	$F_{20} = (0,648, 0,981, 1,000)$
Question 21	0,432	0,765	0,961	$F_{21} = (0,432, 0,765, 0,961)$
Question 22	0,569	0,902	0,981	$F_{22} = (0,569, 0,902, 0,981)$
Question 23	0,550	0,883	0,961	$F_{23} = (0,550, 0,883, 0,961)$
Question 24	0,628	0,961	1,000	$F_{24} = (0,628, 0,961, 1,000)$
Question 25	0,451	0,785	0,922	$F_{25} = (0,451, 0,785, 0,922)$
Question 26	0,589	0,922	0,981	$F_{26} = (0,589, 0,922, 0,981)$
Question 27	0,589	0,922	0,981	$F_{27} = (0,589, 0,922, 0,981)$
Question 28	0,569	0,902	1,000	$F_{28} = (0,569, 0,902, 1,000)$
Question 29	0,412	0,746	0,942	$F_{29} = (0,412, 0,746, 0,942)$
Question 30	0,491	0,824	1,000	$F_{30} = (0,491, 0,824, 1,000)$
Question 31	0,334	0,667	0,922	$F_{31} = (0,334, 0,667, 0,922)$
Question 32	0,569	0,902	1,000	$F_{32} = (0,569, 0,902, 1,000)$
Question 33	0,471	0,785	0,942	$F_{33} = (0,471, 0,785, 0,942)$
Question 34	0,412	0,746	0,902	$F_{34} = (0,412, 0,746, 0,902)$
Question 35	0,608	0,942	1,000	$F_{35} = (0,608, 0,942, 1,000)$
Question 36	0,628	0,961	1,000	$F_{36} = (0,628, 0,961, 1,000)$
Question 37	0,589	0,922	1,000	$F_{37} = (0,589, 0,922, 1,000)$
Question 38	0,550	0,883	1,000	$F_{38} = (0,550, 0,883, 1,000)$
Question 39	0,491	0,824	1,000	$F_{39} = (0,491, 0,824, 1,000)$
Question 40	0,550	0,883	0,961	$F_{40} = (0,550, 0,883, 0,961)$

Table J.2 – Aggregation of the fuzzy values – *Continuation*

Question 41	0,510	0,844	0,961	$F_{41} = (0,510, 0,844, 0,961)$
Question 42	0,432	0,765	0,922	$F_{42} = (0,432, 0,765, 0,922)$
Question 43	0,314	0,648	0,883	$F_{43} = (0,314, 0,648, 0,883)$
Question 44	0,530	0,863	0,981	$F_{44} = (0,530, 0,863, 0,981)$
Question 45	0,569	0,902	1,000	$F_{45} = (0,569, 0,902, 1,000)$
Question 46	0,550	0,883	0,981	$F_{46} = (0,550, 0,883, 0,981)$
Question 47	0,334	0,667	0,902	$F_{47} = (0,334, 0,667, 0,902)$
Question 48	0,530	0,863	0,981	$F_{48} = (0,530, 0,863, 0,981)$
Question 49	0,353	0,687	0,942	$F_{49} = (0,353, 0,687, 0,942)$
Question 50	0,197	0,530	0,785	$F_{50} = (0,197, 0,530, 0,785)$
Question 51	0,353	0,687	0,922	$F_{51} = (0,353, 0,687, 0,922)$
Question 52	0,275	0,608	0,863	$F_{52} = (0,275, 0,608, 0,863)$
Question 53	0,550	0,883	1,000	$F_{53} = (0,550, 0,883, 1,000)$
Question 54	0,471	0,804	0,961	$F_{54} = (0,471, 0,804, 0,961)$
Question 55	0,530	0,863	1,000	$F_{55} = (0,530, 0,863, 1,000)$
Question 56	0,451	0,785	0,961	$F_{56} = (0,451, 0,785, 0,961)$
Question 57	0,589	0,922	1,000	$F_{57} = (0,589, 0,922, 1,000)$
Question 58	0,295	0,628	0,922	$F_{58} = (0,295, 0,628, 0,922)$
Question 59	0,236	0,569	0,863	$F_{59} = (0,236, 0,569, 0,863)$
Question 60	0,608	0,942	1,000	$F_{60} = (0,608, 0,942, 1,000)$
Question 61	0,608	0,942	0,981	$F_{61} = (0,608, 0,942, 0,981)$

Source: Prepared by the author

Table J.3 – Desfuzzificate the values

	x_m^1	x_m^2	x_m^3	Z^*
Question 1	0,8	0,8	0,8	0,8
Question 2	0,7	0,7	0,7	0,7
Question 3	0,7	0,8	0,8	0,8
Question 4	0,8	0,8	0,8	0,8
Question 5	0,7	0,7	0,7	0,7
Question 6	0,7	0,7	0,7	0,7
Question 7	0,8	0,9	0,9	0,9
Question 8	0,7	0,7	0,7	0,7
Question 9	0,7	0,7	0,7	0,7
Question 10	0,6	0,6	0,6	0,6
Question 11	0,7	0,7	0,7	0,7
Question 12	0,6	0,6	0,6	0,6
Question 13	0,7	0,7	0,7	0,7
Question 14	0,7	0,8	0,8	0,8
Question 15	0,6	0,6	0,6	0,6
Question 16	0,6	0,7	0,7	0,7
Question 17	0,7	0,8	0,8	0,8
Question 18	0,9	0,9	0,9	0,9
Question 19	0,7	0,8	0,8	0,8
Question 20	0,9	0,9	0,9	0,9
Question 21	0,7	0,7	0,7	0,7
Question 22	0,8	0,8	0,9	0,9
Question 23	0,8	0,8	0,8	0,8
Question 24	0,9	0,9	0,9	0,9
Question 25	0,7	0,7	0,8	0,8
Question 26	0,8	0,9	0,9	0,9
Question 27	0,8	0,9	0,9	0,9
Question 28	0,8	0,8	0,9	0,9
Question 29	0,7	0,7	0,7	0,7
Question 30	0,8	0,8	0,8	0,8
Question 31	0,6	0,6	0,7	0,7
Question 32	0,8	0,8	0,9	0,9
Question 33	0,7	0,7	0,8	0,8
Question 34	0,7	0,7	0,7	0,7
Question 35	0,8	0,9	0,9	0,9
Question 36	0,9	0,9	0,9	0,9
Question 37	0,8	0,9	0,9	0,9
Question 38	0,8	0,8	0,8	0,8
Question 39	0,8	0,8	0,8	0,8
Question 40	0,8	0,8	0,8	0,8

Table J.3 – Desfuzzificate the values – *Continuation*

Question 41	0,8	0,8	0,8	0,8
Question 42	0,7	0,7	0,7	0,7
Question 43	0,6	0,6	0,6	0,6
Question 44	0,8	0,8	0,8	0,8
Question 45	0,8	0,8	0,9	0,9
Question 46	0,8	0,8	0,8	0,8
Question 47	0,6	0,6	0,7	0,7
Question 48	0,8	0,8	0,8	0,8
Question 49	0,7	0,7	0,7	0,7
Question 50	0,5	0,5	0,5	0,5
Question 51	0,7	0,7	0,7	0,7
Question 52	0,6	0,6	0,6	0,6
Question 53	0,8	0,8	0,8	0,8
Question 54	0,7	0,8	0,8	0,8
Question 55	0,8	0,8	0,8	0,8
Question 56	0,7	0,7	0,8	0,8
Question 57	0,8	0,9	0,9	0,9
Question 58	0,6	0,6	0,6	0,6
Question 59	0,6	0,6	0,6	0,6
Question 60	0,8	0,9	0,9	0,9
Question 61	0,8	0,9	0,9	0,9

Source: Prepared by the author

Table J.4 – Threshold and consensus values

	$d_i(\bar{z}, \bar{n})$																	$d_i(\bar{z}, \bar{n})_{ave}$	#	% C
	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Expert 9	Expert 10	Expert 11	Expert 12	Expert 13	Expert 14	Expert 15	Expert 16	Expert 17			
Q1	0,160	0,113	0,160	0,113	0,16	0,113	0,113	0,16	0,113	0,113	0,113	0,469	0,113	0,113	0,113	0,16	0,113	0,148	16	94%
Q2	0,099	0,19	0,099	0,19	0,099	0,19	0,099	0,099	0,19	0,19	0,19	0,389	0,19	0,19	0,389	0,389	0,19	0,198	14	82%
Q3	0,096	0,096	0,176	0,096	0,096	0,176	0,096	0,096	0,096	0,176	0,176	0,096	0,176	0,096	0,096	0,096	0,176	0,124	17	100%
Q4	0,16	0,16	0,112	0,112	0,16	0,112	0,112	0,112	0,112	0,112	0,112	0,16	0,16	0,16	0,16	0,16	0,112	0,135	17	100%
Q5	0,391	0,083	0,391	0,193	0,083	0,083	0,193	0,083	0,193	0,083	0,193	0,083	0,083	0,193	0,083	0,083	0,193	0,158	15	88%
Q6	0,066	0,066	0,066	0,066	0,066	0,596	0,219	0,066	0,066	0,219	0,219	0,365	0,066	0,219	0,066	0,066	0,219	0,16	10	59%
Q7	0,064	0,064	0,208	0,064	0,208	0,064	0,064	0,064	0,064	0,064	0,064	0,064	0,208	0,064	0,208	0,208	0,064	0,106	12	71%
Q8	0,076	0,076	0,076	0,076	0,076	0,202	0,615	0,076	0,202	0,076	0,202	0,202	0,076	0,202	0,076	0,076	0,076	0,145	11	65%
Q9	0,061	0,061	0,217	0,061	0,061	0,603	0,217	0,217	0,061	0,217	0,217	0,061	0,061	0,061	0,061	0,061	0,061	0,139	11	65%
Q10	0,271	0,312	0,077	0,077	0,077	0,506	0,506	0,077	0,077	0,077	0,312	0,077	0,271	0,077	0,312	0,312	0,077	0,206	9	53%
Q11	0,087	0,087	0,087	0,195	0,386	0,386	0,195	0,195	0,195	0,195	0,195	0,087	0,386	0,195	0,087	0,087	0,195	0,191	14	82%
Q12	0,292	0,069	0,069	0,069	0,292	0,292	0,526	0,288	0,288	0,288	0,288	0,069	0,292	0,069	0,069	0,069	0,288	0,213	7	41%
Q13	0,049	0,049	0,049	0,224	0,049	0,224	0,049	0,049	0,049	0,049	0,049	0,368	0,049	0,224	0,049	0,049	0,049	0,099	13	76%
Q14	0,096	0,176	0,096	0,176	0,096	0,176	0,176	0,096	0,176	0,096	0,096	0,096	0,096	0,176	0,096	0,096	0,096	0,124	17	100%
Q15	0,038	0,038	0,038	0,29	0,038	0,301	0,29	0,038	0,038	0,038	0,038	0,301	0,038	0,038	0,038	0,038	0,038	0,098	13	76%
Q16	0,319	0,262	0,059	0,262	0,319	0,059	0,059	0,319	0,262	0,262	0,059	0,319	0,059	0,059	0,319	0,319	0,262	0,21	6	35%
Q17	0,114	0,42	0,114	0,162	0,162	0,162	0,162	0,162	0,114	0,114	0,162	0,114	0,162	0,162	0,42	0,42	0,114	0,191	14	82%
Q18	0,032	0,24	0,032	0,032	0,032	0,24	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,057	15	88%
Q19	0,114	0,114	0,42	0,162	0,114	0,42	0,114	0,162	0,162	0,162	0,162	0,162	0,162	0,114	0,114	0,114	0,162	0,173	15	88%
Q20	0,016	0,256	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,03	16	94%
Q21	0,083	0,083	0,391	0,193	0,083	0,391	0,083	0,193	0,193	0,083	0,083	0,193	0,193	0,083	0,083	0,083	0,193	0,158	15	88%
Q22	0,192	0,192	0,081	0,081	0,081	0,081	0,081	0,081	0,081	0,192	0,081	0,081	0,081	0,081	0,498	0,498	0,081	0,15	15	88%
Q23	0,099	0,099	0,099	0,099	0,178	0,178	0,099	0,099	0,479	0,099	0,099	0,099	0,099	0,099	0,479	0,479	0,099	0,175	14	82%

Table J.4 – Threshold and consensus values - *Continuation*

Q24	0,240	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,240	0,240	0,032	0,069	14	82%
Q25	0,397	0,106	0,182	0,182	0,397	0,397	0,182	0,182	0,182	0,182	0,106	0,182	0,106	0,182	0,397	0,397	0,182	0,232	12	71%
Q26	0,208	0,208	0,065	0,065	0,065	0,065	0,065	0,065	0,065	0,065	0,065	0,513	0,065	0,065	0,065	0,065	0,065	0,108	14	82%
Q27	0,065	0,208	0,065	0,065	0,208	0,065	0,065	0,065	0,065	0,065	0,065	0,513	0,065	0,065	0,065	0,065	0,065	0,108	14	82%
Q28	0,192	0,192	0,192	0,080	0,080	0,080	0,080	0,080	0,080	0,080	0,080	0,080	0,192	0,080	0,192	0,192	0,080	0,120	17	100%
Q29	0,372	0,072	0,372	0,072	0,211	0,211	0,072	0,211	0,211	0,072	0,211	0,211	0,072	0,211	0,372	0,372	0,072	0,200	6	35%
Q30	0,128	0,128	0,128	0,144	0,128	0,144	0,144	0,144	0,128	0,144	0,144	0,128	0,128	0,144	0,128	0,128	0,144	0,136	17	100%
Q31	0,309	0,045	0,309	0,309	0,045	0,045	0,045	0,276	0,045	0,276	0,276	0,045	0,045	0,276	0,045	0,045	0,045	0,146	10	59%
Q32	0,192	0,192	0,192	0,080	0,080	0,080	0,080	0,080	0,080	0,080	0,080	0,192	0,080	0,080	0,080	0,080	0,080	0,106	17	100%
Q33	0,110	0,110	0,408	0,172	0,172	0,110	0,634	0,172	0,172	0,172	0,172	0,110	0,172	0,172	0,110	0,110	0,172	0,191	15	88%
Q34	0,216	0,085	0,363	0,216	0,216	0,216	0,216	0,216	0,085	0,363	0,216	0,363	0,363	0,216	0,363	0,363	0,085	0,245	3	18%
Q35	0,048	0,224	0,048	0,048	0,048	0,048	0,048	0,048	0,048	0,048	0,048	0,224	0,048	0,048	0,224	0,224	0,048	0,089	13	76%
Q36	0,032	0,240	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,240	0,032	0,032	0,032	0,032	0,032	0,057	15	88%
Q37	0,064	0,208	0,064	0,064	0,064	0,064	0,064	0,064	0,064	0,064	0,208	0,208	0,064	0,064	0,208	0,208	0,064	0,106	12	71%
Q38	0,096	0,176	0,176	0,096	0,096	0,096	0,176	0,096	0,096	0,096	0,096	0,176	0,096	0,096	0,176	0,176	0,176	0,129	17	100%
Q39	0,128	0,128	0,128	0,144	0,128	0,144	0,144	0,144	0,128	0,144	0,144	0,128	0,128	0,144	0,128	0,128	0,128	0,135	17	100%
Q40	0,099	0,099	0,178	0,099	0,099	0,099	0,099	0,178	0,099	0,099	0,479	0,479	0,099	0,099	0,099	0,099	0,099	0,153	15	88%
Q41	0,450	0,130	0,130	0,130	0,146	0,130	0,130	0,146	0,130	0,146	0,130	0,146	0,130	0,130	0,450	0,450	0,130	0,190	14	82%
Q42	0,092	0,197	0,197	0,197	0,197	0,197	0,382	0,092	0,197	0,197	0,092	0,382	0,197	0,197	0,382	0,382	0,382	0,233	12	71%
Q43	0,285	0,296	0,070	0,285	0,285	0,070	0,296	0,070	0,296	0,296	0,285	0,070	0,296	0,285	0,070	0,070	0,285	0,212	6	35%
Q44	0,160	0,113	0,113	0,113	0,160	0,113	0,113	0,160	0,113	0,160	0,113	0,113	0,113	0,113	0,469	0,469	0,160	0,169	15	88%
Q45	0,192	0,080	0,080	0,080	0,192	0,080	0,080	0,192	0,192	0,080	0,080	0,080	0,080	0,080	0,192	0,192	0,080	0,120	17	100%
Q46	0,176	0,097	0,097	0,097	0,097	0,097	0,176	0,097	0,097	0,097	0,097	0,097	0,176	0,176	0,483	0,483	0,097	0,161	15	88%
Q47	0,304	0,057	0,304	0,057	0,057	0,278	0,057	0,278	0,304	0,304	0,278	0,057	0,057	0,057	0,304	0,304	0,278	0,196	7	41%
Q48	0,113	0,160	0,113	0,160	0,113	0,113	0,113	0,113	0,113	0,160	0,113	0,160	0,113	0,160	0,469	0,469	0,113	0,169	15	88%

Table J.4 – Threshold and consensus values – *Continuation*

Q49	0,038	0,038	0,038	0,038	0,038	0,329	0,258	0,038	0,258	0,038	0,258	0,329	0,329	0,038	0,038	0,038	0,258	0,141	10	59%
Q50	0,174	0,168	0,174	0,174	0,174	0,174	0,404	0,174	0,404	0,174	0,404	0,174	0,174	0,168	0,174	0,174	0,404	0,227	13	76%
Q51	0,324	0,048	0,324	0,048	0,048	0,260	0,260	0,324	0,260	0,048	0,260	0,048	0,048	0,048	0,048	0,048	0,260	0,159	9	53%
Q52	0,251	0,093	0,251	0,251	0,251	0,330	0,330	0,251	0,330	0,251	0,330	0,093	0,093	0,093	0,093	0,093	0,093	0,204	7	41%
Q53	0,176	0,176	0,176	0,176	0,096	0,096	0,096	0,176	0,096	0,096	0,096	0,096	0,096	0,096	0,096	0,096	0,096	0,120	17	100%
Q54	0,420	0,114	0,114	0,114	0,162	0,162	0,162	0,420	0,162	0,162	0,162	0,114	0,162	0,162	0,114	0,114	0,162	0,175	15	88%
Q55	0,160	0,160	0,112	0,112	0,112	0,112	0,112	0,112	0,112	0,160	0,160	0,160	0,112	0,112	0,160	0,160	0,160	0,135	17	100%
Q56	0,405	0,099	0,178	0,178	0,405	0,178	0,178	0,099	0,099	0,099	0,099	0,178	0,099	0,178	0,099	0,099	0,178	0,167	15	88%
Q57	0,208	0,064	0,064	0,064	0,064	0,064	0,064	0,064	0,064	0,064	0,208	0,208	0,064	0,064	0,208	0,208	0,064	0,106	12	71%
Q58	0,282	0,308	0,282	0,308	0,282	0,055	0,055	0,055	0,055	0,055	0,055	0,055	0,282	0,055	0,055	0,055	0,055	0,138	11	65%
Q59	0,223	0,223	0,223	0,361	0,223	0,223	0,113	0,113	0,361	0,113	0,113	0,113	0,223	0,113	0,223	0,223	0,113	0,194	7	41%
Q60	0,048	0,048	0,048	0,048	0,048	0,048	0,224	0,048	0,048	0,048	0,048	0,224	0,048	0,048	0,224	0,224	0,048	0,089	13	76%
Q61	0,049	0,528	0,049	0,049	0,049	0,049	0,049	0,049	0,049	0,049	0,049	0,224	0,049	0,049	0,049	0,049	0,049	0,088	15	88%

Source: Prepared by the author