POLITECNICO DI MILANO

Department of Management Engineering

Division of Supply chain Management Engineering

Case study

Advancement of Sales and Operations Planning for Effective Demand Management with IBP

Master of Science Thesis in the master's degree Program Supply Chain Management.

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Abstract (English)

The aim of the thesis is to develop a model for the S/OP and IBP maturity and understand the advancement in S/OP planning with IBP maturity assessment and demand management. The initial focus is given to the Agribusiness where the need for the advancement in the supply, operations and demand planning was understood.

The agribusiness plays a major role in the world economy and has leading contribution towards all the industries. The supply and operations of this industry is connected to various other industries. Thus, improvement in one industry may bring a raise in the supply chain and progress of the entire cycle. The research started by understanding what IBP is and how its related to S/OP. Later after the literature research and key findings were listed to develop a comprehensive model that can test the IBP maturity and provide recommendations by evaluating the IBP using a Questionary algorithm. The model was framed and the execution of the model in the form of an UI/UX application was left to the future scope of the thesis.

The research showed that the entire management and execution depends on the planning department and the accurate demand forecasting. The demand forecasting and demand planning is a very tedious process, the volatile and emergency periods challenge these departments disabling them to predict the demand accurately and the second research question answers in detail on how it effects the S/OP, how different process are interlinked and the demand management in detail. Various methods to perform the demand management were discussed and a what if analysis is made to analyze and suggest the best method. The Entire framework is supported by Literature and qualitative analysis of the aspects suggested. A Sample testing model was also developed with a questionnaire framework.

Abstract (Italian)

Lo scopo della tesi è sviluppare un modello per la maturità S/OP e IBP e comprendere l'avanzamento nella pianificazione S/OP con la valutazione della maturità IBP e la gestione della domanda. Il focus iniziale è dato all'Agribusiness dove è stata compresa la necessità di avanzamento nella pianificazione dell'offerta, delle operazioni e della domanda.

L'agrobusiness svolge un ruolo importante nell'economia mondiale e ha un contributo di primo piano a tutte le industrie. La fornitura e le operazioni di questo settore sono collegate a vari altri settori. Pertanto, il miglioramento in un settore può portare a un aumento della catena di approvvigionamento e all'avanzamento dell'intero ciclo. La ricerca è iniziata comprendendo cos'è l'IBP e come è correlato a S/OP. Successivamente, dopo la ricerca della letteratura e i risultati chiave, sono stati elencati per sviluppare un modello completo in grado di testare la maturità dell'IBP e fornire raccomandazioni valutando l'IBP utilizzando un algoritmo di Questionario. Il modello è stato inquadrato e l'esecuzione del modello sotto forma di un'applicazione UI/UX è stata lasciata al futuro ambito della tesi.

La ricerca ha mostrato che l'intera gestione ed esecuzione dipende dal dipartimento di pianificazione e dall'accurata previsione della domanda. La previsione della domanda e la pianificazione della domanda sono un processo molto noioso, i periodi volatili e di emergenza sfidano questi dipartimenti disabilitandoli a prevedere la domanda in modo accurato e la seconda domanda di ricerca risponde in dettaglio su come influisce sull'S/OP, su come i diversi processi sono interconnessi e la gestione della domanda in dettaglio. Sono stati discussi vari metodi per eseguire la gestione della domanda ed è stata effettuata un'analisi what if per analizzare e suggerire il metodo migliore. L'intero quadro è supportato dalla letteratura e dall'analisi qualitativa degli aspetti suggeriti. È stato inoltre sviluppato un modello di test del campione con un framework di questionari.

1Acknowledgement

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Abbreviations

AI – Artificial Intelligence

GDP – Gross Domestic Population

IBP – Integrated Business Planning

S/OP – Sales and Operations

SCM – Supply chain management

UI/UX – User Interface / User Experience

1. Introduction

Agriculture is a part of living, invented between 7000 to 10000 years ago during the new stone age. Agriculture remains the center of the world's economy. More than 60% of the population depends upon agriculture. Agriculture dependent livelihood accounts for more than 50 per cent of employment and a significant per cent of the country's GDP. The inference is that a person dependent on agriculture earns, on average, less than 30 per cent of what others do. This is since previously agriculture has not been considered as a business. Agriculture began independently in many regions of the world and since then has played a critical role in the economies of those countries. In several developing countries, agriculture is the primary source of income and urged the need for agricultural products to become raw materials for several industries. It was initially intended to fulfil own needs, but the development of industrialization, globalization and improvement of trade activities helped raise the demand with drastic change. With this sudden rise in demand, a new industry, "**Agribusiness**", has been developed to manage the world demand by bringing technology into the picture.

1.1. Agribusiness

Agribusiness is a business that deals with the production and distribution of farm equipment and supplies, including the processing, storage, and distribution of farm products. Until the early 1960s, economists saw agriculture differently, focusing on markets and pricing and recognizing the agricultural sector as separate entities. Cost-free production and distribution coordination were encouraged by market prices. Fixing market defects and pricing distortions are treated with traditional intervention. The study did not look into private agricultural and allied sector strategies. The concept of market intervention policies was a major topic at that moment. Davis and Goldberg's work at Harvard University's Graduate School of Business Administration in 1957 offered up new insights on food systems analysis that proved valuable for public policy design and the architecture of corporate strategies. The authors proposed the concept of agribusiness as: **"The sum of all operations involved in manufacture and distribution of farm supplies, production operations on the farm, and the storage, processing, and distribution of farm commodities".**

1.1.1. Supply chain management

Suppliers look to operate supply chains as efficient and cost-effective as feasible through supply chain management (SCM). SCM refers to controlling the flow of goods and services, and it encompasses all processes that turn raw materials into finished commodities. It entails actively simplifying a company's supply-side processes in order to increase customer value and achieve a competitive advantage over competitors. Everything from manufacturing to product creation comes under Supply chains and the information systems required to coordinate these activities. Typically, SCM aims to centralize or link a product's manufacturing, shipment, and distribution. Companies can decrease costs and deliver items to customers faster by optimizing the supply chain. Internal inventories, manufacturing, distribution, sales, and company vendor inventories are all under tighter supervision. There are five parts to the supply chain process.

Five Parts of SCM

Supply chain management is a vast concept. The supply chain manager (SCM) is in chargeof all the logistics aspects of the SCM, divided into five sections: Plan, Source, Execute, Deliver and Return. The proper execution and management of each team lead to a successful supply chain management process. Each unit goes hand in hand and has critical roles in delivering the functions to the end customer.

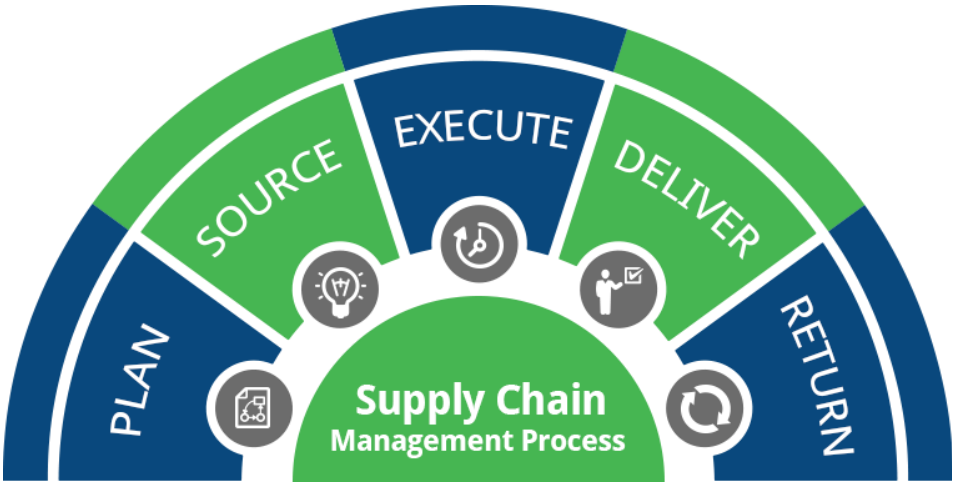

Figure 1: 5 PARTS OF SCM

Plan: The strategic aspect of the supply chain management process is determining the best potential blueprint for achieving the ultimate goal. Plant location and size, warehouse architecture, delivery methods, IT solution selection, and other critical components should be identified by SCM managers. Not only that, but if essential matrices like transportation cost modelling and warehouse efficiency models aren't produced, the supply chain management process will be incomplete.

Source: At this level of supply chain management, the focus is on identifying the most consistent raw material sources so that the manufacturing process is never interrupted. However, when difficult conditions develop during operations, supply chain managers must ensure that important supply chain pain points are constantly tracked in order to keep the engine running. Holisol believes that establishing a contractual framework and selecting a capable supplier is one thing. Still, there should also be an actual mechanism for suppliers' constant development, which would increase their efficiency.

Execute: This is when well-designed processes are put in place to give existing plans a visible shape in the form of manufactured items ready for testing, packaging, and distribution. Not only that but results are quantified at this stage in order to attain optimum efficiency. Holisol's experts create cost-effective IT solutions that assist companies in achieving excellence and increasing efficiency during the SCM execution stage.

Deliver: When the supply chain reaches this stage, the management is primarily concerned with offering the service and product in the correct quantity, at the right location, and at the right time using appropriate carriers. SC managers should be fully equipped with modern IT tools to keep track of warehousing networks, inventory models, invoicing, and payment receipts.

Return: The final phase in the SCM process is processing returns. It entails not just quality control but also inventory management. On the ground, supply chain managers should deploy their personnel and rely on technology to facilitate speedier pickups, replacements, and other

tasks. In the view of supply chain managers, returns management should be viewed as a value enhancement measure, and they must ensure that all appropriate measures are done to achieve optimum efficiency.

1.1.2. Importance of supply chain management in Agribusiness

Agriculture, on the other hand, requires some key management inputs, particularly SCM. SCM principles, such as collaboration among various stakeholders, non-exploitative vertical and horizontal integration, market reforms, precision farming, contract farming, demand-led diversification, and extensive and intensive use of information technology for real-time communication across the chain, can help agribusiness realize its full potential. Horizontal collaboration among politicians, researchers, extension agencies, technological businesses, and financial institutions strengthens the chain, which can be strengthened through SCM. Agriculture should encompass the entire value chain, not simply production. SCM relies heavily on technological contributions. Technologies like sensors, actuators, the cloud, and the internet enable the easy application of the SCM. The most important aspect of the SCM inthe Agribusiness is to monitor. SCM provides time to time updates on the planning, execution and delivery of the products. The Agri products hold Food and Food processed products that require high monitoring when delivered and executed. Proper packing and delivery are essential components in Agribusiness. SCM plays a vital role in allowing to implement it. The Agribusiness and Agriculture Industry to moving to Smart Agriculture and Industry4.0. The

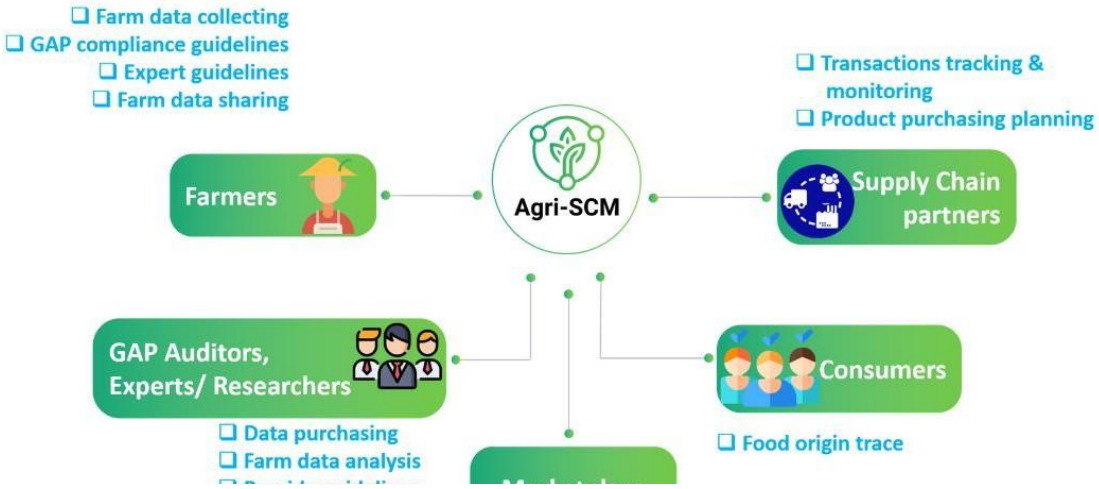

Figure 2: SCM IN AGRI BUSINESS

SCM is responsible for the transactions, tracking and monitoring of the product. The SCM also lies its function responsibilities in the product purchase planning. Thus, SCM plays an important role in Agribusiness.

1.1.3. Role of sales and operations planning in supply chain management

The purpose of sales and operations planning, which is a subset of supply chain planning, is to create a coherent, consensus-based business plan. It incorporates feedback from major functional areas such as sales, marketing, manufacturing, distribution, and finance. Cross-functional collaboration produces plans that are understood and supported by all stakeholders. S&OP is a more advanced discipline on the spectrum of supply chain planning activities. Many small businesses and startups may merely require inventory planning. As businesses expand, companies may add skills such as demand planning and supply planning. When a company sells a large number of differentiated items, it usually seeks out S&OP functionality.

Statistical forecasting, for example, is a planning activity that can yield excellent outcomes. Despite this, the scope of the results is usually somewhat limited. A decent statistical forecast, for example, will rely on algorithms and an item's history to make estimates. However, other variables, including revenue and profit estimates and marketing events, are not often included in statistical forecasting. As a result, collaboration with important business stakeholders is limited. By extending the demand forecasting to sales, marketing, finance, and operations for their joint input and changes, sales and operations planning aims to acquire a holistic view of planning. Point of sale (POS) and other market-related data is also included in more advanced S&OP processes.

Collaboration is where S&OP adds real value and improves performance. Because they use the same data sets, all parties can align. S&OP eliminates excuses and promotes accountability through its built-in checks and balances. The outcomes of this type of collaboration are frequently outstanding. According to studies, high-performing S&OP-driven Organizations have a higher average profit margin than their rivals. On average, the outcomes are 15% less inventory, 17% stronger perfect order fulfilment, 35% shorter cash-to-cash cycle times and $1/10^{th}$ tenth of the stock-outs. The entire planning of the SCM depends on the forecast made by the planning department, which in turn fuels the product purchase, then the operation department, which allows the logistics planning for the execution and delivery of the functions,

services, and products to theend customer. The SCM is involved from the product purchase to the delivery of the product to the end customer. Thus, SCM is directly or indirectly dependent on the Demand, Supply andOperations, making the entire process under single management.

S/OP benefits

Some of the benefits of an effective sales and operations planning process include

- Lower inventories and obsolescence
- Reduced lead times
- Quicker responsiveness
- Increased customer service levels
- Improved profitability
- Higher product revenues
- Top-down management control
- Predictable operating performance for shareholders

1.2. Problem identification

In terms of agriculture, it is without a doubt one of the key factors in achieving the network's long-term success. It is also linked to a country's economic growth, and the term "agribusiness" was chosen because it has become a significant issue. People are increasingly concerned about food safety, which is linked to several variables that have gained prominence in recent years, including economic and social considerations and environmental considerations. In upstream and downstream, major food manufacturing enterprises today demand a substantial component of teamwork and technology. The current market is competitive, requiring manufacturing companies to integrate their capabilities, known as supply chains. Managing relationships upstream and downstream, with the goal of being capable and sustainable by optimizing Supply and demand to provide a value-added product, is the boundary of this network.

The Integration and efficiency of their company's strategic plan (Integrated Business Planning), that is, all linked operations from the transfer of raw materials to the final consumer, has attracted the interest of supply chain managers in recent decades. To establish an SC, the firm

must have a vision primarily motivated by increased profits, performance optimization, and risk reduction, all of which will give the Organization a competitive advantage throughout its supply network.

Between the 1950s and 1960s, Forrester and Burbidge published books on demand management in supply chains. The current concepts of the DM in relation to supply chains were founded in the 1990s, with efficient responses to consumers, supplier-managed inventories, and continuous replenishment. Ten years ago, companies still did not care about the importance of demand management, coordination, and thus addressing the problem in SCM. When it comes to the entire network of Organizations involved, there is not much of a difference between the demand chain and the supply chain, so it is not just about forecasting methodology or the type of demand or pattern those products follow. However, it is also about the management of managed collaboration within itself. Even when the publications examined are concerned with deterministic demand concerns.

Because the criteria and detailed details of the demand are not known precisely, it is not easy to foresee the reality. According to the most recent research on SCM approaches, the prospects lie in their coordination, Integration, collaboration, and relationship with the DM. Predicting and synchronizing demand with other chain processes, including production, procurement, and distribution, is critical for improving operational efficiency and making decisions based on demand direction.

1.2.1. Supply chain in Agribusiness

Because its parameters are not punctual and the poor daily DM, such as seasonality of products, the volume of Supply, and their perishability. The SC in agribusiness includes producers, farmers, cooperatives, logistics centers, suppliers, intermediaries, processing,
transportation, distribution companies, and consumers integrated throughout the network. Given the sector's complexity, it is well recognized that both producers and agricultural processors are unable to get reliable and timely demand information. Entrepreneurial prospects in this industry rely heavily on the interdependence of all network components and the efficient use of its resources to maintain future demand management.

Figure 3: SCM RELATIONSHIP WITH AGRI-BUSINESS

Impact of COVID-19

The pandemic has caused damage to the worldwide economy and social balance, resulting in social isolation, travel restrictions, and one of the worst global recessions since the Great Depression. Supply chain (SC) management (SCM) experienced considerable difficulty dealing with an unexpected demand for particular items when simultaneous travel and production restrictions were imposed at the start of the global outbreak in March and are still battling to recover. Business operations are attempting to adjust to the new environment, and there will almost definitely be long-lasting changes as a result of the epidemic. SCs in relation to the epidemic has been widely addressed in the headlines, and scientific investigation into the crisis' ramifications has already begun. On the other hand, traditional research paradigms are unable to keep up with the present epidemics and economic advancements.

Key Challenges (COVID-19 Crisis)

- Traditional statistical models are unable to incorporate new demand realities or historical demand trends in a timely manner.
- Be on the lookout for new and irrational client habits, such as hoarding or illusory orders.

- Government-imposed factors, such as business closures and reopening, lockdowns, and border closures
- Develop on-demand capability for understanding the ramifications of the entire ecosystem
- Pay more attention to external factors and new data sources.
- Extend efforts beyond demand forecasting to include other critical elements such as supply availability and product capacity forecasts.

1.2.2. Impact on the Organization by lacking the S/OP

What's on the line?

- Misalignments in customer service. In terms of cost to serve and profitability, not all clients are created equal. It is not easy to improve the supply-demand balance without creating client segment-specific service levels and incentives.
- Demand issues. Forecasts, especially for new product releases or style-sensitive items, can be excessively optimistic or pessimistic. Customers may become enraged, and sales may be lost if demand is unexpectedly high. It is a distressing but all-too-common incident.
- Challenges on the supply side, any supply chain or network component can become a bottleneck, resulting in shortages. This might happen in upstream components used as product inputs, at the plant level due to capacity or flexibility constraints, or in the downstream finished goods distribution chain.
- Mismatches in inventory. Given the basic uncertainties involved, inventory at the stages of raw materials, intermediate, and final goods, serves as a vital buffer between demand and Supply. On the other hand, many Organizations are dealing with both shortages of key inputs and goods and an excess of slow movers and obsoletes.

1.2.3. Demand management issues

The main problem that the management system faces with the S/OP is that they are not able to predict the demand with certain accuracy. The S/OP gets executed effectively only when the demand is forecasted as required. The process of estimating the future demand based on the current data is called as demand forecasting. Forecasting can be done in many ways, some are just taking mean of the previous months, some procedures take the weighted average of previous data giving high weight to the current month, but the unknown fact reminds here that the demand is a highly variable Quantity, and it is influenced by many factors starting from

Figure 4: DEMAND PLANNING RELATIONSHIP WITH S/OP

trend, climate, Environment, people's mentality, need and the rival products. The numerical methods to predict demand may be best in an ideal world but that of the real world requires buffer. The buffer allows to control the demand in a highly volatile environment, but it is not as effective in the day-to-day operations. The Sc-marketing and sustainability allows to boost the demand to a certain level, but it doesn't affect the fact of real time operations and the team although bills a lot to the company reducing the overall revenue from sales. In an uncertain environment when the company has unstable demand or declining sales then the creative team tries to boost-up the sales and level the operations according to the demand predicted so as to avoid over stock and keep revenues high.

1.2.4. Cross-functional challenges in an organization.

Challenge no. 1: Misunderstood purpose

Oftentimes cross-functional teams are formed as a "best practice," but no clear definition of what they are supposed to accomplish is provided. Teams can only function if each team member is aware of the group's general aims and objectives. This should include goals, objectives, roles, and duties, among other things. Everything becomes more difficult when there is no clear, well-communicated purpose. The team members cannot agree on priorities, do not know what their jobs are, and generally feel like they are pushing a giant rock up a steep hill.

Challenge no. 2: Misalignment around Organizational goals

Your customer experience programs are equally as vital as your specific customer experience goals since your overall Organization's strategy, vision, and goals are just as significant. Teams that lose sight of this disappoint their superiors by failing to focus. Ascertain that your planned outcomes are linked to the Organization's most critical Key Performance Indicators (KPIs), these can fluctuate depending on annual, quarterly, or even monthly objectives. Connecting these critical parts should be part of the cross-functional team's leadership role.

Challenge no. 3: Limited visibility

Teams that hoard their information miss out on opportunities to obtain support and buy-in along the road. One of a cross-functional team's aims should be to provide visibility into its insights, actions, and outcomes. The ability to identify and reward those team members who are working hard to make things happen is also enhanced by visibility across the business.

Challenge no. 4: Not including customers

It's simple to get caught up in your own little world. Cross-functional teams have a tendency to believe that they don't need to involve clients directly. Customers do not have to be invited to meetings in order to be included. In theory, though, it might be beneficial. Customers can be "invited" by reviewing their particular comments from open-ended responses from surveys or by playing a tape of an actual customer conversation. Staying connected to the customer's actual voice and unique tales allows your team to internalize what's most important to them and exercise empathy while deciding on next steps.

Challenge no. 4: Not evolving best practices

The customer experience is always changing. The customer journey is dictated as much by your commitment to it as it is by your customer expectations, the marketplace, and even your competitors' experiences. Cross-functional teams that fail to consider the marketplace, their customer's ecosystem, and other variables will embed themselves in "the way things have always been done." Teams must be adaptable enough to changes in goals and best practices.

1.2.5. Consequences of Poor Interdepartmental Communication

The difficulty facing today's firms is that, although taking more carefully about how they connect with their employees, they focus more on how to maintain and make happy the present workforce in light of changing situations (Argenti, 1996). Several mid- to large-sized businesses are divided into departments to keep the various operations separate and managed by experts in each field. Organizations must, however, create and sustain efficient interdepartmental communication in order to be successful. Lack of internal coherence and adequate communication methods among diverse divisions is one of the key reasons why firms fail nowadays. Interdepartmental communication disruptions can have a significant influence on an organization’s efficiency and increase employee stress, resulting in poor performance. Internal communication in Organizations has sparked a lot of discussion in the Organizational literature. However, the number of research studies that have been undertaken to assess various aspects of Organizational communication is relatively low (Landsberger, 1961). Organizations are made up of social components that join together for the purpose of production, designed by people with different perspectives and awareness to achieve a shared aim. Most businesses do not place enough emphasis on giving employees with intra-Organizational cooperation and a sense of belonging in order to do their tasks effectively. As a result, employees are unaware of the dynamic, competitive, and confusing situations that exist in the outside world. As a result, a well-designed and effective communication system is critical for adapting Organizational and managerial duties as well as communicating critical information both inside and outside the company.

1.2.6. S/OP as a solution

The difficulty of efficiently matching demand and Supply is one of the most common problems faced by manufacturers across all industries. Manufacturers are constantly faced with the decision of what to create., how much to produce, and when to produce it. When businesses fail to tackle this challenge efficiently, they face plenty of problems. Failure to balance demand with Supply has ramifications not only for the manufacturing Organization, but also for the entire eBusiness trading network. It's possible that the plant lacks the necessary raw resources to meet manufacturing demands. Unscheduled changeovers to fulfill unforeseen promotional activities may result in higher production costs. For discontinued or slow-moving commodities, excessive and costly inventory may be kept on hand. Inventory shortages for new and promoted products, on the other hand, may inhibit promotional efforts. Companies may have stock-outs as a result of failing to have the right goods in the right place at the right time. The answer could be Planning for Sales and Operations- S&OP (sales and operations planning) is a business procedure that assists businesses in better managing demand and Supply.

1.3. Research Questions formulation

The research questions in this thesis are formulated based on the testing of basic principles like Pareto rule of product categorization, supply responsiveness and demand balance. The responsibility has faced major challenges from production campaigns and shortages. The Weakest link for an agribusiness is the SCM – S/OP management. The concept that the sales forecast relates only to operational level and do not interfere with the IBP and revenue maximization lead to the first research question of what IBP is, how its related and different from S/OP and what is the possible model to assess it. The overall demand management process is considered as a basis in comparing all kinds of resource allocation. Due to heavy fluctuation in the covid times the forecasting of demand has reached to several errors. The variation in the demands has affected the entire system of S/OP, thus, to establish and study the relationship between the demand forecast and the Supply & operations in a company a research Question was formulated. The Ideology was to first understand the problem in deep, list out the key factors causing the problems, take help from journals to understand the existing methods and

then formulate a theory of how the literature review has helped us to understand and solve the formulated research questions.

1.4. Purpose of thesis

This thesis is divided into five chapters. Chapter one provides a detailed introduction of the Agribusiness, the importance of supply chain and its supportive concepts, even further discussion about demand management issues and the role of Sales and operations planning, along with the general introduction of Integrated business planning and its role in supply chain planning.

Furthermore, problem identification helps to formulate research questions in the 2nd chapter by following the research questions. Chapter Two reviews the literature on the evolution of S/OP, the relationship between IBP and S/OP, S/OP maturity assessment model and demand management process, etc. This is followed by the specific theories used as a theoretical lens in this thesis and a review of the literature and relevant theories provide a foundation for the conceptual framework presented at the end of the chapter.

Chapter 3 illustrates the research methodology and data collection process. In chapters 4 and 5, the research philosophy, methods and design are discussed. More specifically, this thesis employs a model development to approach to study the S/OP maturity level of Syngenta company. Further, chapter 6 summarizes the importance of the study, its key contributions, its limitations, and suggestions for future research. The major goal of this thesis is to comprehend the demand management mechanism at the lowest level of connectivity, then join these connections towards Supply, operations and business then try to maximize the management level by providing various assessment models and improvement techniques. The thesis also analyses the impact of covid in the S/OP and demand forecasting and how the current techniques and process can be improved for volatile and emergency period such as this and how crisis can be turned towards opportunity by the necessary buffers.

1.5. Overview of model analysis

The requirement to develop a model where we can analyze the S/OP and IBP maturity based on the inputs fed by the company using it. The key parameters involved are People, process, analytics, technology and then they are summarized to give out a cumulative result. The discussion on how we can analyze and in what factors the analysis is based upon is described in detail with the solution to research question 1. The model can be developed as an App using colorful UI/UX features such that the user is attracted and has steady mind while taking the survey. The Questions are framed based on numerous factors testing the user in all possible ways to make the model effective enough to provide necessary assessment. The feedback is very detailed with step-by-step procedure to implement and improve rapidly. The future scope lies in the concept that the model is powered by AI where it can sense and input data automatically by observing the process and shifts in trends and provide necessary recommendations to the user/operator to modify functionality based on the assessment algorithm.

1.6. Reading guidance

The following reading instructions are offered in order for readers of this thesis to obtain an understanding of which chapters and sections may be of interest to them:

- Refer to this intro chapter as well as the solution and discussion in chapter4 and the conclusions in chapter 5 for an overview of the main results and contributionsof this thesis. These chapters may serve as a starting point from where it is possible to refer to chapters you want to learn more about.
- If you are not well understood with the literature and theory behind S&OP and scenario analysis, please refer to the Theoretical Framework, chapter 2.
- If you are interested to learn about demand management and its relationship with S/OP, refer to the Literature under Research Question 2 and solution under the same in chapters2 and 4.
- If you are interested to know about the model and its implementation, refer to the Literature under Research Question 1 and solution under the same in chapters 2 and 4

2. Background

Introduction

This Literature evaluations can be found in a variety of scholarly publications with varied interests and emphases. To set the foundation for the study effort and provide a general overview of the research issue, short or miniature literature reviews can be presented in journal articles, book chapters, or coursework projects. A literature review in a research thesis, on the other hand, is used to identify gaps and argue for the need for more research. The selected strategy has been chosen for this thesis. A single or small number of sources are examined in the selective approach (e.g., as in an annotated bibliography assignment, or the introduction of a journal article).

2.1. literature review

2.1.1. Evaluation of S/OP.

Sales and operations planning has been the essential business management procedure for many manufacturing and supply chain management Organizations since the 1980s (S&OP). Ollie Wight created S&OP in the early 1980s, and the author of this essay attended the first S&OP Workshop in the UK in 1983. The S&OP language has become widely accepted around the world. The underlying behaviors and practices to provide the potential business benefits that best practice S&OP can offer are not always implemented. S&OP's "ambition" has frequently been set far too low. S&OP emerged as a concept in the 1970s, when it was known as Production Planning. The term S&OP was initially used in 1981 to describe the coordination growth between commercial and Supply functions, which had previously been non-existent. During the 1980s, inventory management and the balance of long-term Supply and demand became more critical. Financial Integration, on the other hand, did not gain popularity until the late 1980s. After all, business is about financial success, and S&OP began to evolve from a supply process to a business management process at this moment. Planning. In the late 1990s, the next stage of evolution saw product and portfolio management integration into the S&OP process. This has been considered by many firms and thought leaders as one of the most

valuable changes made to the future-focused business planning process. For many firms, product and portfolio management is critical.

Traditional S&OP product and portfolio management did not integrate as a formal phase into the process and was frequently viewed as a separate "floating" process that was the realm of Innovation and R&D. Scenario and 'what if' planning have been identified as a significant corporate planning technique in the year 2000. This was a huge step forward beyond supply and demand balancing, which focuses on the financial consequences of suggested changes to business performance and strategy.

2.1.2. Difference between S&OP and IBP?

Many claims that IBP is merely a spruced-up S&OP exercise with finance thrown in, and it operates similarly to S&OP processes. The majority of proponents of this viewpoint are from the supply chain, and they appear to regard IBP as essentially a production planning process rather than a strategic process. They do not think the differences are important. On the other hand, others see IBP as a tool for directing the Organization's strategic orientation. Their starting point is the Organization's financial estimates, not the sales forecast in terms of units. While these may appear to be two different measures of the same item, the unit of measurement and means of execution are different sales fuel an organization’s success. IBP is inherently aligned with the Organization's financial numbers and forecasts, something S&OP cannot do.

What does IBP do that S&OP doesn't? IBP begins with the Organization's financial predictions and differs from S&OP, which is based in the supply chain with the primary purpose of aligning production volumes with sales volumes as a tool for driving the Organization ahead. S&OP processes are methodical and follow a set of steps. While there is nothing wrong with that, S&OP's primary purpose is to determine a sustainable production plan in line with sales estimates. The tools and aptitude for optimizing production plans are frequently lacking; the driving element is a feasible plan rather than optimal. Furthermore, when S&OP is used as part of an organization’s strategic planning process, the bottom-up approach, which regards financials as an (optional) add-on, promotes production levels over determining solutions that improve profitability. One of the most significant advantages of IBP over S&OP is that it aids

in the alignment of many departments and functions within a business toward a common goal. It also takes teamwork, trust, and cross-functional interaction easier. Effective IBP processes result in quantifiable and verifiable benefits, in addition to "soft" rewards like teamwork and trust.

2.2. What Is S&OP (Strategic and Operational Planning)?

The first issue with trying to learn S&OP is that the definitions are all over the place. Rather than debating which side is correct, it's probably preferable to start at the beginning and grasp the original concepts of the concept's inventors, Oliver Wight and Dick Ling. They were battling with production planning models at the time, and the technique was initially dubbed "sales and operational planning," which was later abbreviated to S&OP. They understood that efficient production planning required consideration of demand, production capacity, and Supply, and devised the five-step S&OP process as a result:

Gathering Data

Sales or Demand planning

Production and Supply

A review meeting

S/OP approval at an executive meeting

2.3. Definition of IBP

There are several definitions of integrated business planning, just as there are for S&OP (IBP). Perhaps the clearest description comes from Oliver Wight, one of the founders of S&OP, who describes it as an extension of S&OP concepts to embrace the entire business in order to create a seamless management process. It's important to note that it's a broader notion than S&OP and functions at a higher Organizational level. Its goal is to ensure that all business functions are aligned with the Organization's short, medium, and long-term objectives. IBP goals and targets are monetary in nature, and they naturally correspond to the Organization's financial budgets and long-term objectives. The COE, COO, or CFO are normally in charge of IBP.

2.3.1. Supporting tools for S/OP and IBP

The main tools involved in the IBP and S/OP are used to forecast the demand and certain tools to plan and analyze the data provided. The most famous tools are Streamline, analytical and forecasting software. One of the examples of streamline softwares is GMDH streamline which as mentioned in their research can forecast the demand to an accuracy of 99%, reduce stockout by up to 98%, reduce excess inventory up to 50%, increases inventory turnover by up to 35% and directly or indirectly maximizes the entire revenue by about 40%. These tools allow fast and intuitive user interface, seamless integration of company data sources, smooth and fast implementation process, the ideal fit of the business process in your company, syncing ordering dates across different networks and developing an advanced AI interface to forecast demand. Other tools that support S/OP and IBP are spreadsheet, Dynamic GP, QuickBooks, Unleashed, Spire, Dear, Database and most important SAP softwares. Overall, there are several tools to support S/OP and IBP for proper execution and findings.

2.3.2. S&OP maturity model

The requirement to develop a model where we can analyze the S/OP and IBP maturity based on the inputs fed by the company using it. The key parameters involved are People, process, analytics, technology and then they are summarized to give out a cumulative result. we can analyze the entire process and in what factors the analysis based on different criteria can provide various recommendation. Basically, the model asks various questions to the user and in return gets various inputs. Based on the inputs the model suggests various recommendations and methods to improve the overall performance. The model is developed from the criteria to analyze the entire process in various methods such that even the feedback from top level managers and that of the simple operator adds value to the entire setup.

2.3.3. What is Demand forecasting role in an organization.

Demand forecasting is the methodical and scientific estimation of a product's future demand. Demand forecasting is simply the process of projecting future sales proceeds or demand for a product. In terms of the aim of forecasting, data necessary, data availability, and the time span within which demand is to be projected, there are numerous ways of demand forecasting used.

Because each approach differs from the others, the forecaster must choose the method that best meets the requirements. The demand forecasting requires a lot of experience and consideration of various unstable factors that can decline sales at the vulnerable movement. The demand forecasting is divided into two main categories Quantitative and Qualitative. The quantitative methods are as described above where we use various mathematical approach and data of the previous demands to forecast the demand of the future. The method as mentioned in the problem definition has no updates of current events, thus the model fails to face drastic changes. The Qualitative Method on the other hand is derived by both data as well as Educated guess by the experts. The Experts consider various other factors like Environment, current trend and apocalyptic factors such that the forecast can be accurate to variability.

2.3.4. Demand management process

The goal of the demand management process is to balance the client's needs with the supply chain's capabilities. Forecasting demand and matching it to production, procurement, and distribution capabilities are all part of this process. A solid demand management plan can help a company respond more quickly to expected demand. Finding solutions to reduce variability and improve operational flexibility is a critical component of demand management. The Integration of important business processes from end user to original suppliers and information that adds value for customers and other stakeholders is known as supply chain management. The demand management method aims to strike a balance between the client's needs and the supply chain's capabilities. This process includes forecasting demand and aligning it to production, procurement, and distribution capacities. A well-thought-out demand management strategy can assist a corporation in responding more swiftly to anticipated demand. Demand management requires finding solutions to reduce unpredictability and increase operational flexibility. The Integration of important business processes from end users to original suppliers, as well as information that provides value for consumers and other stakeholders, is what supply chain management is all about.

As a Supply Chain Management Process, demand management is very important. Both strategic and operational factors are included in the demand management process. The team creates the structure for managing the process during the strategic process. Demand management is implemented through the operational process. Implementing the strategic process is an essential first step in integrating the firm with other supply chain members; here, IBP plays a critical role in enhancing communication between all supply chain departments. The day-to-day actions are carried out at the operational level. Both the strategic and operational processes are overseen by a process team made up of managers from several departments such as marketing, finance, production, purchasing, and logistics. Members from outside the firm may be included in the group. Customers and vendors, for instance. The process of managing strategic demand. Forecasting and synchronization are key elements of demand management.

Demand Planning in Supply networks must be as efficient as possible if they are to maximize profits. To ensure that supply chains are effective in terms of inventory and, ultimately, income, accurate demand planning is essential. Demand planning is a SCM technique that forecasts or predicts product demand to guarantee that products can be supplied, and consumers are satisfied. The idea is to achieve a balance between having enough inventory to meet client demands while also not having too much. Demand can be influenced by several reasons, including changes in the work force, economic developments, extreme weather, natural disasters, or global crises events. most important characteristics of demand forecasting are as follows:

2.3.5. Product Portfolio Management

Product portfolio management is responsible for overseeing the entire product lifetime, from the launch of a new product to its end-of-life planning. Product lines are often interdependent and knowing how new items influence demand for existing products is critical to determining the overall product mix needed to maximize market share.

2.3.6. Statistical Forecasting

Statistical forecasting uses complex statistical algorithms to make supply chain forecasts based on historical data. It is critical to assess the accuracy of each model, identify outliers and exclusions, and comprehend assumptions in this domain. Statistical forecasting can also be used to examine seasonal shifts (for example, the surge in Christmas shopping that happens between October and December for merchants, or the increase in yard equipment sales in the spring months).

2.3.7. Management of Trade Promotion

Demand can be influenced by trade promotions or marketing events, particularly in the retail business. A trade promotion's purpose is to connect a brand with a customer, usually through an in-store giveaway, discount, or promotion, and these events can influence product demand. We can also consider that sustainability also plays a major role in the developing an effective supply chain as it enables a company to promote human rights, work on preserving the environment, fair labour practices as well anti-corruption polices. Supply chain sustainability refers the management of environmental, social, and economic impacts and reassurance for the good governance practices across the life cycle of goods and services which directly or indirectly plays a major role in trade promotion.

3. Research Framework

The thesis was written following a structured approach which were clear enough to define the methodological steps to accomplish the objectives of the work. It is important to understand which the most suitable approaches are to achieve the objective faster. This chapter provides a comprehensive overview of the approach proposed in literature for reviewing selected topics and to present the selected methodological approach adopted to carry out research and extract the research questions of this thesis. The main driving approach towards this thesis was through the Literature review which defined the research questions thus providing a comprehensive definition and guidelines for their implementation. The review methodology followed was collecting, summarizing, and categorizing the work already done in literature on a specific topic till a given period. The selection of the best suitable approach to literature review allows the reduction of the time needed to gather the information we are looking for and to revise completely all the work done at last. All the methodologies found have been carefully analyzed. Reviews lead us to a fact that the methodology is qualitative rather than quantitative approach used to synthesize primary studies from which conclusions may be drawn by own experience, existing theories, and models. This kind of review tends to be less methodological than others such as systematic review and it does not ensure a comprehensive overview of a topic thus resulting in potential distortions about the knowledge acquired with this method. Overall, the method can give us a comprehensive approach on the current topic leading us to a specific search. The findings drawn from the literature review and the analysis done on the research questions lead us to the framing of the solution and the model. The model was driven from the literature, research questions and the assumptions of the needs. Thus, we can consider the methodology as understanding the problems, literature review, research questions, solution with the model and conclusion with the future scope.

4. Research question 1 (Model development)

Is S/OP Different from IBP? And how S/OP & IBP maturity in an organization be assessed by identifying the Gaps with help of maturity assessment model?

4.1. Is S/OP different from IBP?

The question of whether there is a meaningful difference between S&OP and IBP is still being debated. Opinions differ and are frequently influenced by the proponent's point of view. Many supply chain specialists claim that there isn't a distinction and that it's all semantics, while others in areas like finance and strategic planning argue that there is.

While most people agree that adding a financial component to S&OP improves it, there is often a misperception about how important it is. So, let's take a closer look at the differences between S&OP and IBP.

4.2. Is there a significant difference between S&OP and IBP?

Figure 5: Overview OF S/OP

Many claim that IBP is just a spruced-up S&OP exercise with finance thrown in, and that it closely mimics S&OP processes in operation because of its beginnings in S&OP. Most proponents of this viewpoint are from the supply chain, and they appear to perceive IBP as

essentially a production planning process rather than a strategic process. They don't think the distinctions matter.

Others, on the other hand, see IBP as a tool for directing the Organization's strategic orientation. Their starting point is the Organization's financial estimates, not the sales forecast in terms of units. While these may appear to be two different measures of the same item, the unit of measurement and means of execution are different. Sales fuel an organization's success. IBP is inherently aligned with the Organization's financial numbers and forecasts, something S&OP cannot do. IBP begins with the Organization's financial forecasts and differs greatly from S&OP as a tool for driving the Organization ahead. IBP begins with the Organization's financial predictions and differs from S&OP, which is based in the supply chain with the primary purpose of aligning production volumes with sales volumes, as a tool for driving the Organization ahead.

The Danger of relying exclusively on S/OP Process

S&OP processes are methodical and follow a set of steps. While there's nothing wrong with that, S&OP's primary purpose is to determine a sustainable production plan that is in line with sales estimates. The tools and aptitude for optimizing production plans are frequently lacking; the driving element is a feasible plan rather than the optimal plan. Furthermore, when S&OP is used as part of an organization's strategic planning process, the bottom-up approach, which regards financials as a (optional) add-on, promotes production levels over determining solutions that improve profitability.

4.3. What IBP does That S/OP Can't?

One of the most significant advantages of IBP over S&OP is that it aids in the alignment of many departments and functions within a business toward a common goal. It also makes teamwork, trust, and cross-functional interaction easier. Effective IBP processes result in quantifiable and verifiable benefits, in addition to "soft" rewards like teamwork and trust.

4.4. Why IBP is crucial

Integrated Business Planning (IBP) is an expanded form of Sales and Operations Planning (S&OP) that spans a company's end-to-end value chain and ties strategic, profit-related objectives to short- and mid-term operational planning decisions through cross-functional scenario analysis — informing decisions about more profitable supplier collaboration, demand shaping, marketing, and pro forma financial forecasting.

IBP is fully aligned with growth and innovation metrics at its best, having transformed S&OP into a strategic business partner. Consider how a successful IBP aligns your company's operational decisions with forward-looking financial performance over several timeframes, representing complicated trade-offs, restrictions, and real-time business realities across the value chain.

Our clients have been confused about the term IBP and how it connects to sales and operations planning (S&OP), sales and operations execution (SOE), sales inventory operations planning (SIOP), sales and operations management (S&OM), and other processes for more than a decade. Businesses have been sluggish to implement integrated business planning, despite its relevance. Many companies have yet to develop a fluid S&OP process.

4.5. Barriers to IBP implementation

1. Integration is challenging due to technological and process frameworks. The structure of traditional software solutions varies, making Integration difficult. Supply chain software was created from the bottom up with a data model that was solely focused on specific areas such as demand, Supply, and logistics. The opposite approach is taken by financial planning and analysis tools that model General Ledger/Chart of Accounts from a transactional and roll-up perspective. As a result, the technologies of supply chain planning and financial planning were never meant to collide.

2. Requires a diverse skill set. Modelling a complex supply chain sometimes necessitates difficult code and provides no visualization. Therefore, optimization strategies present obstacles inside barriers.

3. Within the Organization, there are several cultures. Understanding another unit's aims while attempting to achieve one's own seems unattainable.

4. Tools for managing linear scenarios. Scenario management solutions, like optimization, can't reproduce real-world complexities or recognize that what-ifs aren't linear.

5. Spreadsheets are used as a key planning tool. Continuing to use spreadsheets creates an inflexible resource that cannot integrate and align corporate goals.

6. Inflexible solutions obstruct data quality, administration, and access. Solutions are built to work in a specific way, frequently in opposition to the company, which means that data access, quality, and administration are all dependent on the system.

7. There is no awareness among the C-suite. Understanding the meaning and viability of IBP is frequently outside the C-sphere Suites of influence. IBP is an educational initiative within the business, as it is a relatively new procedure that has proven difficult to put into effect; yet, IBP fails to capture the attention of the C-Suite, who stand to benefit the most from it. It's possible that the CEO/CFO isn't aware of the advantages of IBP. We illustrate cases in this post where staff keep profit-enhancing opportunities hidden because a single silo may be severely impacted.

4.6. Importance of moving from S/OP to IBP

S&OP (Sales and Operations Planning) is much more than a tool for forecasting demand and improving operational efficiency. It's also a means to profitably manage your product and customer portfolio. "There's nothing wrong with it," he adds. However, it is clear that S&OP is primarily viewed as a strategy for increasing efficiency and lowering costs. Aside from that, there is frequently a considerable emphasis on the past and the operational application of S&OP. A well-designed S&OP process, on the other hand, provides numerous chances for

future-proofing your product and client portfolio, allowing you to enhance revenue – particularly if it is linked to your strategy and financial planning. It assists you in developing a winning strategy, aligning your operations with the budget, and improving your strategic business results. It's called Integrated Business Planning when you reach to that stage (IBP). In today's market, where strategic priorities include exploring expansion in unexplored regions, cutting expenses and working capital levels, maintaining long-term growth, and strengthening the extended supply chain, it's critical for businesses to do comprehensive integrated business planning (IBP). The concept of "inclusion" takes into account a variety of factors, including supply chain partners, company activities such as finance and product management, end users, and digital capabilities.

While sales and operations planning has benefited some Organizations well since its inception in the 1960s, it has never gained widespread adoption due to well-documented reasons. Integrated business planning (IBP) is a senior leadership-driven process that evaluates and revises the time-phased outlook for demand, supply, product phase-ins and phase-outs (Product life cycle management), strategic projects, and financial plans on a regular basis, at a higher level than S&OP and with the help of digital technologies. It is a decision-making process that provides insights to keep all business departments and regions aligned in terms of operational plans based on the company's business goals and financial aims. IBP's main goal is to obtain agreement on a single operational plan, to which management team executives are held accountable and which allocates key resources to satisfy customers in the most efficient and lucrative way feasible.

Figure 6: OVERVIEWOF IBP IN 8 PIECES

A secondary goal of the IBP process is to develop aggressive and cautious plans to ensure

supply chain responsiveness in the event of unanticipated changes in the business outlook. The planning horizon is normally a rolling horizon of 24 months or more, however this may vary according to the needs of the company. Product Management Review, Supply Management Review, Demand Management Review, Integrated Reconciliation Review, and Management Business Review are the five review sessions that make up IBP. These five are governed by P&L level financial goals and facilitated by underlying product, demand, Supply, and financial planning processes. While IBP's predictive capabilities enable Organizations to create and maintain an annual plan aimed at strategic goals, the analytics component adds responsiveness and agility to decisions and enables Organizations to deliver Plan B from unplanned business scenarios by enabling optimized scenario planning and simulations from product, demand, Supply, and financial perspectives.

In IBP, maturity is a rewarding journey that puts the company on a path of continual improvement. People, Technology, Data Analytics, Metrics, Process, Strategy, and Culture are all factors that influence an organization’s maturity.

The variables in the IBP framework are so essential and important in transitioning to IBP that an incremental improvement strategy to implementation works best. We employ a tiered method in our experience, which involves a Maturity Assessment, Generations Definition to proceed to higher maturity levels, Research and Design to attain the next generation of maturity, and a Build phase to get there. The program's multi-generational approach will address Organizational, process, technology, metrics, and capabilities issues, and will improve IBP maturity as each generation progresses through the transformation.

The cycle is the best representation of how the IBP is created by following step by step procedure which is iterative. The financial Integration being at the center is the ultimate goal to align everythingwith the company's net profit and maximize the revenue.

4.7. S/OP and IBP maturity assessment model

The requirement to develop a model where we can analyze the S/OP and IBP maturity based on the inputs fed by the company using it. The key parameters involved are People, process, analytics, technology and then they are summarized to give out a cumulative result. Now let's discuss how we can analyze and in what factors the analysis is based upon.

4.7.1. People

The Key parameter People can be analyzed in 3 criteria – Culture, Organization, and participant. We believe that the culture followed by the people and the way they tend to act sub-consciously is an important aspect to understand and reveal the relationship with the Supply, operations, and business. The assessment criteria can be termed in form of a questionnaire where the responses can be analyzed and based on the datareceived, we can draw conclusion.

Figure 7: CATEGORIES OF PEOPLE IN A PROCESS

4.7.1.a. Culture

The main of the functioning of this category of the model is to determine the background of the people taking this assessment so that the result comes out fair when assessment is done. The cultureof the people may influence on how the S/OP model is implemented. The criteria of implementingby sharing little information in miscellaneous approach where interconnection between departments is missing to providing full information on the sharing phenomenon is what being evaluated here. From the below table we can clearly understand how the model assess the people based on their culture and relevant model or steps are implemented based on the% of influence of the culture in the persons random life being. The Information sharing, communication channel and the responsibility level also plan an important role in making sure

the model is implemented as per the suggestion of the assessment. The goals and targets of the relevant model is made clear with the project statement and the people involved are shared with the necessary details based on their cultural level.

Influence of Culture	**Approach**
0%	People focus on themselves, and company rewards based on the implementation of the model. The worker and the people are completely unaware of what is being done and the concept going on, but the results are reflected. Very Less Information is shared.
33%	The Functional departments are collaborated with some managementstructure in communicating and implementing the solution. Only relevant information is shared such as to understand the KPI's and channel proper communication.
66%	People are given relevant information such that they can propose ideas to improve the model and to modify the goals to make it realisticand aligned with the aim. There is possible collaboration with external Organizations. Strategies of S/OP are made in several meetings and communicated to all business units.
100%	People are shared with functional responsibility to take over strong decisions and collaborate in all levels. The communication is effective and clear. The strategy of S/OP is clearly visible and becomes one of the objectives or Goals of the Organization.

Table 1: ASSESMENT CRITERIA FOR CULTURE

4.7.1.b. Organization

The understanding of the impact and assessment of the Organization in the implementation of S/OP is a tedious chapter of the model. There is nostandard procedure for the same. The Organizational structure may pe determined as per the image provided based on the process maturity. The Ad-Hoc, defined, Linked, Integrated, and extended can be the types in which the company may choosea model to integrate and find the relevant implementation.

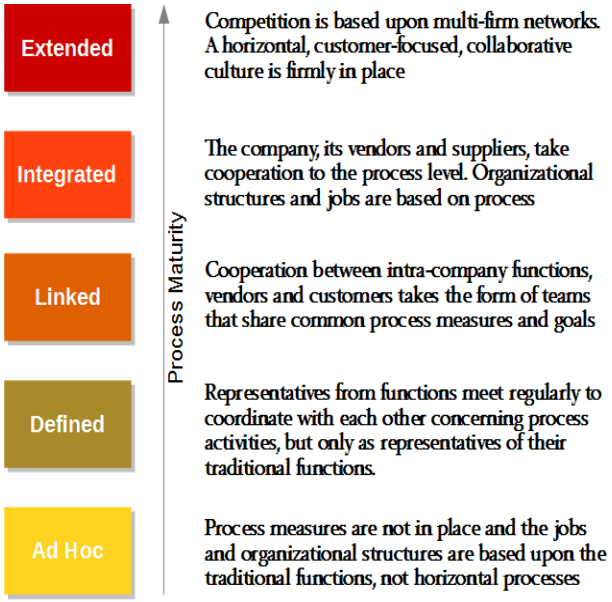

Figure 8: TYPES OF ORGANIZATIONS

Organizational Approach

0% - 25%	The upper management lays no contribution to the people involved. The entire process is dependent on the knowledge of the individualpeople.
25% - 50%	There may be a center of excellence which has some specialized competencies, but the S/OP process is not followed cross functionally.
50-75%	The S&OP is understood as an important functionality of the Organization. Training has been provided to various employees whichare both internal and external. The teams are specialized in the roleson core competencies and business needs. Thus, the entire process is well defined.
75-100%	The S/Op is considered an essential component of the businessprocess and the key part of every functional activity. Theresponsibilities are clearly articulated in such a way that the enterprise is definite on its strategy and every program is in its place.

Table 2: ASSESMENT CRITERIA FOR ORGANIZATION

The analysis is based on the level of involvement of the Organization. The participant is asked to choose the Organizational involvement in the implementation of the solution. The involvement is measured inpercentage and the participant is allowed to input the level, the software generates a cumulative output based on the input received in the Culture and ORGANIZATION and includes the other factors to create a summary at the end. Thus, the user is required to read the approach for which he can allot the percentage. The intervals are 25% so that the user is not required to be very precise. The evaluation is based on the knowledge, information transfer and the involvement of the different levels of the ORGANIZATION in the implementation of the Model.

4.7.2. Process

The process section of the model depends on 5 different parameters. Starting from the Horizon, Decisions, Alignment, product, demand, and Supply.The entire process of the execution, planning and managing is being assessedhere.

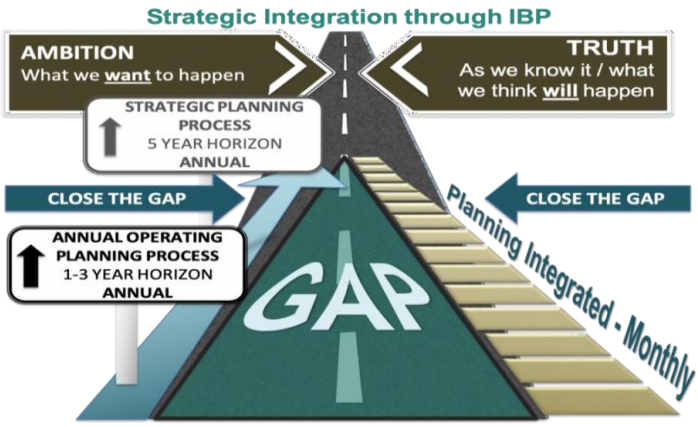

Figure 9: PROCESS PLANNING

4.7.2.a. Horizon

It is the factor that deals with the time before which the planning phase of theS/OP cycle starts. The time horizon can be from the end point in terms of making alldecision at the end analyzing the demand and Supply which can also be called as firefighter as the management and people are completely resisted and prepared to fight the situation.

Figure 10: TIME HORIZON FOR PLANNING

The second scenario couldbe where the planning isdone based on the data of the previous month. So simply the demand of the previous month is taken into consideration which determines the demand of the next month. During their regular and normal scenario, it works out but during adverse times this doesn't workout. The next possibility is 6 months horizon where the data is computed on mathematical models and allowed to estimate based on different consideration. Another possibility is 12-month scenario where the process is perfectly structured, and the execution is as planned for very month and such that the budgeting for the next year is also set. The horizon changes from each company based on their stabilityin demand and the coordination between the planning departments. The horizon alsodepends on the budget allocation to the planning department and their response to instability.

4.7.2.b. Decision

is the process parameter that consist mostly of reporting the data with the attention paid to it. There are generally lot of linkage between the planning and actualexecution of the data taken and analyzed. If the decisions are short and have followup meetings, then they ae analyzed under 25% of the decision criteria in the model and if the meetings align imbalance between Supply and demand but there is minimallinkage to the tactical operations then the decisions made are easier than the onestill need to be approved by the higher authority and may require more time to take action.

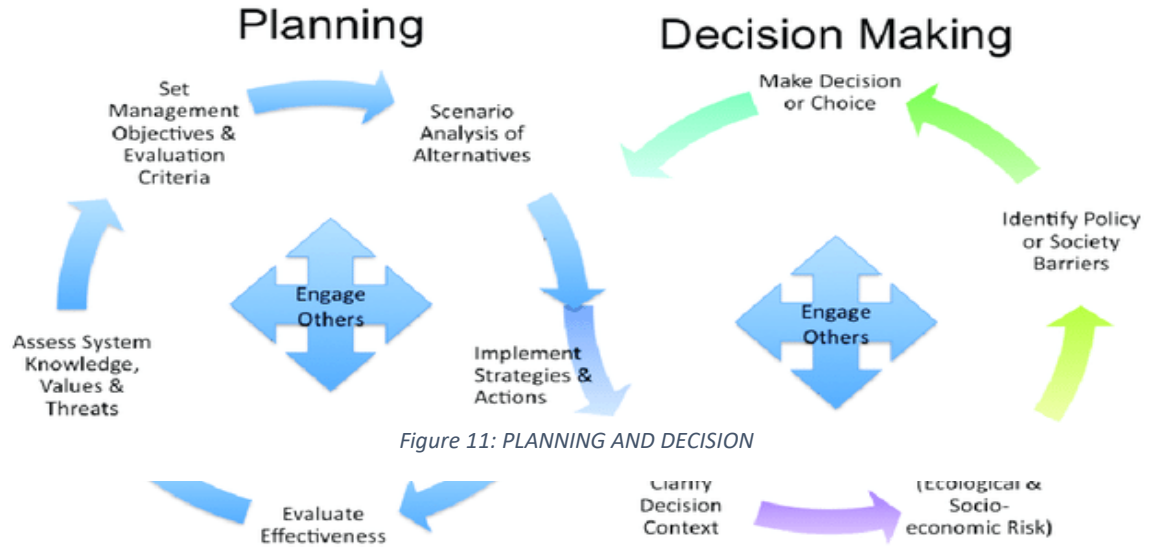

Figure 11: PLANNING AND DECISION

This category is rated up to 50% of the decision-making power in the model and theS/OP process which is fully integrated across each business units and requires the what-If analysis as mentioned in the literature review will be upside to the businessand processing unit's output and give out potential response. There are some functional ranges to the identifying uncertainty and act on it based on the demand shifting and the segmented response given m=by various opportunities. The S/OP can produce probabilistic forecast and the demonstration of various skills that allowsto take structured decisions which may manage demand and react to the volatility inthe current scenario.

4.7.2.c. Alignment

It is a parameter in the process assessment which determines how the information and tasks are aligned with that of the objectives. There is generally an establishment in the center that manages the S/OP process between the departments and cross functional variation between data transfer. But in many corporate Organizations we can seethat the functional process is beingintegrated with that of the of a life cycle management center controlled directly by the CEO which ties the process with all the process, supply, and demand part of the Organization. In small and medium scale enterprises we can observe that thereis standardized process orientation rather than a functional feature or a central management system. Collaboration drives strategic objectives of the company with the network value. The information transfer or the objectives might not be as clearlyassigned as in the top-level Organizations. Based on this structure we can analyze theAlignment parameter.

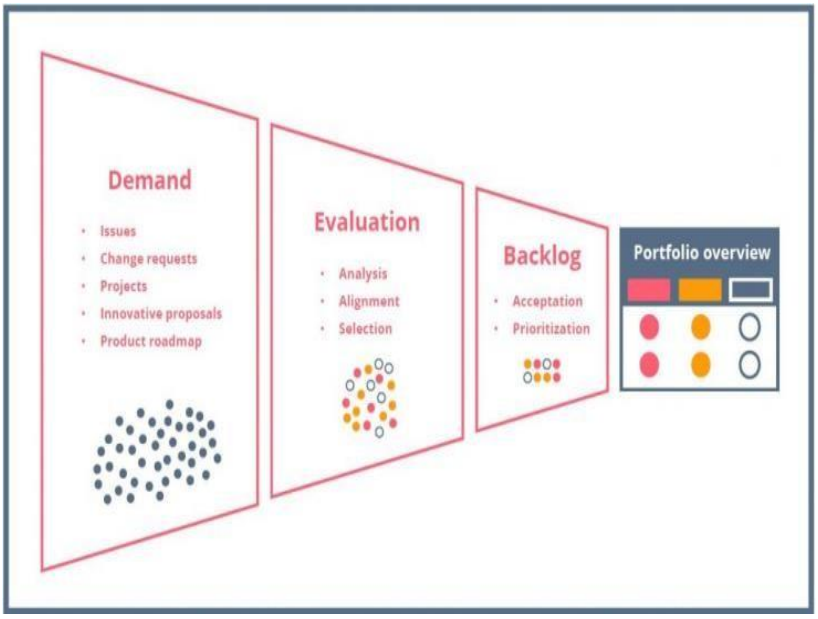

Figure 12: ALIGNMENT BETWEEN PROCESS

4.7.3. Analytics

The **analytics** can be analyzed in two ways. The one being the **metrics of analysis** that is involved. The metrics can be based on the functional and business objectives.Their definition is the analyzing parameter, the categories can be divided as Metricsfor the process exist on which the analysis has to be caried out, but the functioning are not connected to the business objectives of the targets. Metrics can also accumulate the demand forecast or the inventory count. The second category can bethat the metrics can be defined and measured but the function of the competition andthe on-time delivery can be affected by external agents. This turns out to be non- responsible with the business goals of the Organization. The third category can be defined as the value and input based metric where there is active action taken in thedefinition, calculation, and data sources. This includes the Forecasted Value-added service as related to inventory, total Supply, and demand management. The fourth category can be defined as the synchronized metric existing for all process and the steps involved that successfully measure the KPI's which are connected to all the financial parameters of the company. The complete structure can analyze theforecast variability and end to end inventory cost.

The analytics can be also divided and analyzed based on the technology for descriptive analytic and reporting. Determining the relationship between the real time monitoring and rule based algorithmic planning. The demand sharing capabilityin this approach is assessed based on which the results are justified. The Approach used is based on the trial-and-error method to iterate till you reach accuracy.

4.7.4. Technology

The data integration, system and cloud support make a major contribution towards the effective implementation of the S/OP system. The evaluation of the past data helps in forecasting the actualdemand which is the basis to determine the entire S/OP operation. The data between each interaction between the departments allows the system to be integrated and pass the

information flow between departments for successful operations in the company. The Heads and 2nd level managers can manage the entire system based on the actual data and the current performance of the system. They align the flow with the targets and goals to meet the necessary demands. The data is generally integrated in a cloud platform from which it is shared to the entire system and thetransaction between them is recorded. The data can be involved from the marketing department, general demographic, tradition & channel data, Mobile data, system data, Logistics, and supply chain related network data. The cloud platform holds capacity to store huge amount of data and share it among the managers and the necessary supervisors have Level 2 access. The data can be used to align the operations and meet the necessary changes. The technological availability and system utilization are very important for an industry to make it smart. They support the entire planning and execution activities as well as monitor them with actions at a quick rate. Thus, one criteria of evaluation are based on the technological availability and the % utilized for best operation.

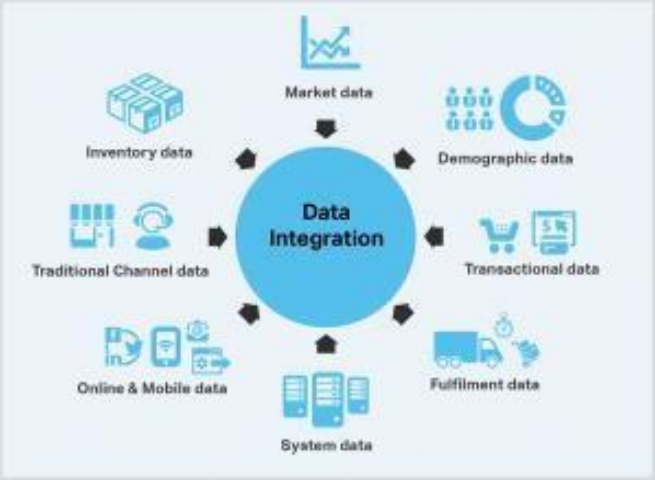

Figure 13: DATA INTEGRATION PROCESS

4.7.5. Solutions

By the research we can reach to a conclusion that the IBP and S/OP have similar objectives of managingthe entire resources, inline the functioning of various departments and executing the plan for better Supply, operations and to maximize the revenue. Step by step each activity contributes towards the revenue maximization. IBP works on the higher managerial level aimed towards business and financial goals whereas the S/OP works on the functional level and improves Supply and operations in turn to maximize revenue. The maturity in an organization be assessed by identifying the Gaps with help of maturity assessment model which as proposed In the model can be assessed in the categories of People,Process, Analytics and Technology. The model can be executed as to ask questions from the user in theform of a survey and then assessing the input received from the user in terms of %. The level of input can be analyzed based on the criteria as explained in the description of the model. The Analysis can give out a cumulative percentage value through which we can determine the effectiveness of the maturity in the IBP and S/OP model in terms of implementation, execution, planning and result. The assessment model can later be designed as an app or a survey form with the usage of UI/UX features that can allow rapid assessment and quick feedback for Quick implementation of the necessary measures. The Categories can be divided based on deeper analysis as People: Culture, Organization and participant, Process: Horizon, Decisions, Alignment, product, demand, and Supply, Analytics and Technology based on the procedure, data, and effectiveness. Thus, we can understand the functioning of IBP, S/OP, the difference between them and we have also successfully created a modelto analyze the maturity and some future scope to allow positive implementation. The sample testing criteria of the questions are as follows:

Workers, Supervisors and Operators: In this level, people are tested based on the culture and organizational feature wherein they are asked several questions to check their skills and attitude towards the work place. The Assesment criteria can be categorized into language, practice, planning, decision making skill, improvement, partnership and focus.

Figure 14: ATTITUDE AND SKILL TEST FOR SCM

The feedback is very important is smooth execution of the framed plan. The Questionaire is not fixed and changes based on the culture and organizational features as mentioned in table 1 and table 2 under the description of model. The criterias fix a percentage of the current organization and sub devide them into categories which later provides different recommendations based on the level of percenatge obtained in their respective fields of culture level and organizational index.

People Level	Question	Assessment criteria
Manager Level 1 (Operations, raw material, or Stock room manager)	Which demand should be proactively driven? With which products and at which channels and customers should this driver work?	The criteria are to focus on operations and intake inputs from operational level manager on what can be the best criteria to fulfill demand. This helps to gather and analyze inputs for demand planning.
Manager Level 2 (Logistics, supply chain or warehouse manager)	Which demand should we supply? What plan maximizes overall value?	The criteria are to test best possible approach to meet the demand as forecasted and executed by operations. The summary is to find out the most efficient way to do so.
Manager Level 3 (Demand planning, Channel, and information control)	How can we structure a customer contract to maximum value? How inventory drives ROIC and what is the impact of lastminute production?	The criteria are to test and gather information of how demand and other operations can affect the revenues and financials of the company. The test also tends to know the best practice to supply and maximize profits with customer channels,
Manager Level 4 (R&D, Support, RGM, Innovation and development)	How to manage new volume? What volume do we assign to which strategic customer?	We try to optimally drive the new product information and the value expected over time, the impact of sustainability and network optimization for demand, supply and financial performance.
Board Level (CEO, President, chairman)	How does an approved S&OP plan translate into P&L and cash flow forecast?	The aim is to find out plan optimized for profitability, cash flow, ROIC and the right amount of working capital.

Table 3: ASSESSMENT SAMPLE BASED ON PEOPLE.

5. Research questions 2

How is demand management connected with S/OP? and what is the role of Sc-marketing and sustainability in managing demand?

5.1. Demand management and its connection with Sales and operation (S/OP)

Demand management refers to the process that a company uses to tailor its capacity to meet the differences in demand or using approaches of marketing or supply chain management so the level of demand can be managed. On the other hand, demand management that is included in supply chain process which stabilities the necessities of customers with the efficiency of the supply chain. It includes harmonizing Supply and demand along with refining flexibility and reducing inconsistency. If an organization has a proper process in place with effective management supporting and sponsoring it, it can match the Supply with demand effectually and ensure proper execution of the plan with minimal disruptions. The author also discusses that the process is not only forecasting as it involves coordinating the Supply and demand and increase flexibility in the operations, reduce variability also help the participants learn the benefits. The proper implementation of such aspects depended on the Sales and operations (S/OP) planning process. S/OP is the core of Demand Management, which is a unified and consensus-based business plan that enable companies to control inventory costs while improving the service levels. S/OP refers to a process that links different aspects of a company to meet the demand of customers with adequate levels of Supply. There is also major importance of being accountable for all steps of the process when establishing. As a result, there will be expectations regarding meetings, how changes are considered. Proper planning of sales and operations is dependent on the input. Also, businesses need to move frontward with a once-a-month S/OP plan.

According to **Bozutti & Esposto (2019)** the first step is about collecting the data in terms of past sales, trend investigation, valuations of forecast correctness and with the help of S/OP software, tasks can be completed having automatic facts upload procedures and build-in reporting. For that, there are many steps that is needed to be followed such as handling new objects, run analytics, review presentation procedures and also correct item-level stock

characteristics. The next step is to develop a claim strategy that involves authorizing demands, sympathizing the bases of demand, bookkeeping for inconsistency and reviewing customer service rules. The required sub-steps for this would be creating a S/OP assessment report, share reports from Input, editing demand plans as per requirements and review and confirm agreement demand plan. Step three is about supply planning which involves interpreting the demand plan into a supply plan. Input and verification for this involve key aspects from manufacturing, operations, logistics and finance. The next step is the reconciliation of plans that happens before the S/Op meeting. Last is the approval and release step where the results are presented to the executive team.

5.2. The role of S/OP for effective demand management:

In accordance with **Bozutti & Esposto (2019)**, a business can achieve a competitive advantage in today's global business with a proper S/OP process. The firms focused on supply-chain utilize the S/OP process for developing a business plan for improving overall business performance. The role of S/OP process is linked with how it is designed which is effective to enable value-based management and ensure the highest overall business results. On the other hand, **Lamjahdi, Bouloiz, & Gallab (2020)** analyses how S/OP has the main goal to attain inclined plan of business to achieve and assign acute possessions for meeting the client at the lowest price. The entire S/OP cannot be accomplished without demand planning. S and OP effectively manage communication and decision-making processes having the main goal of balancing offer, demand, mix and volume. Thus, it can make effective use of statistic sales forecast and the estimate of other areas to estimate the future demand. Also, if the demand planners are aware of likely sales, production capacity and inventory, they can identify the profit margins for products.

5.3. The importance of IBP to make S/OP strong:

Integrated business planning (IBP) refers to the process for interpreting anticipated business consequences into financial and operative resources supplies with the predominant objective of increasing the cash flow while reducing the risk. On the other hand, modern IBP is the amalgamation of the optimization of supply chain, financial preparation and analysis and operative best performs along with supply chain optimization, influenced by the company-wide

culture which is regarding bringing the speed, investments and receptiveness of the consumer demand while managing risk. On the contrary, Schlegel, Birkel, & Hartmann, (2020) focuses on how sales and operations are different from IBP as the first one is related to supply and demand balancing and planning and the latter is about implementation and is related to a outdated planning procedure. S/OP processes are included in the IBP as it includes social alteration without executive buy-in, otherwise, IBP will not be fruitful. There are major benefits of IBP that ensure the development of sales and operations such as real-time insights, ownership and improved customer satisfaction. First is that companies can improve finance which extra swiftly and correctly responses queries on outlay and cash flow after having instituted rolling forecasts. While fully embracing IBP, all of the employees can accept the accountability of conference all goals. Thus, a company need to make sure that the specialist to make decisions is dispersed and tied to accountability for consequences, therefore a culture of ownership can be nurtured by the companies through meeting or exceeding goals. The role of IBP for improving customer satisfaction is not only on-time and in-full distributions that make customers pleased but also better planning to know more about the desire of customers and robust firm philosophy that leads to better purchaser understanding and effective assistance.

Sales and operations are further strong based on the benefits of IBP. The proper S/OP process is a major part of demand management thus, the IBP is highly linked with how sales and operations are impacted. The effective improvement of spending and cash flow and accurate KPIs can ensure how the sales and operations can be improved. On the other hand, the S/OP processes can be created and developed more quickly if the involved personnel have proper knowledge regarding the ownership and how to effectively meet the objectives. The aspect of customer satisfaction of IBP correlates with the sales and operations process as both directly focuses on improving customer loyalty.

5.4. The significance of demand forecasting techniques and explanation of different forecasting techniques relevant to agribusiness:

In accordance with **Allaoui, Guo, & Sarkis (2019),** demand forecasting help in reducing the risks and making proper financial decisions that impact the profit limits, cash flow, allocation of resources, expansion opportunities, inventory accounting, and operating costs, staffing and overall spend. Every strategic and operational plan are developed based on the forecasting demand. As per **ALI, SATIE, & THAI (2021)**, there are many challenges prevalent in the agricultural business which may not be addressed right now. However, demand forecasting and demand-supply management of agricultural and horticultural crops can ensure that there will be no overproduction of a particular crop. If that happens, the rate of the crops will reduce in the market resulting in low remuneration for farmers. For farmers, growing the same crop that has given a good market price last year is a common practice. Also, they are mostly unaware of the market price of the crop in the next six months. Considering proper demand forecast techniques, the agri-businesses can forecast the demand and Supply; hence the global crisis of the sector can be resolved. For demand forecasting method can work only if it has adequate data of crop location, the sown date, contact number and crop type. Based on the information, a firm or the government (based on the power of the authority or policy) can estimate the yield time, total yield, market arrival and the expected crop supply to each market. The statistics regarding the agricultural and horticultural crops can be developed, and with the help of this demand, the forecast can be made on a day-to-day basis. The author also adds that the relevant system is effective for various aspects such as guaranteed support price for farmers, affordable prices for Food for consumers, real-time crop demand forecasting and demand-supply management, crop price stability in agriculture and horticulture markets, identifying the fake seed packets before farmers sow them, minimizing the wastage of crop at all the agricultural markets.

As per **Allaoui, Guo, & Sarkis (2019),** the demand forecasting techniques fall under two different segments, such as survey methods and statistical methods. There are three techniques such as survey method, sale force opinion and Delphi method under survey methods. Whereas the statistical methods are trend projection, barometric forecasting techniques and econometric forecasting techniques. Following the author, the market research technique involves sending

consumer-specific survey forms in tabular format to gather data that cannot be gained from internal sales. It can provide vast information regarding the type of customers and demographic data, which help to target future markets. Also, market research helps young firms to know their customers closely effectively. Sale force opinion is a technique that uses data from the sales groups to forecast demand. Salespeople of a company are closest to the customers thus can acquire rich data on customer needs, behaviour and feedback and also there could be information about the competition of the market. In terms of the Delphi method, a company hires a group of external experts where each expert are liable to develop a forecast based on the market knowledge. Next, all of the forecasts are shared anonymously among the experts, so they become influenced by each other's forecasts. Thereafter every expert is further asked to develop their own forecasts, and this process is repeated until all of them reaches a near consensus scenario. Such a process is to permit the experts to expand on each other's information and assessments.

The trend projection under the statistical method is one of the easiest and common demand forecasting techniques used by firms. It projects future sales based on the previous data on sales. However, it can only be used if the company has enough data from the previous 18-24 months. A time series is formed after arranging the data in chronological order to form a time series as the time series can determine the past trends and can predict the future market trend. Barometric Forecasting Technique considers forecasting demand based on past events or the events happening at present. The users consider analyzing statistical indicators such as saving, investment and income. The effectiveness of the method is that it can be implemented even without the absence of previous data. Econometric Forecasting Technique, on the other hand, uses the combination of past sales data with the factors which influence a mathematical formula for predicting future demand. In other words, the technique establishes the link between the dependent and the independent variables.

5.5. The impact of Covid-19 on supply chain and replenishment process and alternate demand forecasting methods in the time of a pandemic

In accordance with **Nikolopoulos, Punia, Schäfers, Tsinopoulos, & Vasilakis (2021),** the current covid-19 pandemic has created a major challenge for the supply chain across the globe. The majority of the nations considered multiple lockdowns throughout 2020-2021, and due to that the flow of raw materials and finished goods have slowed down or stopped for some time, thus disrupting manufacturing as a result. On the other hand, **Ferreira, et al. (2021)** criticize that the covid-19 did not necessarily create any new challenges to the supply chain, but it brought focus on existing susceptibilities and further, many companies have been tremendously affected by staff shortages and losses because of the pandemic. The problems in the supply chain have been enhanced and magnified, which existed in the supply chain. Before the pandemic hit the world, most of the companies had been applying a lean supply chain, having the focus on minimizing the cost and quick delivery of the goods. But the outcome of such strategy led to decreased inventory which is why firms are left without any barriers regarding provisions. Due to the pandemic, the limitations of this lean supply chain system have been brutally exposed in the manufacturing firms. As a result, the companies have become focused on building inventory which can be used as a buffer to manage disruptions in the supply chain, thus developing local supply chains. Nowadays, companies are not focused on utilizing the conventional linear supply chain model but are motivated to deploy digital supply networks. The reason behind this is that the networks are vigorous and cohesive, thus can provide a fast and continuous flow of information and analytics and can help companies to stay connected with the overall supply chain network so that future challenges like Covid-19 can be properly dealt with. Thus, the author further states that the development of recovery plans as the recovery of an industry should be done by the supply chain leaders even if the mismatch of demand and Supply remains.

Due to the pandemic, demand planners and analysts are looking to have a better understanding of ever-changing the purchasing habits of consumers. These people were responsible for finding variables that would better predict demand and modelling methods that result in consistent forecasts, and many of them were focused on ensuring data sources are nearest to the consumer and point of sale. During the pandemic, many of the researchers can use internet

search data provided by Google Trends for predicting the demand for different products at the country level. As per **Xiong & Bao (2017),** forecasting techniques mainly fall into two major categories as quantitative and qualitative. The methods include time series, economic modelling, and the combination of both approaches. The time series is about predicting the continuation of historical patterns like the growth in sales or the gross national product, and economic modelling is about explanatory variables like prices and advertising affect sales.

5.6. Explanation of demand shaping vs demand manipulating, the reason behind the significance of demand shaping

Demand shaping is an operational supply chain management (SCM) strategy where the company uses tactics such as price incentives, cost modifications and product substitutions for enticing customers in terms of purchasing new items. On the other hand, many companies use the demand shaping technique for meeting product development projections. Demand manipulation refers to the situation when anyone artificially impacts the Supply or demand for security.

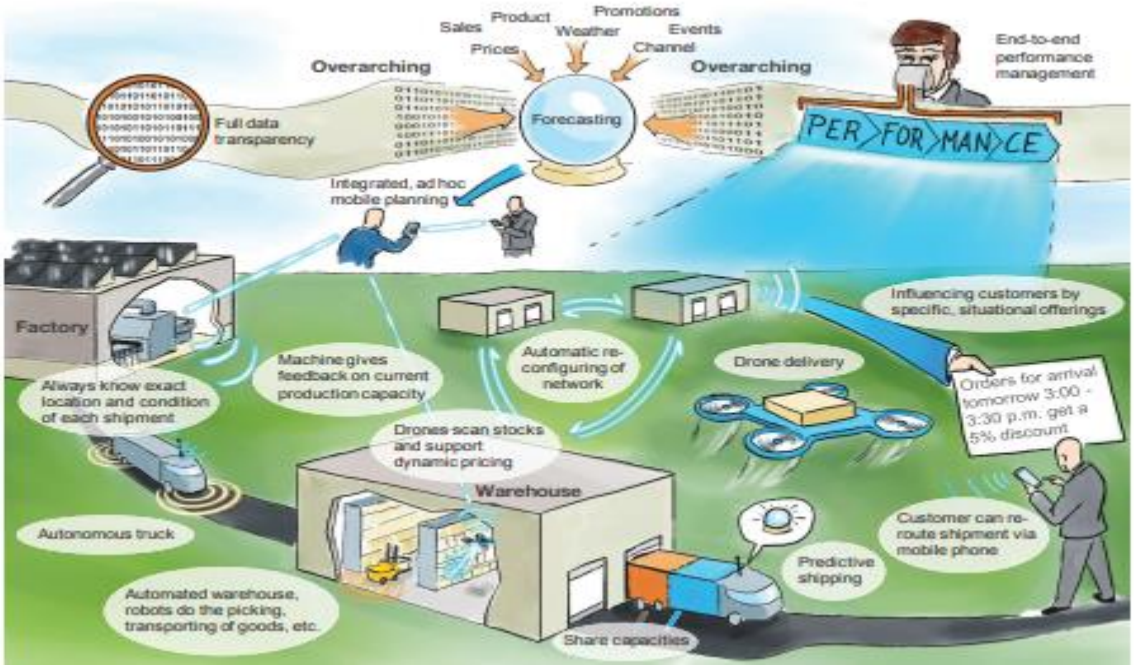

Figure 15: DEMAND MANIPULATING

Demand shaping is calculated to help the company to influence the demand of a particular product for matching the planned Supply. For example, a firm with a surplus can increase marketing efforts for a particular product so that customers are attracted more towards the product. On the other hand, firms can also use demand shaping techniques for meeting product development projections. Some of the major demand shaping tactics that are common to demand shaping strategy that is new product launches to boost demand, price optimization and sales promotion. Besides that, there is dynamic pricing also known as real-time pricing which can set flexible costs for products or service so that a company can be permitted to adjust the prices quickly in response to market demands. The statistics are gathered through demand planning such as forecasts which are also beneficial to a demand shaping strategy.

5.7. The importance of What-If analysis in terms of analyzing future consequences

In accordance with **Daradkeh (2017**), what-if analysis is the method for changing values in cells (excel) for analyzing how those changes can affect the outcome of formulas on the worksheet. In excel, the what-if analysis comes with three different tools such as scenarios, goal seek and data tables.

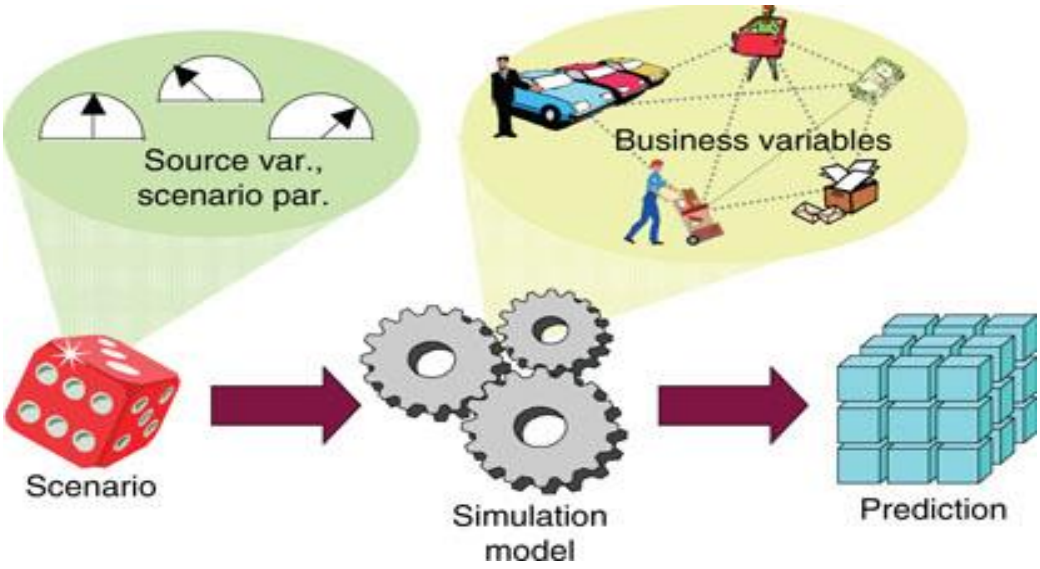

Figure 16: WHAT-IF METHOD FOR MODEL

These both scenarios and data tables are used for input values and to determine possible results. On the other hand, What-if analysis is also a powerful decision-making tool that helps the brands to understand the possible impacts of changing any variables. The author further says that the success of the business is dependent on the ability to make informed decisions quickly using several data and researcher's intuition. For example, if a company wants to introduce a new product in the collection, it is crucial to mix the customer behavior and trusting the understanding of what the customers might enjoy. However, using the what-if analysis approach, the responsible person can prepare this in advance through analyzing the variables such as low product adaption and setting up a pop-up shop so that the customers can try out new products. However, the success of what-if analysis is dependent on three key strategies such as re-evaluating the business model, adapting a customer-first approach and being transparent with the staff.

5.8. The role of SC-marketing and sustainability in management demand:

In accordance with the supply chain management theory which refers to the management of the entire production flow of goods or services. It begins with raw components all the way to delivering the final product to the consumer. The Theory demonstrates that sustainability in

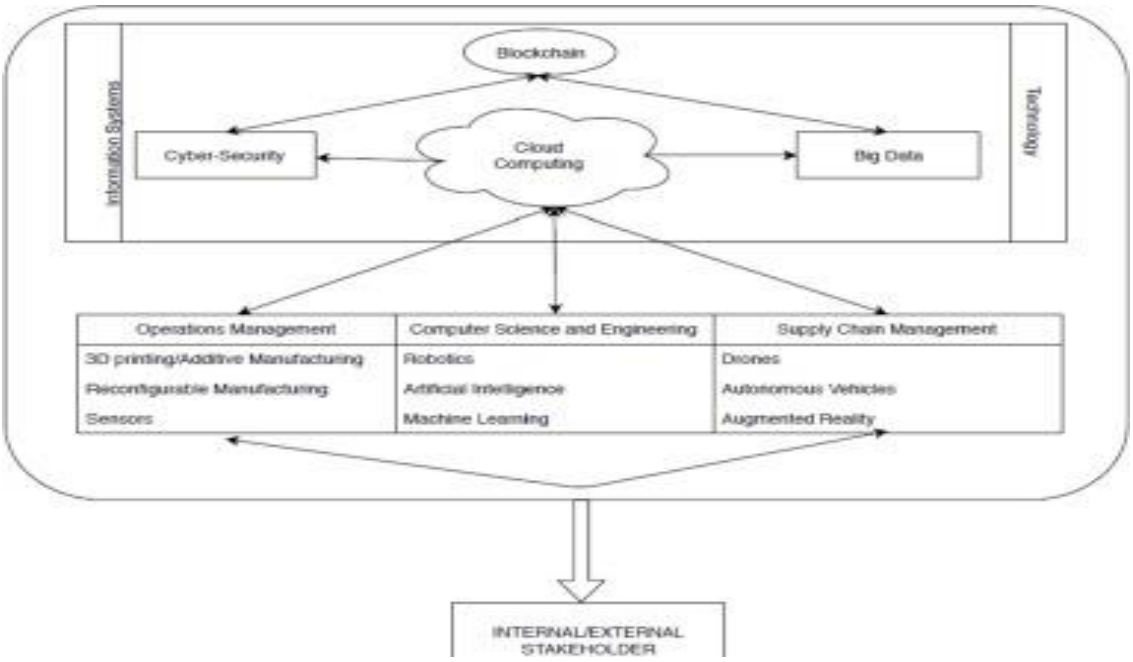

Figure 17: TECHNOLOGICAL ADVANCEMENT IN SCM

management focuses on how a company can ensure better growth of its bottom line which are people, planet, and price. We can also add that sustainability also plays a major role in the developing an effective supply chain as it enables a company to promote human rights, work on preserving the environment, fair labor practices as well anti-corruption polices. The term, supply chain sustainability refers the management of environmental, social, and economic impacts and reassurance for the good governance practices across the life cycle of goods and services.

5.9. Alternative's solutions

From the literature review we can learn different methods to manage demand, flow of information from the forecasting department to the S/OP, the difficulties and flexibility in execution of the S/OP based on the forecasted demand, the effective management of the resources and time to meet the necessary requirements and the actual demand, the creative marketing strategies to boost up the demand which in turn allows better S/OP and advanced technologies that can make the operation of the company much more effective and resisting to demand variance such that high fluctuation in demand can easily be managed.

The entire process of S/OP depends on the forecasted demand and effective management for the forecasted demand, The process is not only forecasting as it involves coordinating the Supply and demand and increase flexibility in the operations and reduce variability. The S/OP process is a unified and consensus-based business plan that enable companies to control inventory costs while improving the service levels, thus is a core department of the Demand forecasting team.

The connection of the demand planning and Demand forecasting department to the sales and operations department is simple, unless proper input has been fed to the S/OP departments the entire system lacks proper execution. The entire department is bound to fail if the forecast or management from the demand planning department has errors.

Case Scenario 1: If the Demand management department forecasts the demand to be less than the actual. The resources allocated to the operations and sales department will also be enough to meet the require or predicted demand and the company will lose the opportunity cost of the

demand which was not met. The rivals will have opportunity to grab that demand and may also affect the entire reputation of the company jeopardizing the entire Sales.

Case Scenario 2: If the Demand management department predicts very high compared to the actual demand. The resource allocation to the operation department is very high, thus increasing the production and labor working hours incurring huge investments from the investors but when sales go in vain then the company may fall into debt and may also go towards bankruptcy leading to production of huge inventory. Thus, in this case scenario the company may try to boost up the sales to meet the necessary revenue which will in turn add more investment and affect the work culture. As studied in the literature review and the problem identification that the forecasting may not be as always predicted. Generally, the demand forecast is over estimated than the actual, the role of Sc-marketing and sustainability kicks in. The Sc marketing boosts up the Sales there by creating more demand to fulfill the order Quantity as forecasted for smooth operations. The significance of this role is that without this department the company faces losses due to Over estimation and the operations get executed according to the forecasted demand and the Sales team faces a lot of trouble selling the same quantity. As the team must sell lot of quantity the price of the product gets reduced thus at last reducing the overall revenue. In Conclusion, The Entire Sales, operations, marketing are interrelated and completely dependent on the demand planning, these pillars are responsible to maximize the revenues of the company and the fall of 1 pillar can collapse the entire system. So, if we make it into a figure in our mind, Its Demand planning on the roof with S/Op and Sc-marketing as the pillars and Demand forecasting as the base.

6. Conclusions

The Entire Sales, operations, marketing are interrelated and completely dependent on the demand planning, these pillars are responsible to maximize the revenues of the company and the fall of 1 pillar can collapse the entire system. So, if we make it into a figure in our mind, Its Demand planning on the roof with S/Op and Sc-marketing as the pillars and Demand forecasting as the base. The Entire operation from the start is directed by the base (Demand forecasting), the other parameters work hand in hand to execute the planned demand. We were able to understand the significance of S/OP in agriculture industry, the importance of IBP and what is the difference between the two. A model is developed to assess the maturity of the S/OP & IBP maturity of the firm. The model is based on the input from the user and a tabular comparison of the possible solutions that leads to recommendations and the future scope of the thesis has been set in terms of developing a UI/UX application powered by an AI based algorithm towards the maturity model that is able to absorb the input from the process and current trends and develop a recommendation scheme automatically making the entire process automated. The Journals referred provided various insights and techniques of how the S/OP is affected, evaluated and its importance especially in the agribusiness. The thesis has met its objectives of evaluation the impact of the S/OP in the agribusiness, the factors that affect the S/OP, the relationship of BIP, Demand management, Forecasting and that of the S/OP, to provide a model for the assessment of the IBP maturity and a scheme-based algorithm to give out suggestions for improvement of the model.

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