



Identification and Ranking of Affecting Factors on Sales and Operations Planning (S&OP) Process Implementation by Using Fuzzy AHP and Fuzzy TOPSIS Approach (Case Study: Dairy Industry)

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| PAPER INFO | ABSTRACT |
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| <p>Chronicle: Received: 08 December 2019 Revised: 12 February 2020 Accepted: 15 March 2020</p> | <p>Sales and Operations Planning (S&OP) includes up-to-date forecasts that lead to sales schedules, production schedules, inventory schedules, customer delivery plans, new product development plans, and financial plans. The purpose of this study is to identify the affecting factors of the implementation of the S&OP Process and determine the significance of each of them, as well as the ranking of the implementing department of this process by using the fuzzy AHP and fuzzy TOPSIS. Data collections in this research, by 10 experts of different planning and production departments of Kalleh dairy production company in 2018 have been conducted. To identify the factors, research findings and expert opinion have been used and the required data have been collected through the designed questionnaires. The validity of the questionnaire has been confirmed by the experts in this area, and its reliability has been analyzed using the incompatibility rate of the AHP method. The data analysis in this study was done using coding in Eecel software. The results show that among the S&OP executing parts, the highest impact of factors on UHT section was observed with 0.56 points and the lowest impact on the concentration with 0.37 points. The major affecting factors of sales and operations planning process implementation, relations with countries of the region and the world, customs rules (roof of the outflow of currency from the country in return for raw materials) and inflation rate and currency changes are known that the organization can be grown in order to thrive to generalize these issues.</p> |
| <p>Keywords: Sales and Operations Planning (S&OP). Supply Chain. Fuzzy AHP. Fuzzy TOPSIS.</p> | |

1. Introduction

If ask any supply chain specialist that if sales and operations planning is important for your organization, the answer will be yes without considering the type of organization. There are some main areas in any organization or organizational unit. If the success is achieved in those areas, the organization will become successful in its work. Identifying theses critical factors is an important step for planning the future of organizations. Organizations have not had appropriate programs for the future without identifying these critical factors. According to the Rukert point of view, critical success factors are specific and confined scopes and if satisfied results are achieved in the organizations, the performance

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of the organizations will become competitive. Therefore, identifying these factors will have an important role in the optimal performance of organizations or even organizational unit [1].

Businesses have been challenged over the past few years with a series of irreversible market factors. Given the decline in profits in the life cycle of the product, the demand has been increasing for humanizing solutions and the growth of distribution networks that has grown into a globally competitive environment with a high degree of uncertainty and high risk, which is a huge position.

These pressures have forced companies to redefine business models, processes, and technologies. The Sales and Operations Planning (S&OP) process is the only tactical process for risk management and profitability. Due to the complexity of S&OP processes, implementation can be difficult and challenging, and also in complex environments, S&OP has attracted less attention due to its high scientific and practical capacities. This lack of attention provides a very good environment for understanding the set of factors that influence the implementation of the S&OP process and examines the barriers to implementation and management of the S&OP process.

The S&OP is the key business process for balancing customer demand with supply capabilities, as well as a tool that connects various business plans to an integrated set of applications, and contains two main goals:

- The balance of supply and demand.
- Creating a link between the business plan or the strategic plan and the company's operational plans.

S&OP poses the main issue of alignment, which is a major issue in strategic management and consists of both vertical and horizontal convergence. The vertical correlation "refers to the configuration of strategies, goals, action plans, and decisions through different levels of the organization," while the horizontal correlation can be defined as "interactive and interdependent".

S&OP is performed at least once a month and is reviewed by management at the product family level. The process should match all supply, demand, and new programs at both minor and overall levels and be a link to the business plan. This is the definitive statement of the company's plans for the near-medium term, which includes a specific horizon for resource planning and support for the annual business planning process. The process of sales planning and operations links the strategic business plans with its implementation and examines what can be done for continuous improvement.

S&OP is an internal process of business management, which was founded by Richard (Dick) Ling in the 1980s. The recent definition of S&OP is the decision-making process, the balancing of supply and demand, the coordination of volume, and the integration of operational and financial programs. We use this definition in this study because it refers to the basic points and they are as follows:

- S&OP certainly included decisions.
- S&OP is not just a mechanism that cause the predict demand insert in the company's planning system.
- The output of the successful S&OP process is a balance that a business plan can be achieved.
- S&OP is a decision-making process and a tool that can be used to coordinate with its primary goals in order to develop tactical plans for better linking the business demand.

In this research, the affecting factors of the implementation of sales planning and operations planning in the Kalleh dairy production company will be analyzed and prioritize according to their importance

base on the AHP analysis method. Also, the status, mode, and quality of implementation of this process in each of the manufacturing departments of this company will be analyzed by using fuzzy TOPSIS analysis method.

The use of fuzzy AHP and fuzzy TOPSIS methods have been selected for the following reasons:

- Uncertainty in determining the data of affecting factors.
- The existence of human mentality in data uncertainty.

Fuzzy set theory has been applied to broad fields. Fuzzy set theory has to be set up using data which is approximately known. Fuzzy numerical data can be represented by means of fuzzy subsets of the real line, known as fuzzy numbers [2].

The S&OP process can be resolved or at least improve the organization's systemic problems in achieving organizational goals and profitable. Achieving the growth, profitability and customer satisfaction, without side investments considering (device, equipment, etc.) is directly related to S&OP.

Although coordination between the demand side and the supply of manufacturing companies is necessary to successfully compete, companies suffer from a lack of management tools to achieve the desired results in terms of demand and supply requirements, which in this regard the S&OP produces a positive correlation with the performance of production [3]. Another S&OP advantage is support of the tactical planning that links strategic planning to operational planning and helping the organization to achieve its goals by combining programs. Understanding S&OP is not only a challenge, but its implementation is also complex. To deploy S&OP, some issues and indicators need to be clearly defined and the implementation and their impact deployment of S&OP should be considered. This process transforms all business plans (sales, marketing, development, production, provision of resources and finances) into a set of an integrated program.

2. Literature Review

Feng et al. [4], Ivert [5], and Tate et al. [6] believed that in order to compete effectively in a dynamic and global environment, in which suppliers and customers are scattered dramatically, the organizations must create mechanisms to counter market turmoil in order to respond quickly to changes through the coordination of demand and supply. Sheldon [7], Baumann [8] and Calfa [9] say that the S&OP process helps companies to manage and reduce changes that affect the business environment and leading to make better and integrated supply chain.

Thomé et al. [10] believed that S&OP has a positive correlation with the functions of an organization and production, hence, the importance of S&OP is based on the fact that it provides the conditions for companies to compete in a highly competitive environment.

The necessary abilities for the implementation of S&OP in this research have been considered. According to comprehensive, accurate, and continuous studies in the literature, there aren't many areas as suggested by Tuomikangas [11] in this regard. Various authors such as Muzumdar and Fontanella [12], believe that companies have made a lot of investment in S&OP. However, many of them have not achieved the desired results due to a variety of reasons. They also raised a lot of discussions about the S&OP implementation process and paid attention to the elements that influenced this process. Although

there is a lot of research about S&OP implementation, on the other hand, few studies discuss the obstacles to S&OP implementation. However, among academics, there is an agreement that identifies every business with the barriers to implementing S&OP.

The results indicate that some of the success factors, such as excellent management support, indicators, and how to monitor the performance of information systems and processes, are very important for the success of S&OP implementation. S&OP is a process that enables management to direct its strategic business in order to achieve a competitive advantage for new and existing products through supply chain management.

According to Mazumdar and Fontanella [12], the vice chairman of supply chain management at Oracle, the vice chairman and director of Aberdeen's supply chain management research services, S&OP are a set of business processes and techniques that enables the organization to which effectively responds to supply and demand changes taking into account the market requirement and the goal of maximizing profitability in the supply chain.

S&OP enable organizations to make on-time planning decisions for better coordination with products, customers and the marketplace [13]. It is not hidden that most organizations are struggling to strike a balance between supply and demand in their supply chain. Another common problem facing companies is that demand is greater than their production capacity or that different products compete for limited resources.

Certainly, all supply chain specialists and executives are working to reduce the uncertainty and continuous improvement of risk management methods. S&OP is the way to achieve this goal [14]. Dynamic S&OP is a series of business and technology processes that enable the organization to respond effectively to demand and supply variables over time periods defined in the market-supply chain [13]. This process helps the organization to balance demand and supply and combines appropriate financial and operational plans in order to get profit. In terms of process, S&OP is a multifaceted process that includes all elements of demand, supply, financial analysis in relation to business goals and strategies, in which the special teams are grouped together according to financial principles so that set up the business on what tactics to do [15]. The most important issue of S&OP is the supply and demand coordination approach by designing processes and guidelines for communicating, identifying and understanding the business environment, and designing and developing feedback on opportunities and challenges.

Organizations are continually seeking to improve their performance in order to profit, reduce costs, and increase customer satisfaction. In this regard, S&OP successful implementation is based on five components: staff, process, technology, strategy, and performance. For companies that are searching for a strategy to manage and mitigate of risk at a time of increased profitability, sales planning and operations are a solution [12].

The sales and operations planning determined the subject of changes and decisions that are required for targeted leadership. Another aspect of this is that each functional area is trying to optimize its field of operation. This is the traditional approach used to better manage businesses. Perhaps, experience has been shown that this attitude leads to the fewer results than the optimal level for the company [14].

Planning is the decision-making process, which often takes place before the work is done. Sales and operations planning has a direct impact on the profitability, performance, customer satisfaction and product portfolio provided by the company [12].

The reciprocal goals of S&OP include profitability in future periods, assurance of market satisfaction, and market preparation for long-term sales. Obviously, the sales department should plan their work. Certainly, management of the life cycle of the current products requires planning at the time of introducing new products [16].

According to research, organizations have spent a lot of money on software supply chain planning in recent years. Despite huge sums of money to use software related to S&OP, organizations did not achieve the expected profits, because the processes did not completely change in order to coordinate with this powerful technology [17, 18].

You cannot improve something until you have evaluated it. In order to implement sales planning and operations, the organizations should consider how to evaluate performance as well as changes in this assessment. Proper measurements of performance will provide conditions for the desired commercial goals. This turnaround process used in the supply chain from the sales and operations process leads to a return on the overall performance of the company versus market change and competitive factors [19-21].

3. Research Objectives

The goals can be pointed out as follows:

- The main goal is to successfully implement S&OP processes.
- Identifying and investigating affecting factors on the implementation of S&OP.
- Prioritize these factors according to their degree of importance based on the fuzzy AHP analysis method.
- Ranking of S&OP executive segments using fuzzy AHP and fuzzy TOPSIS.
- Provide suggestions and guidelines for better implementation of S&OP.

4. How to Collect and Analyze Data and Stages of Doing Research

Data collection is done with the following clauses:

- Reviewing the articles on how to implement and execute the S&OP process, and thus identifying and determining the affecting factors of the implementation of this process.
- Identification of the affecting factors of the implementation of this process in the studied company based on the studied field.
- Weighting the selected affecting factors by providing and offering a relevant questionnaire to relevant and competent persons.
- Selecting the most important part of the implementation of the process through a field survey of relevant people by providing a relevant questionnaire.

Also weighing the affecting factors of the implementation of the S&OP process and prioritizing the executive segments of this process is based on fuzzy AHP and fuzzy TOPSIS methods and analysis of the data obtained by using the Excel software.

The steps for doing the research are shown in Fig. 1.

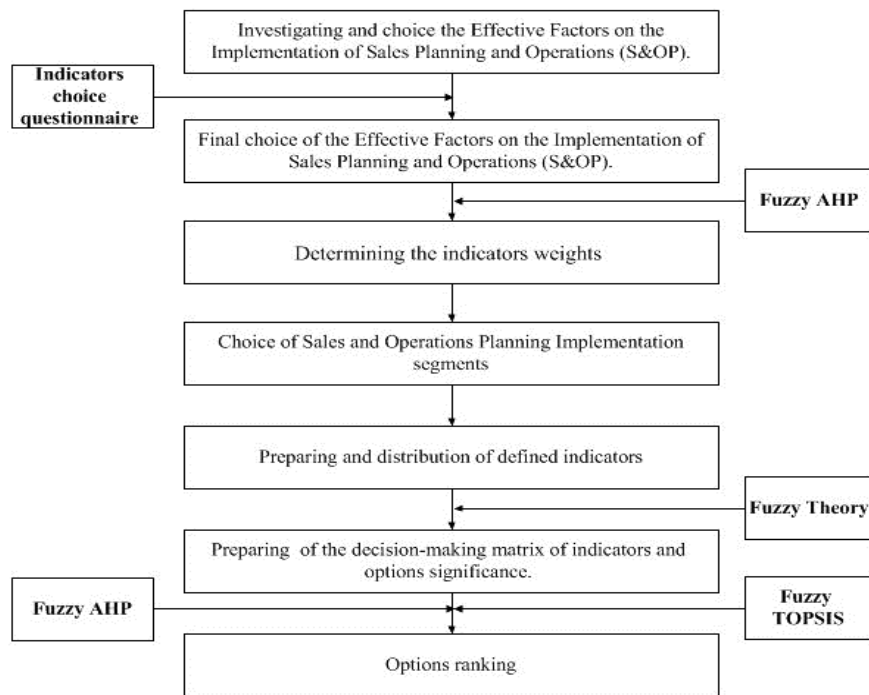


Fig. 1. Stages of doing research.

5. Execution Method and Reasons for Using the S&OP

The basis for sales planning and operations involves integrating the operational viewpoints of the organization. This process identifies the product families and planning horizons. It is also the founder of policies and trends for deploying sales planning and operations in the organization.

Supply planning performance sees demand as a consumption capacity in the form of cash, hours or another unit of measurement for supplying the raw materials and resources needed to produce the desired product. Financial planners see the organization only in the form of money. New product planners are worried about scarce resources and timing for competitive projects. The first phase of sales planning and operations should be clearly defined by the senior management review process.

The management team plays an important role in the success of this project. In addition to determine the purpose, their role includes providing facilities for continuous improvement in the process application. Also, management should be decided on the organization using the supply information, sales, and the operations planning should be considered as a continuous improvement process of management. The ability of the organization to integrate all the functional areas of the organization in the form of a large program, creates this understanding for all managers, how their decisions, in addition to their department, affect the overall organization's outcomes. In essence, the sales and operation planning process is the balancing between demand and supply. The variables that should be considered in this equilibrium activity are inventory, material supply constraints, management constraints, delivery time to the customer, actual customer demand, timing, and volume of new product production and prioritization for customers and products [22].

The starting point for the sales and operation planning preparation is the recent production report for each family. If the level of production we have reached is that we would like to plan future work, this level of production is a fixed capacity that can be used as a basis for future programs.

There are a lot of sources in each of manufacturing company. The confirmation plan of sales and operations in terms of resources is to look at the critical resources and estimate how critical resources in the production of each product unit are considered as Rough-cut capacity planning. The starting point for sales and operations planning is to determine which of our resources are critical. Accessing the sales and operations plan process can be presented along with the production plan after it has been investigated for all critical resources [22].

We will review the implementation of the S&OP process from two viewpoints as follows:

First viewpoint

Sales planning and process operations are formal, consisting of a series of meetings, in which data are aggregated from various business segments and discussed and ultimately lead to decision making. The purpose of the agreement between the various departments of the organization is to achieve an optimal balance between supply and demand and, ultimately, to achieve profitability. Therefore, S&OP for organization senior management are a tool to maintain the balance between supply and demand, thereby reducing the organization's costs to the minimum. This process will lead to improved investment and better customer service.

S&OP includes two distinct phases:

- Process design.
- Process management.

In the design phase, issues are technically evaluated and at the management phase, S&OP is used as a business management process. The steps below describe these two phases, with steps one to five are including the design phases and steps six to 10 are including the process management phases:

- Step 1:** Decide to do.
- Step 2:** Team building.
- Step 3:** Train the team members.
- Step 4:** Create a calendar.
- Step 5:** Design the process.
- Step 6:** Holding the first team meeting.
- Step 7:** Improve the process.
- Step 8:** Document the process.
- Step 9:** Train users (who need to use the documentation).
- Step 10:** Connect S&OP to Enterprise Resource Planning (ERP).

In *Fig. 2*, you can see the relationship between S&OP with other planning segments in terms of timing and outgoing planning.

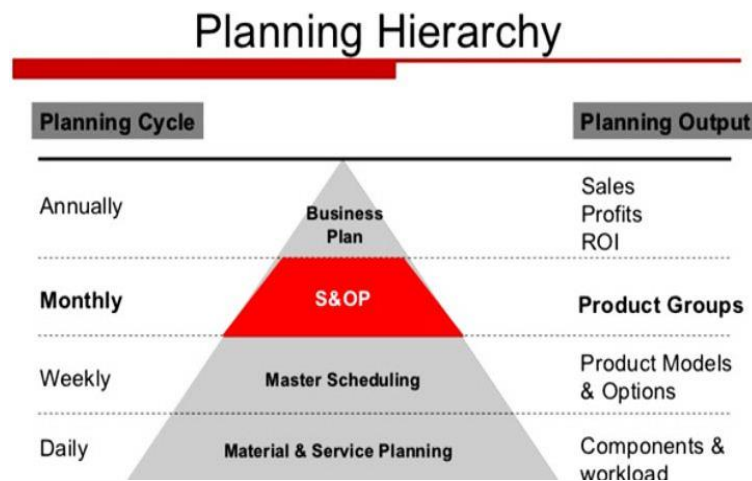


Fig. 2. Sales and operations planning hierarchical.

The S&OP process facilitates communication and collaboration between the planning, sales, production, procurement, and development teams of the new product. S&OP enables shareholders to have a solid assurance of the programs and operations trend that lead to the sale of products. Meeting normally will require a maximum of one day per month. Each unit of orders (orders, clearance, and warehouse), sales, distribution and marketing, and production (production planning and engineering) should update and present their respective reports in accordance with the subject of each meeting. Providing a comprehensive report of the business plan to the executive management of the company will further focus and support the acceleration of sales, decision-making, alignment, and synchronization among the key functions of the organization. The output of the S&OP meeting can be like a useful tool to increase sales team productivity and optimize planning for product development, orders, purchases, and related budgets. Each company can examine and evaluate the Return On Investment (ROI) using S&OP data and analysis:

Second viewpoint

From another perspective, S&OP is carried out in the following three phases:

- Performance development.
- Integration and alignment.
- Competitive advantage.

There are several reasons to use the new approach of S&OP that are referred to below:

- Old and traditional decision-making processes lack the ability to determine the profitability of customer demand.
- Globalization has faced supply chain management with even greater complexity.
- The common models of supply chain management are changing in various industries.
- Customers welcome customized products and do not have to offer the products massively on the market and other traditional ways of appealing to them.
- New channels for offering products, as well as changing customer expectations, have led to a diversification and increase in the number of different products on the market.
- Improving the capabilities and tools based on analysis and wider use of them will change the field of competition in various industries.

- The uncertainty in the economic situation of countries and the world has significantly reduced the risk appetite of organizations.
- Products, technologies, and market dynamics are changing rapidly and moving fast on their path to evolution.

Organizations that use the new approach to profit-making, S&OP often achieve a major advantage due to their superior ability to use pricing policies and tools to determine the optimal price, because of this way, they increase the demand for their products or services, without the slightest detriment to the margin of profit and organization brand credibility.

6. Identification and Monitoring of Affecting Factors (Indicators)

Certainly, there are many factors that will affect the implementation of the S&OP process. Identifying the most important of these factors and how they are monitored are important issues of the present research as well as the major issues of managers and any organization stakeholders and shareholders. Therefore, in this research, will be discussed the hierarchical structure of these factors and how they are gathered.

6.1. The Hierarchical Structure of Research Implementation

According to field studies and literature review research, in the first step, the result has been achieved by 30 effective factors of the S&OP process implementation in six sections (option). As shown in *Table 1*, the affecting factors in six categories (state-political factors, economic-financial factors, supply-procurement factors, technology-resource factors, transport-distribution factors, marketing-sales factors) are classified. Each of which contains sub-indexes related to itself.

By offering a questionnaire to selected experts in this study, 12 factors that have the highest score in terms of influencing importance on the S&OP implementation process have been selected (in the case of equal privileges, the factor randomly selected). It is necessary to explain that the starred items in *Table 1* are items that have been obtained from field study and the others have been extracted from the literature review. Consequently, due to the selected factors, their hierarchical structure is described in *Fig. 3* in accordance with the AHP method, which we will discuss earlier. As you can see in *Fig. 3*, six options are considered as the selected parts of the S&OP process: UHT, cheese, yogurt, beverages, cream butter, and concentration, which should be evaluated and ranked by the offered indicators.

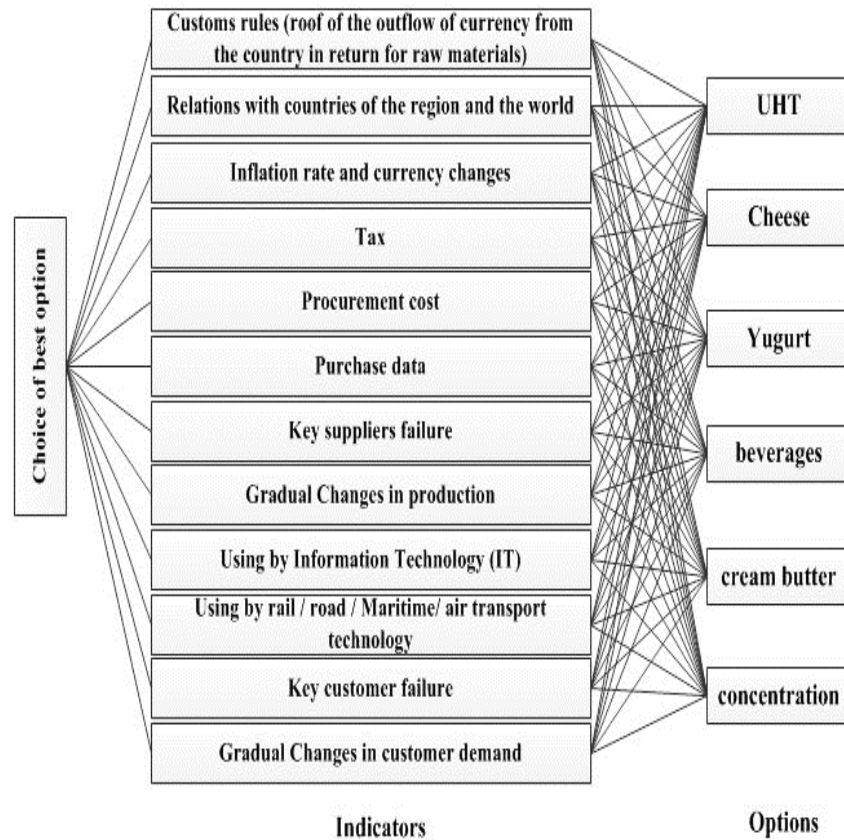


Fig. 3. Hierarchical structure.

7. Data Analysis Methods and Techniques

Today, human decisions are more than ever based on information. But most of this information is not definitive, and in this situation, logical decision making is very difficult based on this uncertainty. Different methods are used to represent this uncertainty, including the fuzzy numbers [23]. In this study, we will use Multiple Attribute Decision-Making (MADM) methods, one fuzzy AHP, and the other combination of AHP and fuzzy TOPSIS, which will further explain these methods.

FAHP is the well-known MCDM approach for the personal selection problems in which some considered criteria are weighted based on their importance, and the candidates are assessed according to these criteria as well. AHP method has emerged as a useful decision-making technique for solving and analyzing the complex problems. Indeed, the AHP converts a complex problem to several simple problems and solve them [24].

TOPSIS is one of the best and useful decision-making procedures with multi-indicators that is based on a simple logic by Hwang in 1981. This logic is in a way that it makes one ideal and one anti-ideal option and then chooses the select options based on the least distance from the ideal option and the most distance from the anti-ideal option [25].

Table 1. Affecting factors.

| Indicators name | Sub-indicators |
|---------------------------------------|---|
| State-Political factors | <i>Customs rules (roof of the outflow of currency from the country in return for raw materials)</i> <i>Relations with countries of the region and the world*</i> <i>The process of monopolization and privatization in the country*</i> <i>Change of government and state institutions*</i> <i>To do external boycotts*</i> |
| Economic-Financial factors | <i>Financing (budget allocation)</i> <i>Inflation rate and currency changes</i> <i>Financial constraint</i> <i>Finance turnover*</i> <i>Tax*</i> |
| Supply- Procurement factors | <i>Procurement cost*</i> <i>Selection and use of various suppliers*</i> <i>Purchase data *</i> <i>Forecast of raw material supply*</i> <i>Key suppliers failure*</i> |
| Technology-Resource factors | <i>Use of modern technology and skilled production personnel</i> <i>Production capacity*</i> <i>Production time*</i> <i>Gradual changes in production*</i> <i>By using Information Technology (IT)*</i> |
| Transport-Distribution factors | <i>Shipping capacity*</i> <i>By using rail/ road/ maritime/ air transport technology*</i> <i>Use of skilled staff*</i> <i>Hold inventory*</i> <i>Delivery speed*</i> |
| Marketing-Sales factors | <i>Customer financial and job information*</i> <i>Price of productions*</i> <i>Market dynamics*</i> <i>Key customer failure*</i> <i>Gradual changes in customer demand</i> |

The phases of fuzzy AHP implementation (using the Chang development analysis method) are carried out in seven steps:

Step 1: Draw a hierarchical chart (as shown in Fig. 3).

Step 2: Define fuzzy numbers to perform paired comparisons.

Step 3: Generate paired comparison Matrix.

Step 4: Calculate the S_i (Grade) for each of the paired comparison matrix rows.

If the fuzzy numbers are triangular, they are represented as (L_i, M_i, U_i) that in this case:

$$S_i = \sum_{j=1}^m M_{gi}^j \times \left[\sum_{i=1}^n \sum_{j=1}^m M_{gi}^j \right]^{-1} \quad (1)$$

$$\sum_{j=1}^m M_{gi}^j = (\sum_{j=1}^m l_j, \sum_{j=1}^m m_j, \sum_{j=1}^m u_j). \tag{2}$$

$$\sum_{i=1}^n \sum_{j=1}^m M_{gi}^j = (\sum_{i=1}^n l_i, \sum_{i=1}^n m_i, \sum_{i=1}^n u_i). \tag{3}$$

$$\left[\sum_{i=1}^n \sum_{j=1}^m M_{gi}^j \right]^{-1} = \left(\frac{1}{\sum_{i=1}^n u_i}, \frac{1}{\sum_{i=1}^n m_i}, \frac{1}{\sum_{i=1}^n l_i} \right). \tag{4}$$

Step 5: Calculate the degree (Si) relative to each other.

$$V(M_2 > M_1) = \text{hgr}(M_2 \cap M_1) = \mu_{M_2}(d) = \begin{cases} 1 & \text{if } m_2 \geq m_1 \\ 0 & \text{if } l_2 \geq l_1 \\ \frac{(l_1 - u_2)}{(m_2 - u_2) - (m_1 - l_1)} & \text{otherwise} \end{cases}. \tag{5}$$

Step 6: Calculate the weight of the criteria and options in the paired comparison matrix.

Step 7: Calculate the final weight of the vector.

Also, in this research because of defining the affecting factors (indicators) as qualitative and answering the questions raised in the questionnaires is also a fuzzy (qualitative) aspect, a triangular fuzzy number is used in accordance with Fig. 4 and Table 2.

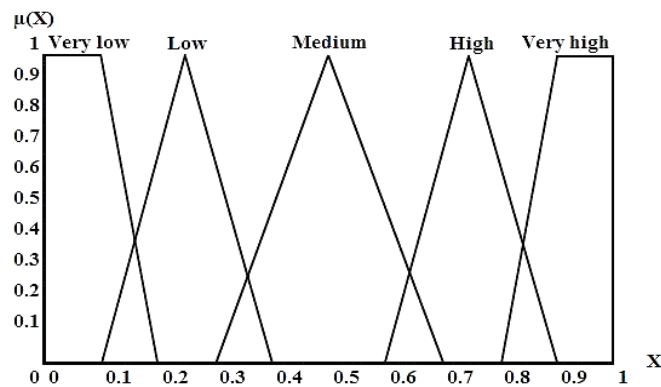


Fig. 4. Convert qualitative (linguistic) word to a fuzzy number.

Table 2. Convert qualitative (linguistic) word to a fuzzy number.

| Row | Qualitative(linguistic) word | Triangular fuzzy number |
|-----|------------------------------|-------------------------|
| 1 | Very high | (1 0.9 0.8) |
| 2 | high | (0.9 0.75 0.6) |
| 3 | Medium | (0.7 0.5 0.3) |
| 4 | Low | (0.4 0.25 0.1) |
| 5 | Very low | (0.2 0.1 0) |

Also, if $A = (a_1, b_1, c_1)$ and $B = (a_2, b_2, c_2)$ are two triangular fuzzy numbers, the mathematical operators of the fuzzy numbers that required in this study are as follows:

- Plural

$$A + B = (a_1+a_2, b_1+b_2, c_1+c_2). \quad (6)$$

Which itself is a fuzzy number.

- Reverse

$$\frac{1}{A} = \left(\frac{1}{c_1}, \frac{1}{b_1}, \frac{1}{a_1}\right). \quad (7)$$

- Average

$$\text{Average} = \frac{\text{Sum}(M)}{N} \Rightarrow. \quad (8)$$

M: The sum of fuzzy numbers.

N: The count of fuzzy numbers.

And to convert fuzzy numbers to definite numbers, the mean method is used as follows:

$$\bar{X} = \frac{1}{3}(a+b+c). \quad (9)$$

The fuzzy TOPSIS algorithm is performed as follows:

Step 1: create a decision-making team and then determine the options and their evaluation criteria.

Step 2: Determine the criteria importance by each determiner by using predetermined speech variables.

Step 3: Determine the options rates according to each criteria by using predetermined speech variables.

Step 4: Create a fuzzy decision matrix.

Step 5: Generate a normalized fuzzy decision matrix.

Step 6: Generate a non-scale normalized fuzzy decision matrix.

Step 7: Determine the positive and negative fuzzy ideal solution.

Step 8: Calculate the distance between each option and the positive and negative fuzzy ideal solution.

Step 9: Calculate the proximity coefficient index for each option.

Step 10: Options ranked according to the proximity coefficient index that calculated in the previous step.

Finally, the following are considered in the present research:

- Determining the indicators weights by using fuzzy AHP method.
- Ranking of options (sales and operations planning implementation segments) by using fuzzy AHP and Fuzzy TOPSIS methods.

8. Calculate and Determine the Indicators Weights

According to the questionnaire prepared in this regard, the decision matrix has been obtained for determining the indicators weights. This matrix is completed for each responsive that after providing all the decision matrices, which consists of 10 matrices of 10 experts, are all converted into a matrix, in which case the arithmetic average method for each triangular fuzzy number component is used. Here is an aggregate matrix in accordance with *Table 3*.

Finally, by the Chang development analysis method, the indicators weights were obtained in accordance with *Table 4* and *Fig. 5*.

Table 4. Indicators weights.

| Indicators | Gradual Changes in customer demand | Key customer failure | By using rail / road / Maritime/ air transport technology | By using Information Technology (IT) | Gradual changes in production | Key suppliers failure | Purchase data | Procurement cost | Tax | Inflation rate and currency changes | Customs rules (roof of the outflow of currency from the country in return for raw materials) |
|-----------------|------------------------------------|----------------------|---|--------------------------------------|-------------------------------|-----------------------|---------------|------------------|------|-------------------------------------|--|
| Abnormal weight | 0.1 | 0.13 | 0.56 | 0.24 | 0.42 | 0.21 | 0.68 | 0.79 | 0.74 | 0.92 | 0.98 |
| Normal weight | 0.01 | 0.02 | 0.08 | 0.03 | 0.06 | 0.03 | 0.1 | 0.12 | 0.11 | 0.14 | 0.15 |

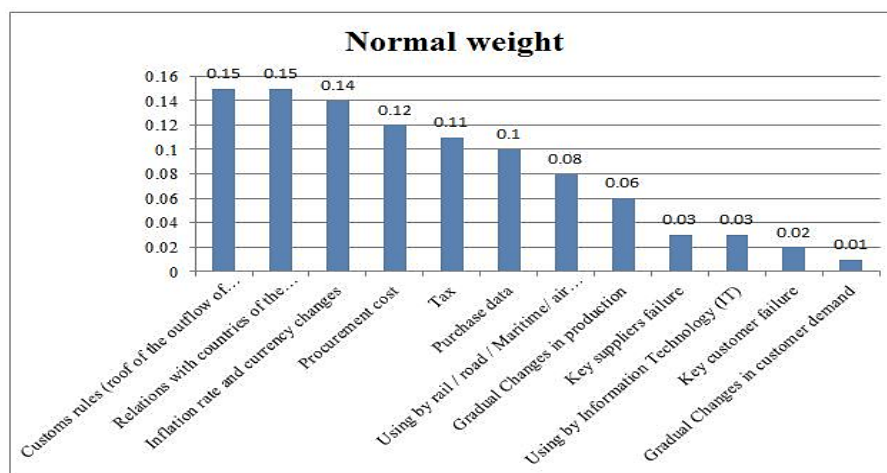


Fig. 5. Indicators weights.

In order to obtain the normal weight, we divide each of the abnormal indicators weight values into the sum of all abnormal weights.

Table 3. Aggregation of expert's decision-making matrixes.

| Indicators | Gradual changes in customer demand | Key customer failure | By using rail / road / maritime/ air transport technology | By using Information Technology (IT) | Gradual changes in production | Key suppliers failure | Purchase data | Procurement cost | Tax | Inflation rate and currency changes | Customs rules (roof of the outflow of currency from the country in return for raw | Relations with countries of the region and the world | |
|--|------------------------------------|----------------------|---|--------------------------------------|-------------------------------|-----------------------|---------------|------------------|------|-------------------------------------|---|--|------|
| Gradual changes in customer demand | 1.00 | 1.00 | 1.00 | 0.57 | 0.75 | 0.90 | 0.30 | 0.50 | 0.70 | 0.60 | 0.60 | 0.75 | 0.90 |
| Key customer failure | 1.11 | 1.33 | 1.75 | 1.00 | 1.00 | 1.00 | 0.10 | 0.25 | 0.40 | 0.60 | 0.60 | 0.75 | 0.90 |
| By using rail / road / Maritime/ air transport technology | 1.43 | 2.00 | 3.33 | 2.50 | 4.00 | 10.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| By using Information Technology (IT) | 1.11 | 1.33 | 1.67 | 1.11 | 1.33 | 1.67 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Gradual cction | 1.43 | 2.00 | 3.33 | 1.43 | 2.00 | 3.33 | 1.11 | 1.33 | 1.67 | 1.43 | 1.43 | 2.00 | 3.33 |
| Key suppliers failure | 1.11 | 1.33 | 1.67 | 1.11 | 1.33 | 1.67 | 1.11 | 1.33 | 1.67 | 1.11 | 1.11 | 1.33 | 1.67 |
| Purchase data | 1.43 | 2.00 | 3.33 | 1.25 | 1.54 | 2.00 | 1.11 | 1.33 | 1.67 | 1.43 | 1.43 | 2.00 | 3.33 |
| Procurement cost | 1.43 | 2.00 | 3.33 | 1.11 | 1.33 | 1.67 | 1.22 | 1.54 | 2.08 | 1.43 | 1.43 | 2.00 | 3.33 |
| Tax | 1.11 | 1.33 | 1.67 | 1.11 | 1.33 | 1.67 | 1.20 | 1.48 | 1.92 | 1.11 | 1.11 | 1.33 | 1.67 |
| Inflation rate and currency changes | 1.11 | 1.33 | 1.67 | 1.11 | 1.33 | 1.67 | 1.11 | 1.33 | 1.67 | 1.11 | 1.11 | 1.33 | 1.67 |
| Customs rules (roof of the outflow of currency from the country in return for raw materials) | 1.43 | 2.00 | 3.33 | 1.43 | 2.00 | 3.33 | 1.16 | 1.43 | 1.85 | 1.43 | 1.43 | 2.00 | 3.33 |
| Relations with countries of the region and the world | 1.11 | 1.33 | 1.67 | 1.64 | 2.35 | 4.17 | 1.43 | 2.00 | 3.33 | 1.11 | 1.11 | 1.33 | 1.67 |

Table 6. Options weights in all indicators.

| Options | Concentration | Cream butter | Beverages | Yogurt | Cheese | UHT |
|--|---------------|--------------|-----------|--------|--------|------|
| Indicators | Normal weight | | | | | |
| Relations with countries of the region and the world | 0.09 | 0.08 | 0.08 | 0.17 | 0.31 | 0.27 |
| Customs rules (roof of the outflow of currency from the country in return for raw materials) | 0.08 | 0.07 | 0.07 | 0.17 | 0.26 | 0.35 |
| Inflation rate and currency changes | 0.08 | 0.07 | 0.07 | 0.17 | 0.26 | 0.35 |
| Tax | 0.08 | 0.04 | 0.13 | 0.19 | 0.25 | 0.3 |
| Procurement cost | 0.06 | 0.07 | 0.14 | 0.17 | 0.26 | 0.3 |
| Purchase data | 0.06 | 0.1 | 0.14 | 0.18 | 0.25 | 0.27 |
| Key suppliers failure | 0.06 | 0.1 | 0.14 | 0.18 | 0.25 | 0.27 |
| Gradual changes in production | 0.01 | 0.13 | 0.17 | 0.18 | 0.23 | 0.28 |
| By using Information Technology (IT) | 0.01 | 0.13 | 0.17 | 0.18 | 0.23 | 0.28 |
| By using rail / road / maritime/ air transport technology | 0.08 | 0.07 | 0.07 | 0.17 | 0.26 | 0.35 |
| Key customer failure | 0.08 | 0.07 | 0.07 | 0.17 | 0.26 | 0.35 |
| Gradual changes in customer demand | 0.08 | 0.07 | 0.07 | 0.17 | 0.26 | 0.35 |

10. Options Ranking by Using Fuzzy AHP

The ranking is done according to *Table 7*.

Table 7. Options ranking.

| Options | Weight | Rank |
|---------------|--------|------|
| UHT | 0.32 | 1 |
| Cheese | 0.25 | 2 |
| Yogurt | 0.18 | 3 |
| Beverages | 0.11 | 4 |
| Cream butter | 0.08 | 5 |
| Concentration | 0.06 | 6 |

As you can see, the UHT, cheese and yogurt segments have ranked first to third and the concentration unit has ranked sixth.

11. Options Ranking by Using a Combination of Fuzzy AHP and Fuzzy TOPSIS

According to the prepared questionnaire, the options importance in each indicator decision matrix was completed for all experts, and then all converted into an aggregate matrix, in which case the arithmetic average method for each triangular fuzzy number component is used (*Table 8*).

Finally, the ranking is done according to *Table 9*.

Table 9. Options ranking.

| Options | Weight | Rank |
|----------------------|-------------|----------|
| <i>UHT</i> | <i>0.56</i> | <i>1</i> |
| <i>Cheese</i> | <i>0.55</i> | <i>2</i> |
| <i>Yogurt</i> | <i>0.52</i> | <i>3</i> |
| <i>Cream butter</i> | <i>0.44</i> | <i>4</i> |
| <i>Beverages</i> | <i>0.4</i> | <i>5</i> |
| <i>Concentration</i> | <i>0.37</i> | <i>6</i> |

As you can see, the UHT, cheese and yogurt segments have ranked first to third and the concentration unit has ranked sixth.

Table 8. Aggregation of decision-making matrixes.

| Indicators | Relations with countries of the region and the world | Customs rules (roof of the outflow of the currency from the country in return for raw materials) | Inflation rate and currency changes | Tax | Procurement cost | Purchase data | Key suppliers failure | Gradual changes in production | By using Information Technology (IT) | By using rail / road / maritime/ air transport technology | Key customer failure | Gradual changes in customer demand |
|---------------|--|--|-------------------------------------|------|------------------|---------------|-----------------------|-------------------------------|--------------------------------------|---|----------------------|------------------------------------|
| Concentration | 0.80 | 0.80 | 0.62 | 0.77 | 0.91 | 0.57 | 0.73 | 0.88 | 0.60 | 0.77 | 0.80 | 0.75 |
| Cream butter | 0.78 | 0.78 | 0.78 | 0.89 | 0.99 | 0.30 | 0.50 | 0.70 | 0.88 | 0.77 | 0.73 | 0.60 |
| Beverages | 0.60 | 0.57 | 0.57 | 0.73 | 0.88 | 0.33 | 0.53 | 0.70 | 0.75 | 0.73 | 0.56 | 0.88 |
| Yogurt | 0.62 | 0.35 | 0.62 | 0.77 | 0.91 | 0.57 | 0.73 | 0.88 | 0.59 | 0.74 | 0.54 | 0.73 |
| Cheese | 0.75 | 0.86 | 0.70 | 0.82 | 0.94 | 0.30 | 0.50 | 0.70 | 0.75 | 0.82 | 0.33 | 0.50 |
| UHT | 0.30 | 0.50 | 0.30 | 0.50 | 0.70 | 0.30 | 0.50 | 0.70 | 0.30 | 0.50 | 0.30 | 0.50 |

12. Answer the Research Questions

In answer to each research question, the results are as follows:

- How can S&OP processes implementation with success?

In companies with overseas activities, the successful implementation of the sales and operations planning process depends on a large extent on the political and governmental issues of that country. As the indicators of this research have been deduced, using information technology, having proper road infrastructure, having the economic and political stability that influences the internal and external communications of the organization can lead to successful sales and operations planning.

- How can the affecting factors the S&OP implementation are identified?

There are many factors in the correct implementation of the planning process of sales and operations, which include the political, economic, social and cultural factors of each organization and the surrounding community in this implementation.

Using the analysis of internal methods of sales planning and operations of the company studied and utilizing the opinions of experts and by using literature review can identify these factors.

In this study, due to many of the activities externality of the company studied, the political factors are very influential.

- How can the affecting factors the S&OP implementation are ranked?
- By using ranking methods such as fuzzy AHP and fuzzy TOPSIS, which are used in this research.
- What methods can be used to improve S&OP?
- Having regular and coherent meetings to make the right decisions, using skilled staff, experts and using information technology can have a significant impact on the sales and operations planning implementation process.

Also, the use of modern transportation technologies and having a suitable political relationship will also have a great impact.

13. Suggestions Based on Findings

Sales and operations planning is one of the most important strategic processes in any organization that can lead to more sales and more profitability and less missed sales.

According to the studies, suggestions for this research are as follows:

- The Kalleh dairy production company can provide the necessary training to all levels of employees involved in the creation and implementation of the S&OP process, to ensure the correct implementation of this process in the organization and increase the commitment of personnel to it.
- Correct communication with customers and consumers can provide the right information about their needs, demands, and experiences to the organization, which will lead to the correct planning of sales and operations. This will be achieved by upgrading the Customer Relationship Management (CRM) system.

- Participation of all relevant managers at annual, monthly, and weekly meetings in order to strengthen the approval execution of all relevant units.
- The use of information technology at all levels of the organization uniformly, including supply, production, transportation, sales, distribution, and finance.

14. Conclusion

In this research, we tried to identify the affecting factors of the sales and operations planning process implementation and with using the fuzzy AHP and fuzzy TOPSIS ranking methods, the influence of these factors was seen on the executive segments. According to the ranking of options through the two methods used in this study, the results according to the seven tables indicate that the selected affecting factors of the sales and operations planning process implementation has had the most impact on UHT, cheese and yogurt segments, and less impact on the concentration segment. Comparison of the two ranking methods has been shown in *Table 10*.

Table 10. Comparison of fuzzy AHP and fuzzy TOPSIS ranking methods.

| | Ranking Methods | | Rank |
|---------|-----------------|---------------|------|
| | AHP | TOPSIS | |
| Options | UHT | UHT | 1 |
| | Cheese | Cheese | 2 |
| | Yogurt | Yogurt | 3 |
| | Beverages | Cream butter | 4 |
| | CREAM butter | Beverages | 5 |
| | Concentration | Concentration | 6 |

Therefore, suggestions for future articles by the author are presented as follows:

- Use of indicators and sub-indicators simultaneously in a hierarchical structure.
- The use of indicators with definite values (for example, the quantity of distribution or the price of products in numerical order).
- Use of this research in all companies with extraterritorial activities, especially dairy companies.
- Use multiple ranking models simultaneously in order to use prioritization techniques.

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