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Forecasting demand and optimizing the ordering of goods in the supply chain using artificial intelligence in Kaleh Company

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Abstract

The globalization of business market competition has created an uncertain environment for manufacturing organizations, so the managers are trying and planning more to survive. One of the world's largest and most complex industry sectors is the food supply chain, which plays an important role in economic growth. Food characteristics, especially shelf life, strongly influence the three sustainability criteria. Much attention is paid to perishable food products with a limited lifespan due to the large amount of waste, harmful environmental effects and special storage and transportation conditions. One of the problems faced by organizations facing customer demand is the change in demand, which causes uncertainty on the producer's side (production quantity), which also causes uncertainty in purchasing and, in a sense, in the entire supply chain. In this research, the 2-layer perceptron neural network and the following neural network parameters were used to predict the demand for the product, because the demand value is a large number, for this reason, in the data entry table, we divide the demand output value by 1000 to get the average The squared error should be examined. The results showed that the prediction using the multi-layer perceptron neural network toolbox in MATLAB software, due to the upward trend of Venezuelan demand, the prediction value of the neural network is close to the real value.

Keywords: Optimization, neural network, MATLAB software, supply chain
2020 MSC: 90B06, 92B20

1 Introduction

The globalization of business markets and competition has created an uncertain environment for manufacturing organizations. So, the managers of these organizations are trying and planning more to survive; one of the essential things that managers can achieve a competitive advantage by paying attention to is supply chain management and risk management [7]. One of the critical and essential solutions that service institutions and companies can use to differentiate themselves from other competitors is to identify factors and characteristics that affect supply chain management to provide superior service quality because many companies focus on this point. They have realized that providing quality services can bring them a competitive advantage. An advantage that leads to higher profits and sales, and to achieve this goal, it is enough to meet or exceed customer expectations of service quality [13]. Today, competition in individual and independent factories has changed to competition among supply chains. Improving

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the competitiveness of companies and responding quickly to diverse customer demands requires optimal supply chain management [23]. As a result, there was no competition between independent companies as in the past. However, this competition has spread between a group of related companies and at a higher level between all supply chains [10]. The increase in competitiveness in supply chains and disruptions in supply chains have increased the need for forecasting in the supply chain [2].

Demand forecasting is one of the most fundamental issues in the supply chain and has always been the primary concern of management. With the increase in the number of competitors, the organizations were forced to improve the internal process to remain in the global competition scene and strive to develop detailed market strategies that focused on the estimation of customer satisfaction. They realized that solid engineering, design, and coherent manufacturing operations are prerequisites for achieving market requirements and, thus, more significant market share and accurate and timely forecasts [31]. Forecasting is the basis for all supply chain planning. Because each member of the supply chain made orders and stock decisions with a view to their interests towards the upper side of the supply chain, it led to an increase in the number of forecasts towards the upper side. It led to excess inventories in all parts of the supply chain [16]. This issue causes incorrect planning, increases inventory levels, decreases profit, decreases service levels, and harms organizations. It is based on this that much research has been done on it. One of the main reasons for this issue is the unavailability of data related to the end customer's demand and the decision-making of each chain member (in ordering) based on the data received from his subordinate member. Data sharing in the supply chain is considered a degree of appropriateness between the chain members, and it is usually known as facilitating the effective allocation of inventory during the supply chain [11]. Demand forecasting can significantly reduce costs for large companies [18]. All these statistics show the importance of more accurate demand forecasting for different sectors.

Due to the emergence of digital transformation, new starting points for the scientific study of supply chains have emerged [15]. While in the past, most operational processes in the supply chain were carried out independently in conventional organizational structures, most of these tasks are no longer self-sufficient due to technological changes. Therefore, supply chain management is also affected by digital transformation. Therefore, the way of managing materials, information and financial flows in an integrated business network is constantly changing due to the influence of digital technologies. Innovative technological concepts, such as Cyberphysical Systems (CPS), Artificial Intelligence or Cloud Computing, can be agents of digital transformation [8]. Machine learning and artificial intelligence methods have introduced new approaches to forecasting problems in which the relationships between variables are modelled in a deep and layered hierarchy [8]. These methods, such as artificial neural networks, support vector machines, random forests and deep learning models, such as recurrent neural networks and long short-term memory, have recently attracted researchers' attention in prediction [14].

With the rapid development of scientific tools and methods, many classical concepts, principles and relationships in purchasing, maintenance, ordering and warehousing have been revised and evolved. These revisions, especially in artificial intelligence, make applying specific time and place conditions regarding decision patterns possible. As a branch of artificial intelligence, the artificial neural network has much applicability in many prediction and approximation problems [30]. Therefore, the use of genetic algorithms and artificial intelligence in forecasting demand in the supply chain has a special place and deserves many studies. However, despite the research in this field, there are still many ambiguities that the necessity of conducting more studies reveals. Among the most important of them:

The many similarities and overlaps between the presented concepts and the lack of a clear border confuse students, researchers, and policymakers when correctly diagnosing the problem. Most of the research conducted in this field has been analyzed from a specific aspect and, therefore, is not comprehensive.

One of the other factors that can be considered in this field is the small number of studies that use mathematical modelling to explore the problem as much as possible. Most of the studies were carried out instrumentally using the research subject, and its criticism either used a statistical approach to investigate the relationship between variables to prove hypotheses or used a scientific approach. They have reviewed the theories.

One of the important and influential issues in adopting a new approach is paying attention to its consequences or the consequences of continuing the previous process. This issue is also not well resolved in the existing research. Therefore, the results of this research can open the way for decision-makers of supply chains to make decisions in forecasting and collaborative planning. In recent years, with the trend of the country's industry managers towards forming business networks and forming supply chains in various industries, it seems necessary to benefit from scientific methods for better planning in this field. Even though this orientation will bring potential benefits, the lack of planning and proper movement in this direction will cause a double loss for the country's manufacturing companies. Therefore, the method used in the present research can be used as a model for correct decision-making by industry managers in supply chains. This model can be considered an approach to analyzing different supply chain scenarios.

Therefore, the present study was conducted to provide a framework for forecasting demand in the supply chain using artificial intelligence and genetic algorithms. To achieve this goal, it sought to answer the question, "How is demand forecasting in the supply chain using artificial intelligence and genetic algorithms? "

2 Research Literature

2.1 Supply Chain Management

Supply chain management is a procedure that can provide conditions for customers to receive reliable and fast services with quality products at minimum cost. Mentzer et al. [22] define supply chain management as planning, organizing and controlling activities. Supply chain management includes activities related to the transfer and flow of goods and services and their information flows from the source of raw materials to the final consumers. There are other definitions of supply chain management, such as integrating key business activities from the final consumer to the primary producer that supplies products, services, and information, thereby creating added value for customers and other stakeholders.

From a process point of view, supply chain management is the management of the main work processes in a network of organizations that make up the supply chain and includes the final customer to the leading supplier. The general supply chain assembly members define the leading supply chain management processes. They are customer relationship management, customer service management, demand management, order fulfilment, production flow management, supplier relationship management, product development and commercialization, and management of activities related to returned goods [29].

2.2 The importance of demand forecasting

One of the challenging issues in improving the performance of organizations is forecasting demand, improving their supply chain and reducing related costs. According to published statistics in 1998, US companies spent $898 billion on supply chain-related costs (which equals 10% of the country's gross national product that year). Unfortunately, most of these costs are unnecessary, and improving supply chain management can significantly reduce them. For example, experts believe that by using better supply chain strategies, the food industry can save about 30 billion dollars or 10% of operating costs. Reduce their annual. Among the solutions to reduce supply chain costs is increasing the accuracy of demand forecasting with the help of new statistical methods. In addition to low accuracy, traditional demand forecasting methods cause other problems for organizations. Among these problems, we can mention the "whiplash effect" [28]. With recent advances in artificial intelligence, new prediction techniques have been presented that are more accurate than traditional techniques. The most common of these techniques are neural network algorithms, which have shortcomings such as the need for many control parameters, the difficulty of achieving a stable result, and the risk of overfitting [6]. Due to such weaknesses, better models have been designed to improve the neural network model. Support vector machines use a novel neural network algorithm based on statistical learning theory [17].

2.2.1 Prediction methods (algorithms)

Demand forecasting methods are divided into two general categories [19].

1. Qualitative method (intuitive)
2. Quantitative method (calculation method)

In qualitative methods, prediction is based on intuition and predictive understanding, which is usually associated with significant error. However, prediction is based on statistical methods and mathematical formulas in quantitative methods. Some quantitative methods are the exponential smoothing method, the Croston method, intelligent methods, support vector machines, artificial intelligence networks, and neural networks.

2.3 Neural Networks

In neural network design, we seek to produce a computer system that can provide human reasoning capabilities by imitating the biological nervous system. The primary element of a neural network is the mathematically modelled artificial neuron created by McCulloch and Pitts [20]. It has been proven that in solving classification and regression problems, the neural network can efficiently estimate any function under certain conditions, considering the nonlinear relationship between the input and output variables.

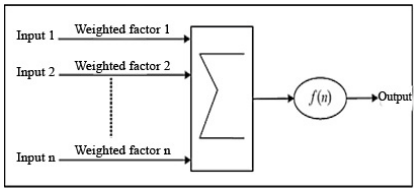

Figure 1: Nero McCulloch-Pitz [12]

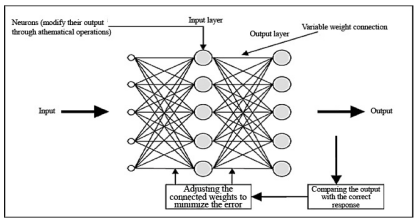

Figure 2: **Three-layer network [12]**

Figure 1 shows how an artificial neuron works. Each neuron has several inputs and one output. Each input is multiplied by a predefined weighting factor, and then the output is determined by a mathematical function f(n), which is the sum of the product of the inputs and the weighting factors.

Figure 2 shows one of the most common network topologies available: a three-layer feedforward network. In this network, each signal in the input layer is fully connected to each neuron in the hidden layer. These connections are established between neurons in the hidden and output layers.

3 Research Methodology

This research was based on the practical purpose and descriptive survey data collection of a cross-sectional type. In this research, the demand for some Kalleh company products has been predicted using artificial intelligence networks. The statistical population in the qualitative section (Delphi method) included all the experts and managers of the Kaleh company. In this study, 12 experts and managers of Kalleh company were selected to finalize the model's components. Sampling was done purposefully in the framework of the logic of the qualitative method. Criteria were considered for the selection of experts, and people were selected to select the final factors that met at least one of the following criteria:

1- Having documented studies in the field of study (forecast and demand)

2- having teaching experience in the fields related to the research topic,

3- Having executive management experience in departments related to customer demand

The first round of the Delphi questionnaire, which includes 8 factors affecting the demand for the strategic products of Kaleh Company, was distributed among 12 members of the Delphi panel of experts and managers of Kaleh Company and collected on the same day. These factors include warehouse inventory, last week's sales, last month's sales, cargo on the way, changes in the number of customers compared to the past, the status of competitors in the market, government laws, and the company's development plans. In the first part of the first round of the Delphi questionnaire, the respondents were asked to weigh the indicators on the Likert spectrum according to their experience and studies. These options were in the form of a Likert spectrum and included "very little: 1", "low: 2", "moderate: 3", "high: 4", and "very high: 5".

The quantitative statistical population includes all the products of the Kaleh company. Due to the large number of products, this research was done to predict demand and optimize ordering, and three important strategic products of this company were selected as a statistical sample.

· 350 grams of Ana Labneh cheese

· Seven Yogurt 2.2 kg

· 1 litre full-fat milk from Kaleh

In this research, prediction has been done using the multi-layer perceptron neural network toolbox in MATLAB

Row	Side	Education
1	Manager of sales department of Kale company	Doctorate
2	Sales expert of Kale company	Master's degree
3	Sales expert of Kale company	Master's degree
4	Sales expert of Kale company	Master's degree
5	Manager of sales department of Kale company	Doctorate
6	Sales expert of Kale company	Master's degree
7	Sales expert of Kale company	Master's degree
8	Manager of sales department of Kale company	Master's degree
9	Manager of sales department of Kale company	Master's degree
10	Manager of sales department of Kale company	Doctorate
11	Sales expert of Kale company	Master's degree
12	Sales expert of Kale company	Master's degree

Table 1: Characteristics of Delphi panel members

objects	Number	Average	standard deviation	Variance	Kendall coefficient	Order of importance
warehouse stock	12	3/82	0/355	0/781	5/55	5
Last week's sale	11	4/05	1/05	1/14	5/05	3
Last month's sale	12	4/20	1/10	1/22	5/20	2
You are on your way	10	2/45	0/886	0/901	1/35	8
Change in the number of customers compared to the past	12	4/44	0/604	0/366	5/20	1
The status of competitors in the market	12	4/10	0/788	0/621	5/46	4
governmental laws	12	3/75	0/966	0/933	5/25	6
Development plans of the company	11	2/75	0/910	0/829	1/90	7

Table 2: Results of the first round of Delphi

software. Research experts completed the data used by the Delphi method, and its output was analyzed in this software. Descriptive data and the Delphi section were analyzed using SPSS software.

4 Result and Findings

4.1 Features of the Delphi panel

Table (1) shows the characteristics of Delphi panel members and their position and education. As it is clear from the Table, in addition to experts, managers were also used for the Delphi panel from the Kalleh company

4.2 The results of the first round of the Delphi method

Table (2) contains the results related to the first round of Delphi, which includes items such as the number of responses for each item, the average of the responses, their standard deviation, Kendall's coefficient, the order of importance of each factor based on Kendall's coefficient and the average of the responses. According to the results obtained in the first round of the Delphi method, according to dispersion indices and Kendall's coefficient for the variable of road load with a mean of 2.45, standard deviation of 0.886, variance of 0.901, and Kendall's coefficient of 1.35, it has the lowest rank. The company's development plans, with an average of 2.75, standard deviation of 0.910, variance of 0.829, and Kendall's coefficient of 1.90, are ranked the next lowest. Therefore, they were removed from the second round questionnaires according to experts' opinions.

4.3 Results of the second round of the Delphi method

The questionnaire obtained from the first round of Delphi, which included 6 factors of inventory, last week's sales, last month's sales, change in the number of customers compared to the past, the status of competitors in the market, government regulations, and again between 12 Delphi panel of experts and managers Calais Company, was distributed. The result of the second round is evident in Table (3): In the second round, it can be seen that according to the dispersion indices and Kendall's coefficient, none of the components is removed, and in this way, the Delphi rounds are over, and the components are finalized.

4.4 Proposed neural network

This research used the 2-layer perceptron neural network and the following neural network parameters to predict the demand for the product. Because the demand value is significant, we divide the demand output value by 1000 in the data entry table to get the average. The squared error should be examined.

objects	Number	Average	standard deviation	Variance	Kendall coefficient	Order of importance
warehouse stock	12	3/91	0/455	0/602	6/02	5
Last week's sale	11	4/25	0/609	1/05	5/55	3
Last month's sale	12	4/35	1/12	1/10	5/12	1
Change in the number of customers compared to the past	12	4/26	0/705	0/455	5/78	2
The status of competitors in the market	12	4/19	0/699	0/752	5/23	4
governmental laws	12	3/85	0/455	0/855	5/45	6

Table 3: Results of the second round of Delphi

parameter	Amounts (fat milk)	Amounts (milk cheese)	Values (yogurt seven)
The number of hidden layers	2	2	2
The number of neurons in each layer	10	10	10
The percentage of using data for training	%70	%70	%70
Data usage percentage for validation	%15	%15	%15
Data usage percentage for testing	%20	%20	%20
First layer transfer function	tansig	tansig	Tansig
Second layer transfer function	logsig	logsig	Logsig
Network training algorithm	Levenberg- Marquardt	Levenberg- Marquardt	Levenberg- Marquardt

Table 4: Neural network parameters of the products

Training: This collection is used to obtain the weight parameters of network inputs at the beginning of the learning process.

Test: This section tests and evaluates the neural network capability, which is less than the training set.

Validation: This section prevents overfitting in the network training process. Thus, when network learning improves, but the generalization power of the network for this data set decreases, the learning process should be stopped.

Number of layers: The number of neural network layers plays a vital role in neural network design. The first layer is the input data, and the middle layers are the neurons that perform the calculations. The number of intermediate layers is obtained based on trial and error.

The number of neurons in the intermediate layers: In neural networks, the number of neurons in the input and intermediate layers depends on the type of problem, which is estimated by trial and error.

Activation (transfer) function: Tansig and logsig functions are usually used in neural networks for hidden layers.

4.5 Neural network parameters of products (Full-fat Milk, Labneh cheese and Seven Yogurt)

First, the neural network parameters are determined using the trial-and-error method. Then, the mean square error charts and their Regression are analyzed for high-fat milk, cheese, and Yogurt. Table (5) shows the output table of mean squared error and the absolute value of error between the actual value and the predicted value.

4.6 Error mean square diagram

In the chart of mean square error in neural networks, there are three stages: one is training, which is called Train; the other is the Validation stage, and one is the Test stage. The row of this chart shows the algorithm's iterations and its column shows the mean squared error in three charts. The green chart shows the mean squared validation error. The blue chart shows the mean square of the training, and the red chart shows the mean square of the test error. In this criterion, the algorithm is stopped in the eighth iteration, which is based on one of the stopping indicators, one of which must happen for stopping. Supposedly, one of those indicators is the number of repetitions, which has 1000 repetitions, for example, stopping at the eighth repetition. Another is time; one is performance or mean squared error that stops when it reaches zero. One is gradient; the other is mu. One is the Validation check, which has the right to check up to 6 times, and if the error gets worse, it stops. As can be seen in the first diagram of the high-fat milk product, in this product, Validation continuously decreases and decreases compared to Train. In the chart, the red

the product	Average absolute value of MSA error	Mean squared error MSE
full fat milk	0.23513	0.10456
Labneh cheese	0.36843	0.19677
yogurt seven	0.43318	0.36917

Table 5: The mean squared error and the mean absolute value of the error between the actual value and the predicted value

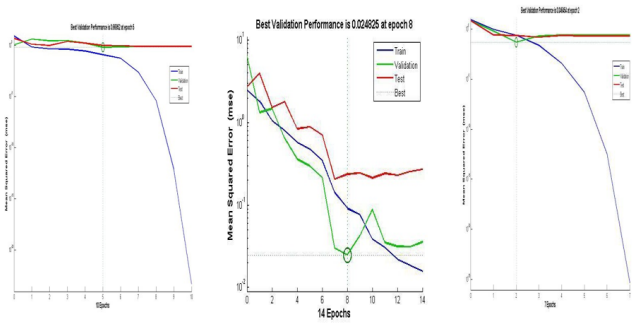

Figure 3: ***Mean square error for training, testing and Validation of high-fat milk, Labneh Cheese and Seven Yogurt products***

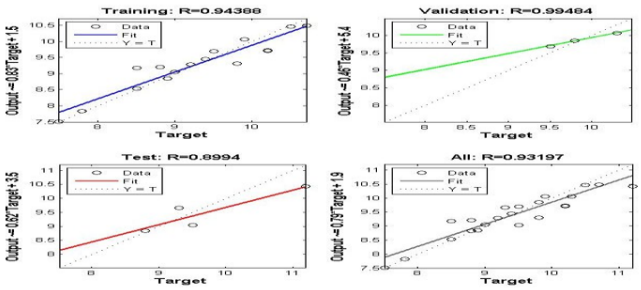

Figure 4: Neural network regression for high fat milk product

colour also decreases. The eighth point is the best. In this chart, the mean square error of Validation and testing in the 8th iteration went through a downward trend; after that, they started an upward trend; as a result, in the 8th iteration, the best error for Validation is 0.02. In the diagram of Labneh cheese (middle) in the second iteration, there is the most negligible error difference; the error rate for Validation is 0.04. In the Mastson diagram, the lowest error difference is in the fifth iteration, and the error rate for Validation is 0.6. The chart of mean square error of the products is presented in Figure (3).

4.7 Neural network regression for Kalleh products

4.7.1 Full fat milk

Regression means the linear relationship between the actual value and the predicted value. The regression diagram is the relationship between the target and the actual state, compared to the output made in the training state. In the regression diagram, Training is shown on the upper left side, Validation is on the upper right side, the test is on the lower left side, and finally, on the lower right side, the overall state, i.e. Brind's sum of three states, is shown and its Regression is drawn. In this chart, the total regression rate is high, and the regression values for the test and validation set and training are close to one and have high values (Figure 4).

4.7.2 Regression of the neural network for the milk cheese product

In the chart of Paneer Labneh, the regression rate of the total value is high, and the regression value for the test and Validation set and the training set are also close to one (Figure 5).

4.7.3 Regression of the neural network for the mass product

In the Mast-son diagram, the regression rate of the total value is high, and the regression value for the test, Validation and training set is also close to one (Figure 6).

4.8 Demand Forecast (Trend Chart)

4.8.1 Full fat milk

The trend chart shows how the actual value changes, with the green colour representing the actual value and the blue colour representing the forecast value. The closer the two are, naturally, the better. According to the charts,

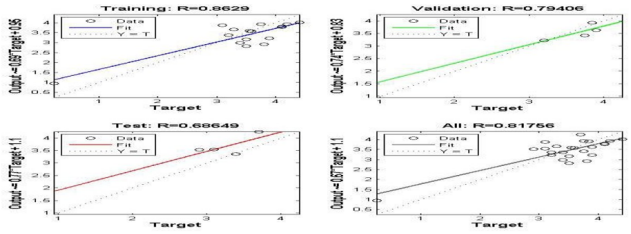

Figure 5: Regression of neural network for the product of Labneh chees

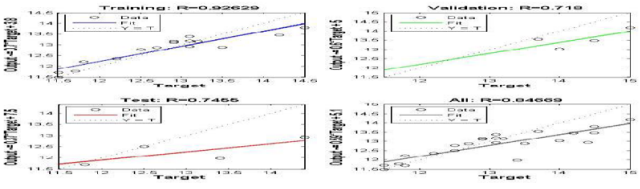

Figure 6: Neural network regression for yogurt seven product

table values and average squared errors, the neural network prediction for the high-fat milk product is acceptable due to the rapid downward and upward trend of the actual values (Figure 7). Therefore, compared to 2021 and 2022, which had complete data, the forecast amount for the next year (2023) will be in Figure 8.

4.8.2 Labne cheese

As the diagram shows, due to the upward and downward trend of the demand, the neural network's prediction value is close to the actual value. According to the diagrams, the table values of the average squared errors of this prediction due to the rapid downward and upward trend of the actual values can be Accepted (Figure 9). The predicted demand for Labneh Kalleh cheese in 2023 is presented in Figure 10.

4.8.3 Seven Yogurt

As can be seen in the diagram, due to the upward and downward trend of the demand, the neural network's prediction value is close to the actual value. Paying attention to the charts and the values of the average squared errors table, the neural network's prediction is acceptable due to the rapid downward and upward trend of the actual values (Figure 11). The predicted amount of demand for Mast Son Kalleh in 2023 is presented in Figure (12).

5 Discussion and Conclusion

What is the demand forecasting model and optimization of ordering goods in the supply chain using artificial intelligence, and what are their antecedents and consequences?

The results showed that the prediction using the multi-layer perceptron neural network toolbox in MATLAB software, due to the upward trend of Venezuelan demand, the prediction value of the neural network is close to the

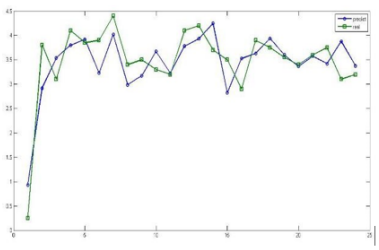

Figure 7: The predicted amount of demand for Kale high-fat milk in 1402

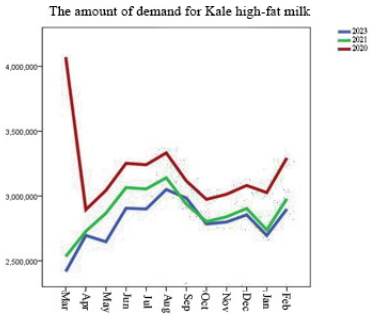

Figure 8: Trend chart of predicted value and Full fat milk product actual value

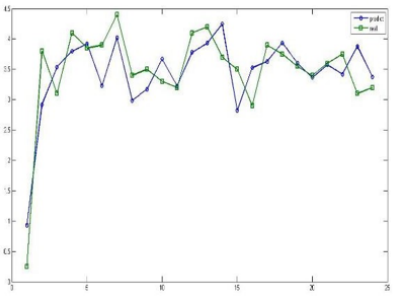

Figure 9: ***Trend of the predicted amount and the actual amount of Labneh cheese product***

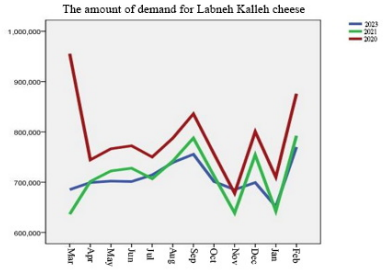

Figure 10: ***The predicted amount of demand for Labneh Kalleh cheese in 2023***

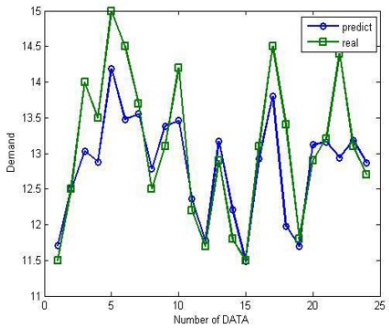

Figure 11: ***The trend of forecast amount and the actual amount of our product***

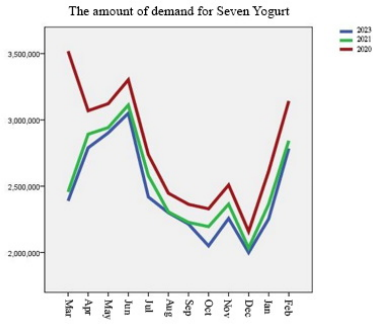

Figure 12: ***The predicted amount of demand for Seven Yogurt in 2023***

actual value. These results follow the findings of [5, 9, 24, 26, 27, 30, 32]. Machine learning and artificial intelligence methods have introduced new approaches to forecasting problems in which the relationships between variables are modelled in a deep and layered hierarchy [25]. These methods, such as artificial neural networks, support vector machines, random forests and deep learning models, such as recurrent neural networks and long short-term memory, have recently attracted researchers' attention in prediction [21].

One of the world's largest and most complex industry sectors is the food supply chain, which plays a vital role in economic growth. Food characteristics, especially shelf life, strongly influence the three sustainability criteria. Much attention is paid to perishable food products with a limited lifespan due to the large amount of waste, harmful environmental effects and unique storage and transportation conditions. One of the problems faced by organizations facing customer demand is the change in demand, which causes uncertainty on the producer's side (production quantity), which also causes uncertainty in purchasing and, in a sense, in the entire supply chain. Companies try to reduce this uncertainty in a way that one of the most common methods is to predict customer demand based on their previous demands. Forecasting is the process of estimating unknown situations. Forecasting provides a prediction about future events and can turn past experiences into predictions of future events [3].

The rapid and inevitable changes in today's world due to the phenomenon of globalization have caused companies to interact more with each other to maintain competitiveness, customer satisfaction and optimal achievement of their goals. in this regard, the concept of a supply chain has been formed. Sustainable supply chain management: managing the flow of materials, information, capital, and coordination between companies in the supply chain, while the three dimensions of economic sustainability, environment, and community are considered from the demands of customers and stakeholders. Integrating environmental thinking in supply chain management includes product design, finding sources and their selection, production process, product delivery to the customer, and end-of-life management of products after their useful life. Supply chain management can be divided into three categories: strategic (long-term, related to company strategy and design issues), tactical (mid-term), and Operational (short-term, related to flow management and scheduling issues). Decisions are made at these levels for procurement, production and distribution of the supply chain [33].

Cost and time are key factors when the manufacturer requests a product. According to the timely distribution policy, the right amount of goods must be delivered at the right time and place, which is vital in efficiently distributing goods. Since logistics costs account for a large portion of total supply chain costs, making decisions related to distribution and inventory planning simultaneously can significantly reduce total supply chain costs, and, on the other hand, it has an essential effect on determining the level of customer service. Among all supply chain processes, distribution refers to the flow of materials and goods from suppliers to the final customers of the chain [4].

Accurate and correct demand forecasting is vital for all organizations, both in the private and public sectors, in theory and practice. Management judgment is typically required to adjust statistical forecasts in response to specific events. Therefore, forecasting methodology is the most relevant and applicable in management. In addition, a key management issue is demand forecasting. Short-term and random data are essential for correct forecasting. Demand forecasting is essential for the supply of goods, production planning, determining the necessary inventory level and establishing the appropriate distribution method. When a service or product reaches a desired market, its current size and potential future volume must be accurately estimated. An overestimation or underestimation of the actual market will cause the supplier to lose most of his profit. With this definition, what is vital for managers is the forecasting model's accuracy. Many models have been proposed and used so far to increase the reliability of management forecasts.

Considering that the results showed that the forecasts made for the following years are consistent with current demands and are close to reality, it is suggested that food industry companies reduce storage costs, eliminate a significant part of additional costs, and reduce corruption. Foods use different demand forecasting methods to always have a better understanding of future demand. Since the success of a supply chain is related to its overall profitability, it is suggested that the demand for both the company's strategic products and other products be forecast. It is also suggested that the factors that predict customer service are considered to be thoroughly studied so that they do not interfere with meeting customers' needs or are affected by the lack of prices.

Conducting any study is faced with limitations; the present study is no exception to this. Moreover, the following are among the most critical limitations of the present study:

· The information was obtained from a single source, and it is prudent to generalize it to other areas.

· Introducing other important intervening variables into the research is impossible due to their incredible complexity.

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