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Using fuzzy logic in the treatment of external factors affecting the changing demand of the BSDC

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Abstract *:- as many external factors like security, weather, competition affect product`s order of Baghdad Company for the production of soft drinks what resulting in a high uncertainty in the estimation of the order, As well as the company depends on personal experience only to estimate the order without the use of scientific reasoning methods of estimation.*

For this reason, the researcher used the techniques and methods of fuzzy logic represented by IF-THEN and trigonometric functions for order forecasting, what will enable the company plan to reduce the gap between the production power and order.

The research reached a number of conclusions, the most important of which is that the difference between the output of the fuzzy processing and the fuzzy input (historical order`s values) Is dependent on the value of the factors witch affecting the orders and the greatest impact of factors affecting the order whether negative or positive is the security factor, the climate factor and then the competitive factor also The researcher recommended that the company rely on modern scientific methods to predict future order and not rely on personal experience.

Research Methodology

First: Research problem

The demand forecasting process is difficult to define in normal circumstances and is becoming more difficult to identify when demand fluctuates. The Baghdad Soft Drinks Company today suffers from operating under these conditions and in a complex dynamic environment with high fog making its work in yesterday different from its work in Today, and today the following, and hence stems from the problem of research core in the company sample research is the uncertainty and high uncertainty in estimating the amount of demand, because of the adoption of the company in determining the amount of demand for personal experience, especially that the nature of the demand for the products of this company are seasonal consumption, Iron research problem by raising the following questions:

1. What factors affect demand for the company's products?
2. The extent to which these factors negatively affect the increase or decrease in demand for the Company's products.
3. Will the application of IF-THEN help estimate future variable demand?

Second: Research Objectives

The search objectives stem from the search problem and can be summarized as follows:

1. Determine the factors affecting the demand for the company's products.
2. Predicting the demand for the company's products after removing the blur in the historical data.

Third: The importance of research

The research derives its importance from the importance of what it can offer the company in terms of benefits, which can be summarized as follows:

1. Helps the company identify the factors affecting the demand for its products.
2. Helps the company cope with the fluctuating demand for its products.

Fourth: Research limits

Baghdad Company for soft drinks / private contribution, located in the Zafaraniya area, one of the industrial sector companies affiliated to the Ministry of Industry and Minerals as a study sample , and the factories belonging to it (plant of dejlah ,

Alfurat and Shatt Al Arab) were selected for a number of reasons,

1. Baghdad Company for Soft Drinks is considered one of the companies subject to international supervision in Iraq, as it has a certificate of excellence from PepsiCo International.
2. Demand for the company's products is fluctuating due to security conditions, seasonality of the product, and competition.

Fifth: Statistical methods and tools used in research

1. To address the blur in the company's data, the IF _ THEN (IFL) 2018 was used.
2. Ensure that the historical data of the company being surveyed is distributed (using Spss software).
3. Predicting the demand for the planning period developed using the trend line equation (Spss).

FUZZY

The only certainty is that his plans will not be what we make, because the only constant in life is continuous change (Sabet, 2012: 37). Where there are many uncertainties in the decision-making environment and the production planning system, including market demand, which takes into account significant progress in describing the reality of demand and the need for production. Production planning models that do not recognize uncertainty are expected to make lower planning decisions Level compared to models that clearly take into account the uncertainty of demand. Mula et al, 2008: 1)

First: Fuzzy logic

In 1965, the Iranian scientist Lutfi Aliaske Zadeh developed the idea of fuzzy logic (or weighted logic or confused logic) as a means of representing and manipulating data that was not accurate, somewhat vague and the basis of this idea is to focus on the conclusion through expressions and words Unspecified language (Mora-Camino and Cosenza 2018: 1)). For example, a person's age is an unspecified linguistic variable that can be expressed in words or phrases, such as a person who is very large, large, average, young or young. Such expressions are called linguistic variables or misty variables. (Mateo, 2016: 56).

Second: the mechanism of implementation of fuzzy logic

After obtaining clear traditional information or data for the purpose of processing, the mechanism of implementation of the fuzzy logic technique as shown in Figure 1 can be summarized in three main steps that require real application:

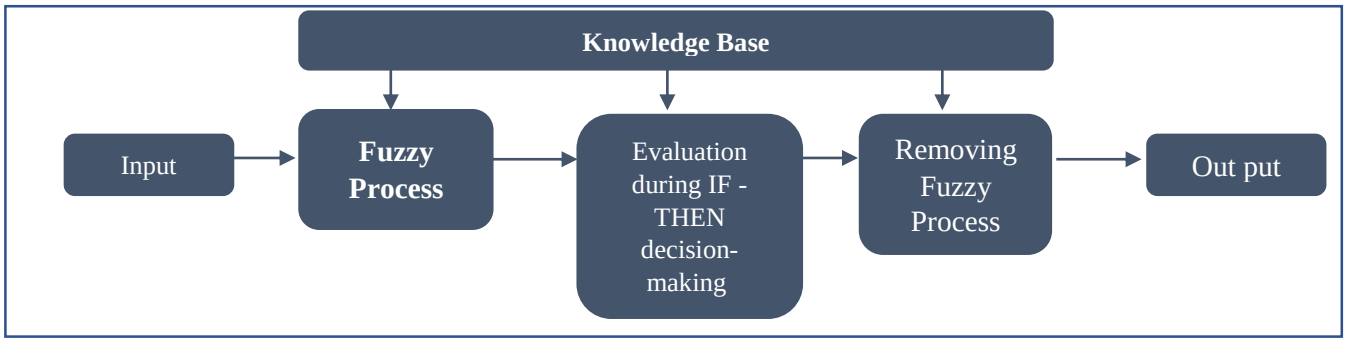


Figure (1) structure of the fuzzy resolution support system

Source: Abd, Khalid Karam(2016), Intelligent Scheduling of Robotic Flexible Assembly Cells, Springer, Switzerland, p.103.

Step 1: Fuzzification

Is the first step to implement the system of fuzzy logic, since most of the variables in the real world are clear or classical variables, so one needs to convert those obvious variables (inputs and outputs) to hazy variables (Bai et al., 2007, 25). Where this process is based on the subsequent step (the process of fuzzy interpretation)

Step 2: Fuzzy Inference (Knowledge Base)

The most important element of the fuzzy logic system is the blurry process or the knowledge base. This process stores both the integer functions and the IF-THEN rules provided by the experts. To create a knowledge base, three steps are developed: linguistic variables, interpolation functions, and ambiguous rules (Abd, 2016: 42). As shown in figure (2) below.

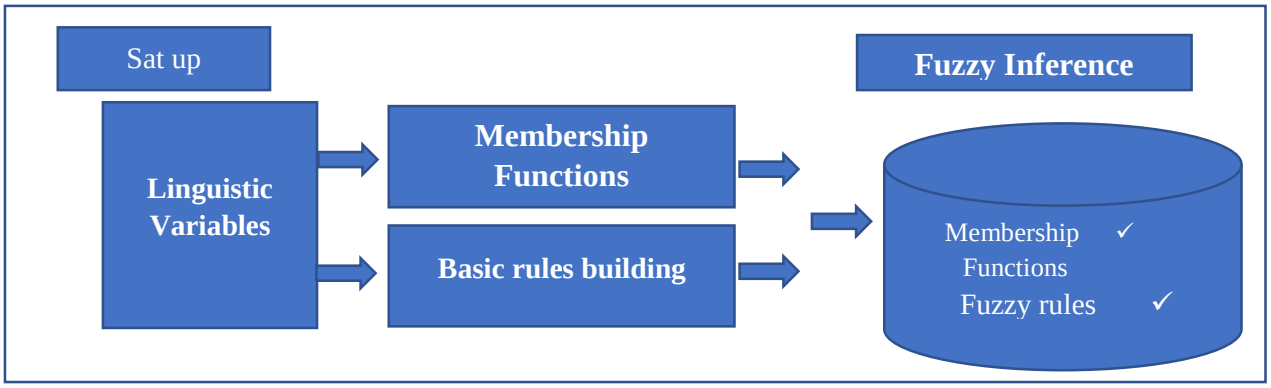


Figure (2) building a knowledge base for the fuzzy logic approach

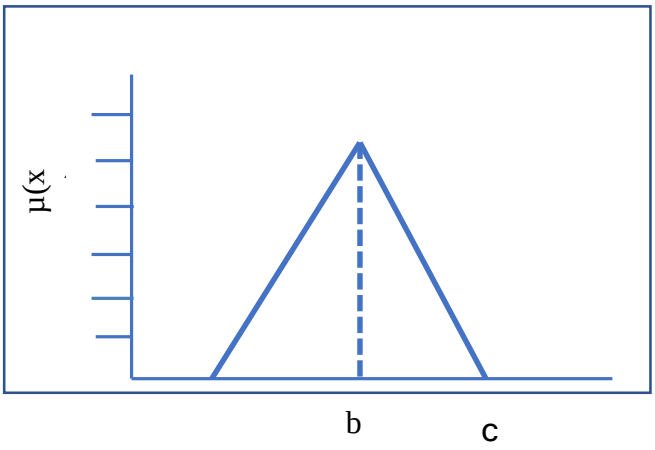
Source: Abd, Khalid Karam (2016), Intelligent Scheduling of Robotic Flexible Assembly Cells, Springer, Switzerland, p.42

1. Linguistic Variables: The linguistic variable is the basic concept on which the fuzzy logic is based. The linguistic variable can be defined as a variable whose values are not a number but words or phrases in a natural language. In general, the linguistic variable consists of a set of words or phrases called linguistic terms Misty Abd, 2016: 42)). Although words are less accurate than numbers, their use is closer to human intuition. In addition, computing uses the words flexibility and tolerance for inaccuracy, thus reducing the cost of the solution (Math, 2017: 4).
2. Membership Functions: The mathematical theory of the blurry groups is far from over, especially with regard to the objective reality of the functions of the intestine in misty groups. In practice, the process of giving objective and appropriate degree of belonging to a blurry group is very important because it will directly affect the correction of the results we obtain from the mathematical model based on the theory of unclear groups (Cao et al., 2016: 184).

There are several types of integer functions to embody the blurry group graphically, and the function used in this research is.

Triangular Membership Function: The fuzzy number in this function is represented by three values (a, b, c) as shown in the formula and figure below (Abd, 2016: 43).

$$\mu_A(x) = \begin{cases} 0, & x < a \\ \frac{x-a}{b-a}, & a \le x \le b \\ \frac{c-x}{c-b}, & b \le x \le c \\ 0, & x > c \end{cases}$$



Source: Abd, Khalid Karam (2016), Intelligent Scheduling of Robotic Flexible Assembly Cells, Springer, Switzerland, p.43.

3. Fuzzy Rules: The ambiguous rule usually assumes the form (R: If x is A, then y is B) where A (and B) are specific linguistic values by vague groups or it is not clear that the letter X (and Y) (IF-THIN) is also called ambiguous or conditional representation, where x is A is called previously or in advance, while y is B is called the result or conclusion. In general, the previous and the result are represented by the form Before we use Fuzzy if-then rules for a system model and analysis, we first have to formalize what is meant by expression (R: If x is A, then y is B) Greeted R: A) shares (B, in essence, the expression describes the relationship between the two variables x) and (y This indicates that it can be blurry rule is defined as a bilateral relationship on the product R X × Y space (Lee, 2006,221)

Step 3: Defuzzification

It is the process of converting a blurry output from the fuzzy inference system to a clear or real output, ie the final product required for each variable is one number (Math, 2017: Glossary-1). Defuzzification takes out the blurry output in the form of different outputs along with the degrees of its membership or membership and converts it into real digital output. This process is the opposite of the process of inhibition that takes inputs with real numbers and turns them into degrees of belonging (Kala, 2016: 288).

Steps and results of the search

The first step is to determine the factors affecting the demand (inputs): The factors affecting part of the uncertainty and fluctuating demand for the products of the company being investigated. Table (1) shows the historical data for the demand for the company's products obtained by the sales department in addition to the values of the factors affecting demand it is determined by the experts in the company, which are three main factors whose values can be limited to 0 as the lowest value and 10 as the highest value. The Matlab user has complete freedom to define these values provided that the input functions are defined as is limited between these two values, so M use the above values of all factors for the purpose of regulatory and standardization of inputs over the three factors.

1. The security factor: The poor security situation in the distribution areas of the company's products negatively affects the amount of demand. This effect is manifested by the difficulty or inability to deliver the company's products to the consuming markets and the general lack of activity in the areas of deteriorating security. , In addition to the customer's distance from the request of the company's products (and all similar products) in times of security crises, and there is a great difference in the impact of this factor, the security situation is significant negative impact only when isolating a large geographical area of the areas consumed so that the delivery of the product to those Taq is impossible as in the period between 2014 and 2017, where the demand for the product stopped in all cities that saw military operations during that period, so the security factor was evaluated to be equal to (2) between 2014 and 2017, Are shown in Table (1) below.
2. Climate: The climate is one of the most influential factors in the demand for the company's products. Its effect is evident by increasing customer consumption of the product during the summer periods. The increase in demand is directly proportional to the high temperature of the climate. In contrast, the decrease in temperature has the opposite effect. Demand decreases as the weather becomes colder, so we notice that the value of this factor increases in the months of the same year.
3. Competitive factor: The existence of the competing product is considered to be a factor affecting the volume of demand as determined by the company's experts.

Table (1) Historical demand and factors affecting the company's products

Historical demand for products						Fuzzy factor			data	
250 RB	750 PET	1750 PET	250 NRB	355 Can	250 Can	competitive	Climate	security	month	year
79786	0	0	72480		763784	4	1	9	1	2012
87253	0	0	117517		886720	4	2	9	2	2012
148422	0	620662	285972		732147	4	8	9	3	2012
142188	0	565202	317633		1009082	4	9	9	4	2012
148970	375241	328374	204791		926335	4	10	9	5	2012
162967	324076	636285	398868		924025	4	10	9	6	2012
195856	383527	491233	440200		1332834	4	10	9	7	2012
147152	302667	859131	252947		1171271	4	10	9	8	2012

109197	452265	729809	401310		1024608	4	8	9	9	2012
140091	453632	559097	302958		1154726	4	5	9	10	2012
69150	284036	326968	166983		729992	4	3	9	11	2012
20854	205788	155675	122415		622680	4	2	9	12	2012
79786	274367	387087	37887		989823	5	1	9	1	2013
87253	415617	487775	211867		956971	5	2	9	2	2013
148422	395445	748438	316244		1070429	5	8	9	3	2013
142187	392765	540974	405742		850626	5	9	9	4	2013
148970	600503	760814	158268		569863	5	10	9	5	2013
162967	593020	742540	512600		422877	5	10	2	6	2013
195856	1096800	544670	200892		1185245	5	10	2	7	2013
147152	631631	788669	297276		1447273	5	10	2	8	2013
109197	850622	617706	229436		1187995	5	8	2	9	2013
140091	389645	1049286	175630		985104	5	5	2	10	2013
69150	816782	355264	181076		1174031	5	3	2	11	2013
20854	0	0	0		0	5	2	2	12	2013
44692	405763	348922	57499	0	821422	6	1	2	1	2014
64253	646856	501435	121826	0	884390	6	2	2	2	2014
84800	665224	542342	245518	56488	644226	6	8	2	3	2014
135078	427451	408710	166360	26541	656182	6	9	2	4	2014
153450	694110	788082	380381	9304	1455047	6	10	2	5	2014
148150	658320	688868	134736	1840	855684	6	10	2	6	2014
117358	478804	730375	228222	34	739270	6	10	2	7	2014
182839	867110	720410	280973	521	1147068	6	10	2	8	2014
226750	827230	790442	221243	0	1358442	6	8	2	9	2014
136403	615763	734408	320678	0	1323984	6	5	2	10	2014
125403	695286	522248	69229	0	861216	6	3	2	11	2014
53089	431870	211624	35129	0	345205	6	2	2	12	2014
80000	527572	530337	140256	0	848949	7	1	2	1	2015
100653	719112	483854	154090	0	952104	7	2	2	2	2015
134300	645320	496679	241127	437791	1095755	7	8	2	3	2015
173650	633721	882390	250152	366927	956528	7	9	2	4	2015
162753	815920	737770	245778	341058	1140832	7	10	2	5	2015
150750	1045820	914489	237704	320161	1183385	7	10	2	6	2015
152100	1084090	935057	203412	348593	1104244	7	10	2	7	2015
195300	1306756	1221788	285758	637851	1355976	7	10	2	8	2015
230005	1434440	1233518	169165	505559	1373538	7	8	2	9	2015
164908	971434	849677	134086	547708	1155034	7	5	2	10	2015
116773	462061	491369	58023	244196	710743	7	3	2	11	2015
64700	505074	449044	28501	227776	722468	7	2	2	12	2015
100650	742704	598003	103464	347980	990238	8	1	2	1	2016
96500	819231	712900	51727	304134	976455	8	2	2	2	2016
147000	833958	836409	88125	349906	1076308	8	8	2	3	2016
170500	965395	788990	119564	402374	1216306	8	9	2	4	2016
229603	991309	971859	128858	378582	1520960	8	10	2	5	2016

188132	**1162129**	**894091**	**227780**	**280153**	**1299219**	**8**	**10**	**2**	**6**	**2016**
208138	**1577551**	**922045**	**204990**	**579908**	**1797168**	**8**	**10**	**2**	**7**	**2016**
291191	**1926118**	**1054210**	**209163**	**483530**	**1762881**	**8**	**10**	**2**	**8**	**2016**
238389	**1633568**	**1224001**	**196049**	**428804**	**1685863**	**8**	**8**	**2**	**9**	**2016**
171724	**1551754**	**919549**	**233762**	**580773**	**1633208**	**8**	**5**	**2**	**10**	**2016**
174811	**586539**	**627236**	**135014**	**261826**	**982611**	**8**	**3**	**2**	**11**	**2016**
143152	**306261**	**323970**	**42861**	**124045**	**638104**	**8**	**2**	**2**	**12**	**2016**
93248	**1016714**	**650194**	**129431**	**294084**	**1123612**	**9**	**1**	**2**	**1**	**2017**
138801	**844554**	**651536**	**177956**	**262876**	**1595428**	**9**	**2**	**2**	**2**	**2017**
126357	**1100267**	**934188**	**132748**	**393833**	**1666079**	**9**	**8**	**7**	**3**	**2017**
64108	**870990**	**639200**	**100247**	**230524**	**1201494**	**9**	**9**	**7**	**4**	**2017**
270101	**1368389**	**1131936**	**163216**	**457963**	**1718277**	**9**	**10**	**7**	**5**	**2017**
159150	**1057996**	**921704**	**169598**	**255377**	**1399827**	**9**	**10**	**7**	**6**	**2017**
294950	**1823103**	**1704369**	**1366121**	**573686**	**1925739**	**9**	**10**	**9**	**7**	**2017**
291800	**1632551**	**1334869**	**204232**	**459936**	**2007632**	**9**	**10**	**9**	**8**	**2017**
226651	**1459766**	**884028**	**208458**	**412957**	**1280118**	**9**	**8**	**9**	**9**	**2017**
154050	**1684451**	**1510249**	**192665**	**398832**	**1629351**	**9**	**5**	**9**	**10**	**2017**
122550	**954533**	**589790**	**130064**	**257411**	**947757**	**9**	**3**	**9**	**11**	**2017**
185500	**1055369**	**686489**	**137018**	**206508**	**1108721**	**9**	**2**	**9**	**12**	**2017**

Source: based on the sales department and experts in the company

The second step is the process of conversion. The process of converting the digital values of the factors affecting the demand into ambiguous language variables through the use of fuzzifiers or otherwise known membership functions, and then use the blurry laws to obtain the outputs as shown in Figure (4) below Indication of the process of inhibition of each factor.

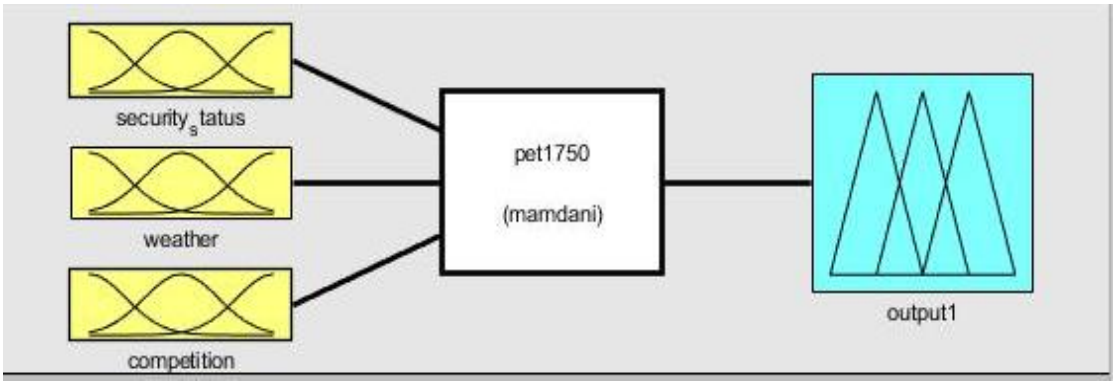


Figure (4) to illustrate the mist treatment process

The security factor: Three functions were defined as belonging to this factor (bad, medium, and good) as shown in Figure (5). The vertical axis represents the degree of intestine. The horizontal axis represents the security factor between 10 and 0, (7.5) and (2.5), and (good) the higher the (5) and the higher the degree of belonging to being (good) when the value is greater or equal (7.5).

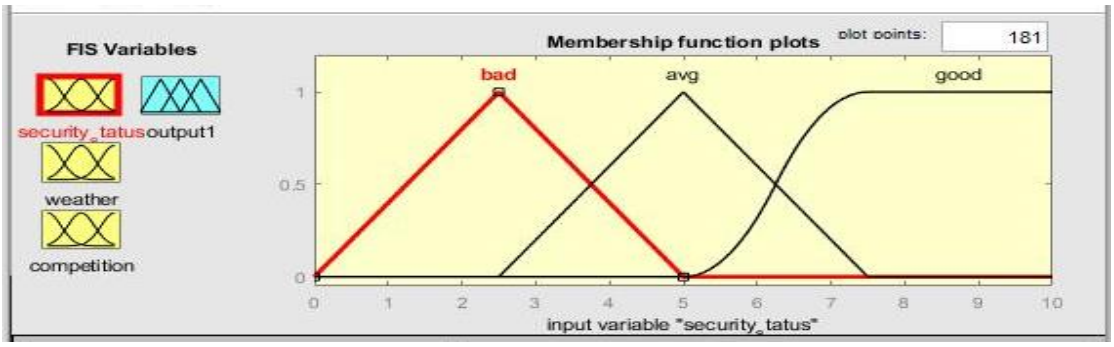


Figure (5) security functions of the security factor

Climate factor: Three functions were known to belong to this factor (cool, mild, hot) as shown in Figure 6 below. The vertical axis represents the degree of intestine. The horizontal axis represents the degree of the climate factor, which is confined to (10, 0) (4) and be moderate if it is confined to (9, 1), which is in the most moderate degrees when it is equal to (5) and tends to be hot whenever it rises from (5) to be at the top The degrees of intimacy for being hot for any value greater than or equal to (7.5).

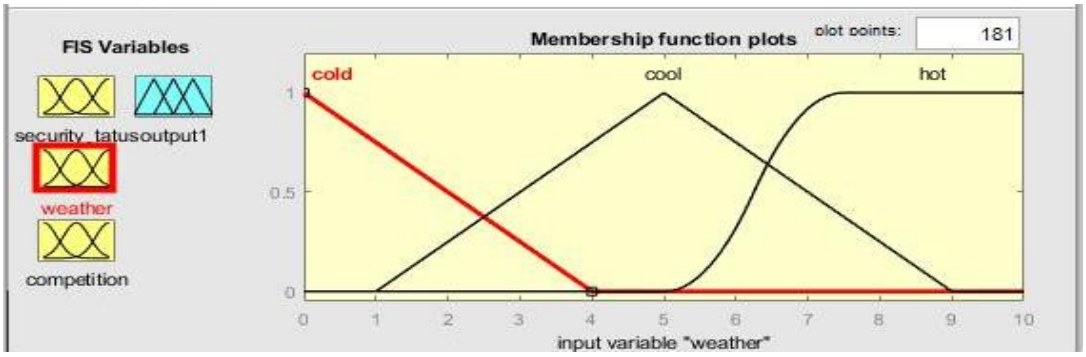


Figure (6) the function of the integration of the climate factor

Factor of the competition: Three functions have been identified as belonging to this factor (low, medium, high) as in Figure (7). The vertical axis represents the degree of intimacy. The horizontal axis represents the degree of the factor of competition, which is as little as (4) (8, 2) becomes the closest to be medium when the value is (5) and becomes high at (6.5) and is in the highest degrees of belonging to being high when the value is greater or equal (8.5).

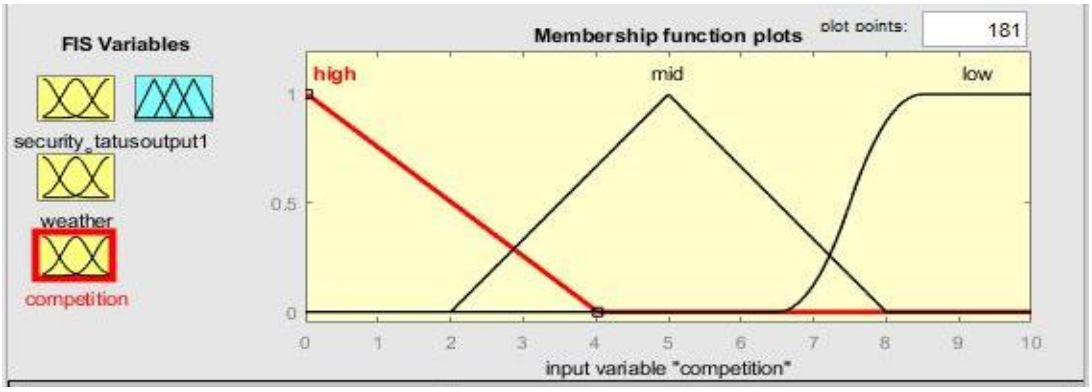


Figure (7) the function of the affiliation factor of the competition

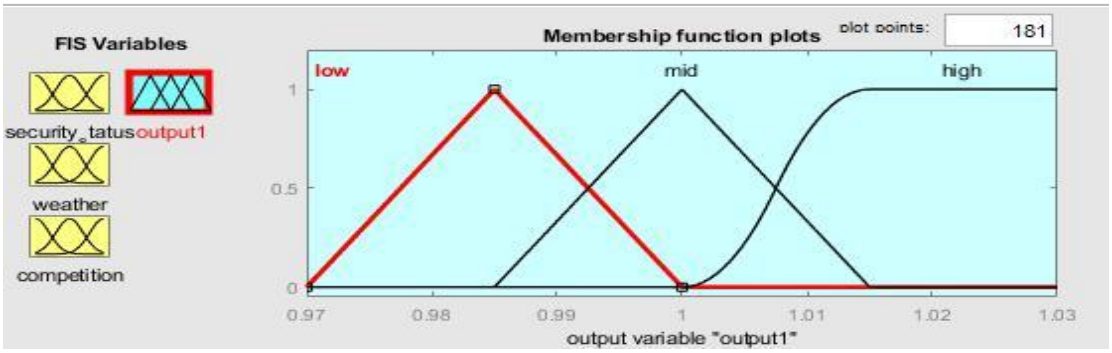
The third step is the rules of ambiguity (IF - Then): It consists of (24) laws developed by experts in the company. These laws represent the relationship between the three factors mentioned and the effect of this relationship on the outputs, for example when the security factor is bad and the atmosphere is moderate The average degree of competition is the output of the fuzzy process (small) as shown in Table (2) below.

Table (2) the relationship between inputs and outputs according to fog rules

Out put	Competition factor	Climate factor	security	Sequence
Few	Average	cold	Bad	1
Few	Few	cold	Bad	2
Few	high	cold	Bad	3
Few	high	warm	Bad	4
Few	Average	warm	Bad	5
Few	Few	warm	Bad	6
Average	high	hot	Bad	7
Average	Average	hot	Bad	8
Average	Few	hot	Bad	9
Few	high	cold	Average	10
Few	Average	cold	Average	11
Few	Few	cold	Average	12
Few	high	warm	Average	13
Average	Average	warm	Average	14
Average	Few	warm	Average	15
Few	high	cold	good	16
Few	Average	cold	good	17
Average	Few	cold	good	18
Average	high	warm	good	19
Average	Average	warm	good	20
Average	Few	warm	good	21
High	Few	hot	good	22
High	Average	hot	good	23
High	high	hot	good	24

Source: The table of the researcher's numbers based on the company's experts.

Step 4: Elimination of Boundary and Output: The resulting output value is limited to (1.03, 0`.97) as determined by the company's experts. There are three functions of (low, medium, high). The output value is limited to (1, 0.97) If the function of intonation is small, the value is limited between (1.015 and 0.985) when the function of the integer is mean, and the value of the values that are more than (1), where the degree of belonging to being high for any value greater than or equal to (1.015) Shown in Figure 8 below



The blurry effect of these factors is 0.03% as an increase or decrease according to the factors applied for each historical reading. In contrast to the fuzzy effect on the demand recorded on that date, this value is multiplied by the demand reading. For example, the values of the factors the uncertainty affecting demand for the month (12 of 2015) is:

Security Status = 2

Climate Factor = 2

Competition Factor = 7

(0.985). since the demand for this month is (505074), the resulting demand will be 497498 = 505074 * 0.985

Because the historical data include information on six types of production lines per month during the years from 2012 to 2017, where it will require 408 data entry process, so the researcher developed the code as shown in Figure 9 below to automatically enter Factor values on the fog machine and multiplying the output of the blur process in the amount of demand for each historical reading without any manual intervention and without the need to change any value within the fog machine.

anwarcode.m | Untitled.m

```
% read fuzzy machine file
fuzzyMachien =readfis('pet1750.fis');
%initialize output array to zero
for i=1:408
final(i)=0;
end
%loop over all th input data
for i=1:408
%run the fuzzy machine and pass (security state weather competition) as parameters
fuzzy_output =evalfis([security_status(i) weather(i) competition(i)],fuzzyMachien);

temp =(orders(i)* fuzzy_output(1));
%round the fraction to the nearest whole number
final(i)=round(temp);
end
mat=vec2mat(final,1);
filename = 'output_excell_file.xls';
xlswrite(filename,mat);
```

Figure 9: A programmatic code for automatic extraction of outputs

Figure (10) illustrates the application of fuzzy inference using fuzzy inference rules. The first column represents the distribution of the functions of the security factor on the bases. The second column represents the distribution of the functions of the climate factor on the bases. The third column represents the distribution of the functions of belonging to the competition factor on the bases. The security factor is equal to 9, the value of the affiliation function is (good) and is located in the bases (16 to 24) and the value of the climate factor is equal to (8) 23, 24) and are within the function of belonging (moderate) and are simple in the rules (4, 5,6,13,14,1 5, 19, 20, 21) and the value of the factor of competition is equal to (5). It is within the function of the average affiliation and is located in the bases (1, 5, 8, 11, 14, 17, 20, 23) where we note that when the data of these rules are merged The value of the outputs is equal to (1.02) and is within the function of belonging (average) very little and is located in base (20) and is within the function of belonging (high) significantly and located in the rule number (23).

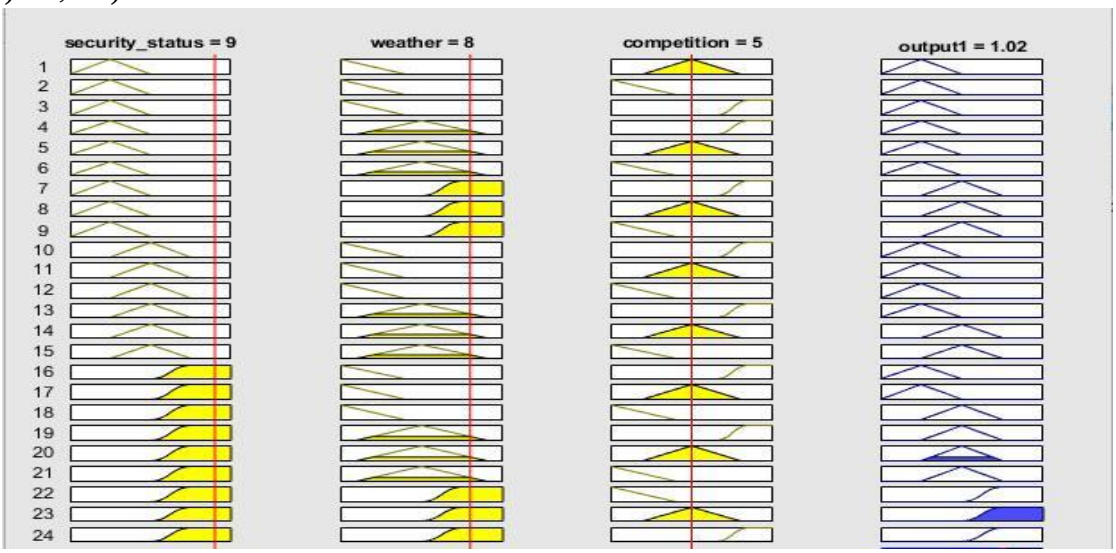


Figure (10) Application of fuzzy inference

Figure (11) shows the relationship between the factors affecting the demand and the results of the fog process after applying the fog rules mentioned in Table (2). The horizontal axes represent the values of the influencing factors and are limited between 0 and 10. The vertical axis represents the value of the outputs, (1.003, and 0.997).

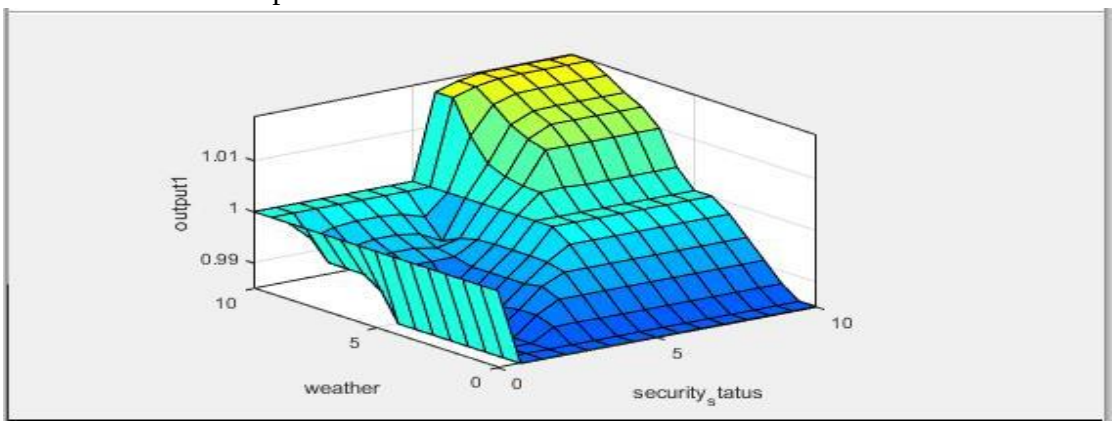


Figure (11) the relationship between the factors affecting the demand and the results of the fuzzy process

Table (3) below shows the results of the blurry process for the historical data resulting from the implementation of the previous steps. When comparing this table with Table 1 we note that the difference between the output of the fog process and the fog input (the amount of historical demand) the value of factors affecting the blurry of demand.

Demand after fuzzy treatment						Fuzzy factor			date	
250 RB	750 PET	1750 PET	250 NRB	355 Can	250 Can	Computation	climate	security	month	year
78602	0	0	71405		752453	4	1	9	1	2012
86394	0	0	116360		877991	4	2	9	2	2012
150402	0	628943	289787		741915	4	8	9	3	2012
144741	0	575352	323337		1027203	4	9	9	4	2012
151645	381980	334271	208469		942970	4	10	9	5	2012
165894	329896	647711	406031		940619	4	10	9	6	2012
199373	390414	500055	448105		1356769	4	10	9	7	2012
149795	308102	874559	257489		1192305	4	10	9	8	2012
110654	458299	739546	406664		1038278	4	8	9	9	2012
140091	453632	559097	302958		1154726	4	5	9	10	2012
68793	282571	325282	166122		726228	4	3	9	11	2012
20649	203762	154143	121210		616550	4	2	9	12	2012
78589	270251	381281	37319		974976	5	1	9	1	2013
86394	411526	482973	209781		947551	5	2	9	2	2013
150659	401404	759717	321010		1086560	5	8	9	3	2013
144845	400107	551087	413327		866527	5	9	9	4	2013
151755	611729	775036	161227		580516	5	10	9	5	2013
162967	593020	742540	512600		422877	5	10	2	6	2013
195856	1096800	544670	200892		1185245	5	10	2	7	2013
147152	631631	788669	297276		1447273	5	10	2	8	2013
108732	846999	615075	228459		1182935	5	8	2	9	2013

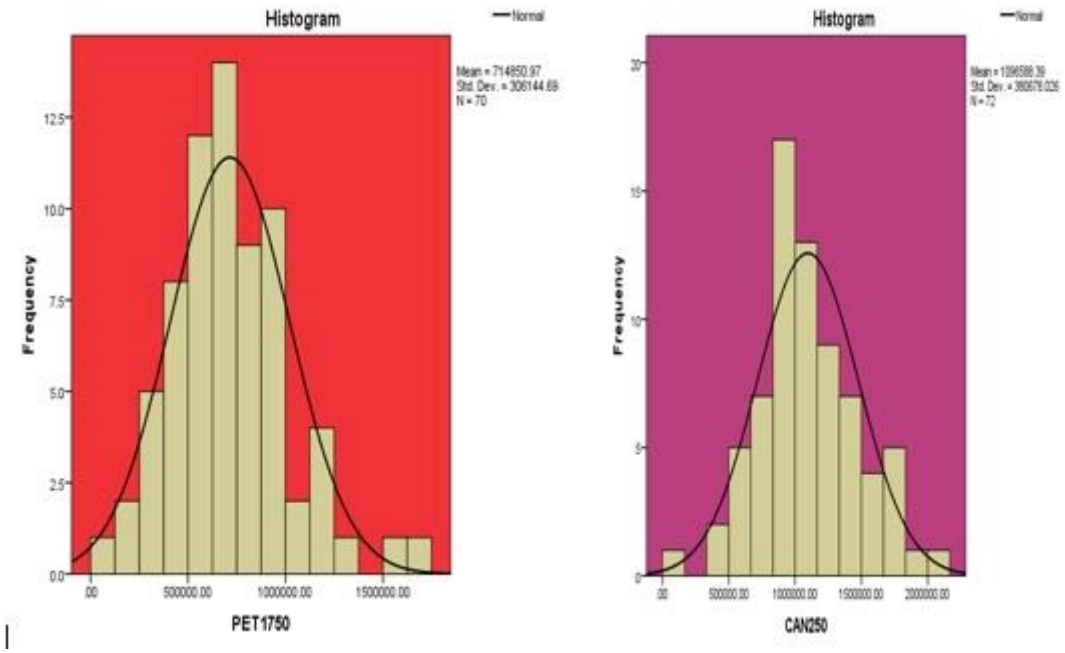
137990	383800	1033547	172996		970327	5	5	2	10	2013
68113	804530	349935	178360		1156421	5	3	2	11	2013
20541	0	0	0		0	5	2	2	12	2013
44022	399677	343688	56637	0	809101	6	1	2	1	2014
63289	637153	493913	119999	0	871124	6	2	2	2	2014
84416	662213	539887	244407	56232	641310	6	8	2	3	2014
135078	427451	408710	166360	26541	656182	6	9	2	4	2014
153450	694110	788082	380381	9304	1455047	6	10	2	5	2014
148150	658320	688868	134736	1840	855684	6	10	2	6	2014
117358	478804	730375	228222	34	739270	6	10	2	7	2014
182839	867110	720410	280973	521	1147068	6	10	2	8	2014
225724	823485	786864	220241	0	1352293	6	8	2	9	2014
134357	606527	723392	315868	0	1304124	6	5	2	10	2014
123522	684857	514414	68191	0	848298	6	3	2	11	2014
52293	425392	208450	34602	0	340027	6	2	2	12	2014
78800	519658	522382	138152	0	836215	7	1	2	1	2015
99143	708325	476596	151779	0	937822	7	2	2	2	2015
133440	641189	493500	239584	434989	1088741	7	8	2	3	2015
173650	633721	882390	250152	366927	956528	7	9	2	4	2015
162753	815920	737770	245778	341058	1140832	7	10	2	5	2015
150750	1045820	914489	237704	320161	1183385	7	10	2	6	2015
152100	1084090	935057	203412	348593	1104244	7	10	2	7	2015
195300	1306756	1221788	285758	637851	1355976	7	10	2	8	2015
228533	1425258	1225622	168082	502323	1364746	7	8	2	9	2015
162434	956862	836932	132075	539492	1137708	7	5	2	10	2015
115021	455130	483998	57153	240533	700082	7	3	2	11	2015
63729	497498	442308	28073	224359	711631	7	2	2	12	2015
99140	731563	589033	101912	342760	975384	8	1	2	1	2016
95053	806943	702207	50951	299572	961808	8	2	2	2	2016
146374	830406	832846	87750	348416	1071723	8	8	2	3	2016
170500	965395	788990	119564	402374	1216306	8	9	2	4	2016
229603	991309	971859	128858	378582	1520960	8	10	2	5	2016
188132	1162129	894091	227780	280153	1299219	8	10	2	6	2016
208138	1577551	922045	204990	579908	1797168	8	10	2	7	2016
291191	1926118	1054210	209163	483530	1762881	8	10	2	8	2016
237374	1626610	1218787	195214	426978	1678682	8	8	2	9	2016
169148	1528478	905756	230256	572061	1608710	8	5	2	10	2016
172189	577741	617827	132989	257899	967872	8	3	2	11	2016
141005	301667	319110	42218	122184	628532	8	2	2	12	2016
91849	1001463	640441	127490	289673	1106758	9	1	2	1	2017
136719	831886	641763	175287	258933	1571497	9	2	2	2	2017
127743	1112332	944432	134204	398152	1684349	9	8	7	3	2017
65294	887106	651027	102102	234789	1223725	9	9	7	4	2017
275099	1393709	1152880	166236	466437	1750071	9	10	7	5	2017
162095	1077572	938758	172736	260102	1425728	9	10	7	6	2017
300464	1857184	1736230	1391659	584410	1961738	9	10	9	7	2017
297255	1663070	1359823	208050	468534	2045162	9	10	9	8	2017

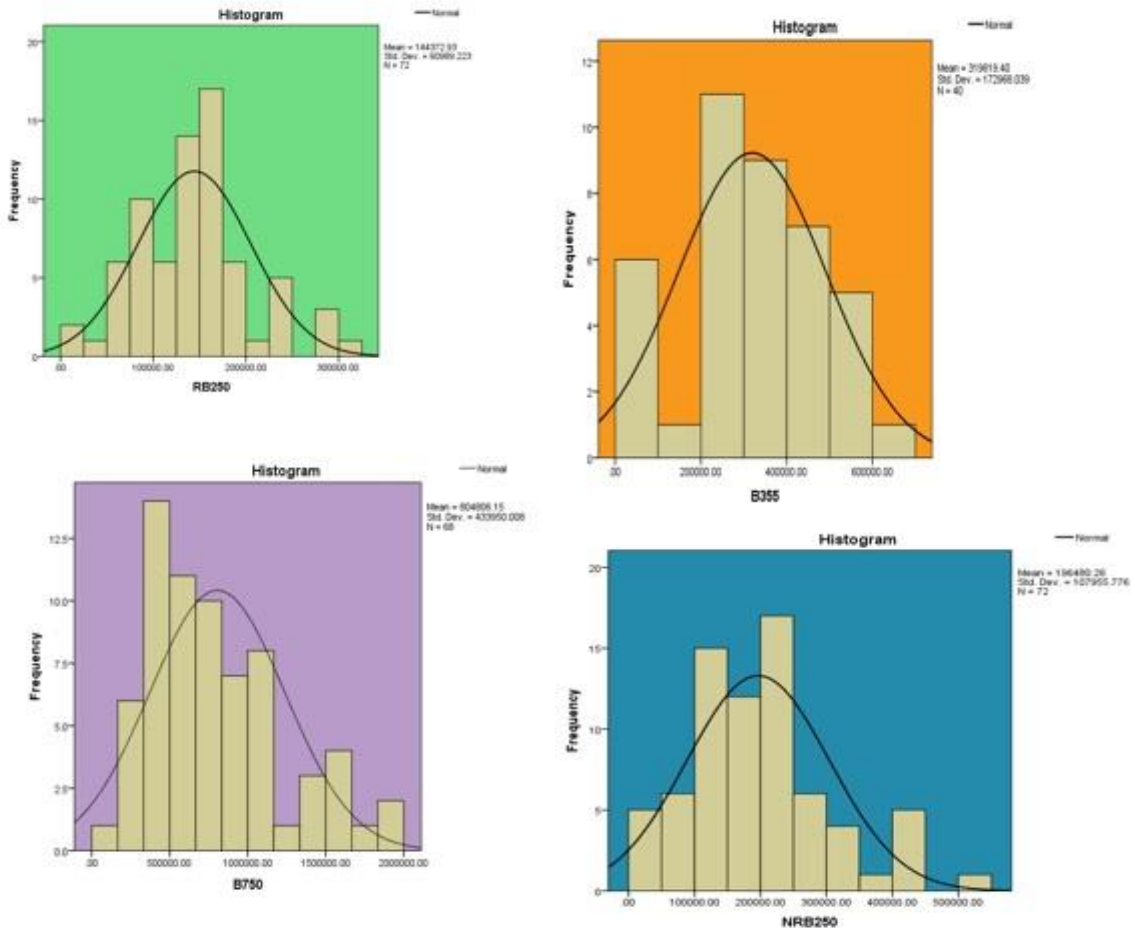
230067	1481765	897350	211599	419180	1299410	9	8	9	9	2017
154050	1684451	1510249	192665	398832	1629351	9	5	9	10	2017
121918	949611	586749	129393	256084	942870	9	3	9	11	2017
183674	1044980	679731	135669	204475	1097807	9	2	9	12	2017

Step 5: Results of the normal distribution test of the data after mist treatment: Table (4) shows the results of the normal distribution test of the data after treatment of the blur of the products (PET 1750, 250 CAN, 250 NRB, 250 RB, 335 CAN, 750 PET) For the simple linear regression method known in this field at the level of each of the studied production lines that are included in the hypothesis test models, it is clear from the natural distribution drawings and the table of the data of the processed production lines that the data for these products met the normal distribution condition (p> .05) to ensure your EMC The use of Linear Regression Models and their acquisition of a scientific characteristic in line with the nature of linear regression equation according to literature.

Table (4) Results of the normal distribution test of production lines

Kolmogorov-Smirnov			Parameter & Type / Product lines
Significant test	value significant	Test Count	
Not significant	.200	.09	PET 1750
Not significant	.200	.081	250 CAN
Not significant	.200	.088	250 NRB
Not significant	.197	.093	250 RB
Not significant	.200	.091	355 CAN
Not significant	.072	.103	750 PET





Step 7 Determination of the demand: After the data were prepared for the forecasting process, the demand for the production line products (PET 1750, 250 CAN, 250 NRB, 250 RB, 335 CAN and 750 PET) was estimated according to the equation $y = \alpha + \beta x$ In the table (5), after the subject of digestion logic and treatment, the significance of the model by its parameters for all production line data, as well as the significance of the beta coefficient and the maximum determinants at the level of (0.05). After adjusting the estimation functions based on these data, The apparent disparity in demand levels from month to month, a natural result of the variation and fluctuation of demand levels during This was followed by the use of the simple linear regression model to express the expected correlation between demand as a response variable (time) and time as an explanatory variable (independent), after verifying the distribution of data in a natural

Table (5) Estimation of demand for production lines

Significant	test-f	R^2	Significant	T-test	R	β	α	product line
.000[b]	22.199	.246	.000	4.712	.496[a]	7462.8	449920	PET1750
.000[b]	23.276	.250	.000	4.825	.500[a]	9086.421	764934	CAN250
.011[b]	6.794	.088	.011	-2.607	.297[a]	-1534.3	252482.7	NRB250
.000[b]	13.414	.161	.000	3.663	.401[a]	1168.638	101717.641	RB250
.014[b]	6.617	.385[a]	.014	2.572	.148	5697.8	202812.7	CAN335
.000[b]	67.266	.505	.000	8.2	.710[a]	15591.5	266898.4	PET750

Table (6) demand forecasting

Forecasting						date	
250 RB	750 PET	1750 PET	250 NRB	355 CAN	250 CAN	month	year
187028	1342712	979779	140479	436422	1428243	1	2018
188197	1358303	987242	138944	442120	1437329	2	2018
189365	1373895	994704	137410	447818	1446416	3	2018
190534	1389486	1002167	135876	453516	1455502	4	2018
191703	1405078	1009630	134342	459214	1464588	5	2018
192871	1420669	1017093	132807	464912	1473675	6	2018
194040	1436261	1024556	131273	470609	1482761	7	2018
195209	1451852	1032018	129739	476307	1491848	8	2018
196377	1467444	1039481	128204	482005	1500934	9	2018
197546	1483035	1046944	126670	487703	1510021	10	2018
198715	1498627	1054407	125136	493400	1519107	11	2018
199883	1514218	1061870	123602	499098	1528193	12	2018
201052	1529810	1069332	122067	504796	1537280	1	2019
202221	1545401	1076795	120533	510494	1546366	2	2019
203389	1560993	1084258	118999	516192	1555453	3	2019
204558	1576584	1091721	117464	521890	1564539	4	2019
205726	1592176	1099184	115930	527587	1573625	5	2019
206895	1607767	1106646	114396	533285	1582712	6	2019
208064	1623359	1114109	112861	538983	1591798	7	2019
209232	1638950	1121572	111327	544681	1600885	8	2019
210401	1654542	1129035	109793	550378	1609971	9	2019
211570	1670133	1136498	108259	556076	1619058	10	2019
212738	1685725	1143960	106724	561774	1628144	11	2019
213907	1701316	1151423	105190	567472	1637230	12	2019

Conclusions

1. Lack of knowledge of the senior management of the company methods and tools used for planning and forecasting demand, including prediction of fuzzy demand.
2. When comparing Table (3) to Table (1), we note that the difference between the output of the fog process and the fog input (the amount of historical demand) is dependent on the value of the factors affecting the fog of demand.
3. The greatest impact on the factors affecting the demand, whether negative or positive on the products of the company being investigated, the security factor and then the climate factor and then the factor of competition.

Recommendations

1. Because there are many factors that affect negatively or positively in the demand for the company's products, the researcher recommends that the company should rely on statistical methods and tools when predicting future demand, including fuzzy and distancing from the use of historical data, and personal estimates, and discretion.
2. Provide simple courses for the decision makers in the company on the above tools, with the offer that there are many statistical programs ready to be used for the prediction process.

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