Journal of Multidisciplinary Engineering Science Studies (JMESS)
ISSN: 2458-925X
Vol. 9 Issue 1, January - 2023

Application of a Q-type inventory model in Candle Cake Company

Carolina Rojas López[1]
University of Guanajuato, Multidisciplinary Studies Department
Yuriria, Guanajuato
c.rojaslopez@ugto.mx

Dr. Roberto Baeza Serrato[2]
University of Guanajuato, Multidisciplinary Studies Department
Yuriria, Guanajuato
r.baeza@ugto.mx

Abstract- This research was developed with the aim of designing and developing a type Q inventory system within a company dedicated to the sale of raw materials and baking utensils, starting from the problem of not having a good inventory policy. Therefore, research will be conducted on the different products available and 5 selected to study their demand and behavior.

Ninety days were taken into account and the demand for each of them was recorded using the Microsoft Excel application.

Keywords- Inventory, inventory policy, Model Q, Level of security.

I. INTRODUCTION

The inventory is the documentary record of the goods and other things belonging to a person or community made with order and precision, but in the business world it is the ordered relation of goods and stocks, at a finished date [1]. In addition, inventories are a very important tool that we must take into account for the company, whether small, medium or large, because this way we have a better control over the products that are kept in stock or on the contrary, the same ones that are missing to have a better demand and have to offer to customers.

Inventory is the set of goods or items that the company has to market, allowing the purchase and sale or manufacture for subsequent sale, in a given economic period. Its fundamental objective is to provide the company with the necessary materials for its continuous and regular development. It plays an essential role in the operation of the production process that allows the company to meet demand [2]. That is why a company must have a good inventory policy with the following objectives: Define the optimal level of inventory, maintain adequate levels through inventory tracking, Maximize the profit on the inventory investment and maintain a good level of service that allows the company to improve its profitability [2]. In turn, inventories in an organization are of high importance, whether it is an SME or a large company. To have control in a sophisticated way, implies to have a greater supervision of the stock, to reduce costs and to accelerate the fulfillment of the demand [3].

SMEs are small and medium-sized enterprises, with no more than 250 workers in total. These companies are very flexible and agile in their procedures and decisions [4]. Likewise, a company is classified as an SME if it has most of the following particularities: they do not express exchangeable securities, the owners do not have a wide range of diversified investor list, they have a complete management team to run the company and they face eminent market values [4].

This research is oriented to measure the importance of inventory control and demand within the company Candle Cake, which is dedicated to offer raw material products for confectionery. In addition, a Q-type inventory model was designed and developed to generate inventory policies and improve efficiency within the company, as well as to determine how much and when to order product.

II. LITERATURE REVIEW

The following is a review of the state of the art, highlighting some of the applications of inventory systems:

[5] developed an inventory policy that fits the needs of the company, with the objective is the optimal inventory management of the products (beer, rum and gin) sold by the company to be able to adequately meet the demands of customers with the least possible expense. [6] proposes research to improve the management of maintenance inventories in the weaving area of a textile company, in order to prioritize the most important inventories and know how much to buy and when to buy them. [7] proposed a methodological approach to improve inventory management in a beverage company, which is Just in Time is a tool that mainly ensures that things are in the right place, at the right time and with the right quantities, as well as quality control, qualified personnel and reduced inventories. [8] implemented formats for better inventory control in the warehouse area. [9] proposed the application of an inventory control system with independent demand, with the objective of covering the demand and market requirements, avoiding losses, therefore, the ABC classification method will be used, which will determine the majority, medium and low category, which will allow to know exactly the order of storage and strict control according to its level of output to

cover the demand and avoid stock ruptures. [10] worked on the implementation of an inventory system through the accounting software that would allow better control over the raw materials acquired by the company for the production of its products. [11] proposed the implementation of the computerized inventory system, in order to organize and control the inputs and outputs of medicines, which was determined that the software to be used is Microsoft Excel, since it is a spreadsheet program designed to record, analyze numbers and data. [12] proposed the design of a suitable inventory management system in the Nuestra Señora de Regla pharmacy, as well as an application in Microsoft Excel developed as part of the research and the IBM SPSS Statictics software. [13] Developed a web-based system to improve the inventory management of IT assets and support services. [14] presented a proposal for the application of the continuous inventory control (s,Q) policy, taking into account the analysis of the policies used for spare parts and validated by means of a case applied to a sugar mill.

III. METHODOLOGY

Table 1 below shows the methodology where a series of activities are applied, which are conformed as follows.

Table 1 Methodology

Activities performed	
Activity	**Description**
Identify the case study	Analyze the company in which this research will be carried out for the application of inventory systems.
Theoretical framework	A theoretical framework was integrated to support the research.
State of the art	Different applications of inventory systems were reviewed to integrate the model.
Methodology	The steps for the implementation of a Q-type inventory system were identified.
Company information	The 90-day sales record was taken in order to continue with the process.
Obtaining the quantities sold for 90 days	The demand for the 5 products was analyzed.
Delivery time	The days of delivery of the products were determined.
Daily standard deviation and delivery time	Time it takes for products to arrive.
Product price	The price of the products, which are intended for sale, was analyzed.
Reorder point	Define product units when decreasing.
Initial inventory	Quantity of product in the company.
Iterations	Realization of graphs with security level.
Conclusions	General conclusions.

IV. RESULTS

In this section, each of the activities mentioned in **Error! Reference source not found.** was developed for the application of the Q-type inventory model.

To apply this tool, the first step was to analyze the company's products, of which three were considered. See Diagram 1.

Flours Creams Cartons

Diagram 1 Products analyzed

Table 2 below shows the demand for the 3 products taking into account 90 days from August to October.

Table 2 Product demand

DAYS	DATE	Flours	Creams	Cartons
1	Monday August 2, 2021	53	64	26
2	Tuesday 3 August 2021	60	45	10
3	Wednesday August 4, 2021	34	87	23
4	Thursday, August 5, 2021	21	19	13
5	Friday 6 August 2021	50	20	30
6	Saturday 7 August 2021	50	6	21
7	Sunday 8 August 2021	78	20	15
8	Monday, August 9, 2021	54	32	15
9	Tuesday, August 10, 2021	66	42	42
10	Wednesday, August 11, 2021	89	32	16
11	Thursday, August 12, 2021	78	73	4
12	Friday, August 13, 2021	55	61	23
13	Saturday, August 14, 2021	15	12	19
14	Sunday, August 15, 2021	32	10	42
15	Monday, August 16, 2021	90	73	13
16	Tuesday, August 17, 2021	93	56	15
17	Wednesday, August 18, 2021	36	53	20
18	Thursday, August 19, 2021	20	22	11
19	Friday, August 20, 2021	18	14	14
20	Saturday, August 21, 2021	100	15	15
21	Sunday, August 22, 2021	69	74	35
22	Monday, August 23, 2021	46	38	62
23	Tuesday, August 24, 2021	120	25	17
24	Wednesday, August 25, 2021	58	62	23
25	Thursday, August 26, 2021	43	85	15
26	Friday, August 27, 2021	58	22	23
27	Saturday, August 28, 2021	64	42	22
28	Sunday, August 29, 2021	18	64	10
29	Monday, August 30, 2021	64	36	13
30	Tuesday, August 31, 2021	58	16	23

DAYS	DATE	Flours	Creams	Cartons
31	Wednesday September 1, 2021	89	45	20
32	Thursday, September 2, 2021	75	26	24
33	Friday, September 3, 2021	25	74	13
34	Saturday, September 4, 2021	43	24	16
35	Sunday, September 5, 2021	44	43	60
36	Monday, September 6, 2021	19	34	12
37	Tuesday, September 7, 2021	140	34	14
38	Wednesday September 8, 2021	320	26	6
39	Thursday, September 9, 2021	64	44	22
40	Friday, September 10, 2021	27	62	21
41	Saturday, September 11, 2021	59	58	14
42	Sunday, September 12, 2021	52	28	23
43	Monday, September 13, 2021	59	46	11
44	Tuesday, September 14, 2021	46	40	21
45	Wednesday September 15, 2021	16	63	26
46	Thursday, September 16, 2021	89	24	42
47	Friday, September 17, 2021	20	23	11
48	Saturday, September 18, 2021	68	20	14
49	Sunday, September 19, 2021	50	12	24
50	Monday, September 20, 2021	66	15	10
51	Tuesday, September 21, 2021	49	23	6
52	Wednesday September 22,2021	23	23	22
53	Thursday, September 23, 2021	13	56	21
54	Friday, September 24, 2021	79	53	10
55	Saturday, September 25, 2021	55	24	22
56	Sunday, September 26, 2021	39	20	13
57	Monday, September 27, 2021	60	64	22
58	Tuesday, September 28, 2021	20	45	10
59	Wednesday September 29, 2021	90	15	20
60	Thursday, September 30, 2021	69	22	9
61	Friday, October 1, 2021	52	53	5
62	Saturday, October 2, 2021	56	24	19
63	Sunday, October 3, 2021	21	25	20
64	Monday, October 4, 2021	64	26	14
65	Tuesday, October 5, 2021	27	25	22
66	Wednesday, October 6, 2021	97	27	25
67	Thursday, October 7, 2021	49	52	5
68	Friday, October 8, 2021	30	73	11
69	Saturday, October 9, 2021	88	52	26
70	Sunday, October 10, 2021	30	67	4
71	Monday, October 11, 2021	51	77	35
72	Tuesday, October 12, 2021	69	15	19
73	Wednesday, October 13, 2021	55	62	21
74	Thursday, October 14, 2021	98	47	22
75	Friday, October 15, 2021	50	14	15
76	Saturday, October 16, 2021	82	26	21
77	Sunday, October 17, 2021	40	10	5
78	Monday, October 18, 2021	85	5	22
79	Tuesday, October 19, 2021	23	63	14
80	Wednesday, October 20, 2021	97	38	22
81	Thursday, October 21, 2021	66	52	32
82	Friday, October 22, 2021	43	20	10
83	Saturday, October 23, 2021	140	22	15
84	Sunday, October 24, 2021	61	10	11
85	Monday, October 25, 2021	20	16	9
86	Tuesday, October 26, 2021	90	18	21
87	Wednesday, October 27, 2021	66	11	26
88	Thursday, October 28, 2021	20	20	24
89	Friday, October 29, 2021	32	20	5
90	saturday, october 30, 2021	67	53	50

Subsequently, Table 3 shows the most important parameters taken into account to obtain the performance of the products. Where the demand (**D**) was determined, which was obtained by adding the 90 days analyzed by 4, which are the weeks of the month, resulting in 21,308.00 of product 1. Then the demand (**d**) was obtained, in which the average of the 90 days was obtained, resulting in 59.19.

Next, we have the delivery time (**L**) which is the time it takes the suppliers to supply the company, then we analyze the daily standard deviation, the deviation in delivery time and the price of the product (**P**) which is also added manually.

To obtain the cost (**H**) and the cost (**S**) we took as a reference the price of the product for 5% and 3% in which for (H) we obtained 2.72 and for (S) 1.65. Subsequently we have the economic quantity per order (Q) where the following formula was used:

(1)

$$Q = \frac{\sqrt{2 * D * S}}{H} = 159.90$$

Next, we can analyze the reorder point (**R**) which was obtained with the following formula:

(2)

$$= d * L = 887.83$$

Finally, there is the initial inventory, which data was recorded manually because it is the amount of product that the company has.

Table 3 Parameters for behaviors

Concept	Flour	Creams	Cartons
Annual demand **D**	21,308.00	13,316.00	6,956.00
Daily demand **d**	59.19	36.99	19.32
Delivery time **L**	15	8	15
Daily deviation	38.92	20.90	10.79
Delivery time deviation	150.72	59.11	41.79
Product price **P**	55	62	20
Cost **H** (5% price)	2.75	3.10	1.00
Cost **S** (3%)	1.65	1.86	0.60
Quantity Q	159.90	126.41	91.36
Reorder point R	887.83	295.91	289.83
Initial inventory	1400	350	330

Safety inventory	Reorder	P-1	P-2	P-3
1.28155157	R 90%	1080.993517	371.668999	343.387408
1.64485363	R 95%	1135.751746	393.145307	358.569244
2.32634787	R 99%	1238.469075	433.43129	387.047843

We can analyze in Table 3 the reordering of the different confidence levels in which 90%, 95% and 99% were applied, which was obtained with the following formula:

(3)

$$= R\ (1.28155157 * 150.72)$$

Once we have the corresponding parameters for the 3 products, we can observe in **Error! Reference source not found.** the behavior of product 1, where the corresponding reorder levels were applied. Likewise, the following formula was used for the first day of the product (flours):

(4)

$$= \$1400\$ - \$53\$ < 0{,}0\$1400\$ - \$53\$$$

These quantities were fixed, because it is the inventory with which the company currently started and the quantities that were sold on the first day, therefore the company has a quantity of 1347 flour products.

Subsequently, the results of the second day were obtained with the following formula:

(5)

$$= SI(1347 - 60 < 0{,}0, 1347 - 60)$$

We are going to use the above formula until day 15, because these are the days that the order of this product is placed. In the same way we can observe that the quantity of products is decreasing, therefore on day 16 the product arrives again, for this was obtained in the following way:

(6)

$$= SI(1347 < \$887.83\$, SI(1347 + \$159.90\$ - 93 < 0{,}0, 1347 + 159.90 - 93), SI(575 - 93 < 0{,}0{,}575 - 93))$$

In Table 4 it can be seen that there are days marked with a color, which represent the days on which suppliers arrive at the company to drop off merchandise.

Table 4 Behavior of product 1 with reorder

DAYS	PRODUCT 1 FLOURS	INITIAL PRODUCT 1	PRODUCT 1 REORDER R 90%	PRODUCT 1 REORDER R 95%	PRODUCT 1 REORDER R 99%
1	53	1347	1347	1347	1347
2	60	1287	1287	1287	1287
3	34	1253	1253	1253	1253
4	21	1232	1232	1232	1232
5	50	1182	1182	1182	1182
6	50	1132	1132	1132	1132
7	78	1054	1054	1054	1054
8	54	1000	1000	1000	1000
9	66	934	934	934	934
10	89	845	845	845	845
11	78	767	767	767	767
12	55	712	712	712	712
13	15	697	697	697	697
14	32	665	665	665	665
15	90	575	575	575	575
16	93	482	482	482	482
17	36	446	446	446	446
18	20	426	426	426	426
19	18	408	408	408	1373.90497
20	100	308	308	308	1241.90497
21	69	239	239	1222.90497	1222.90497
22	46	193	1167.90497	1167.90497	1167.90497
23	120	73	1039.90497	1039.90497	1039.90497
24	58	15	1035.90497	1035.90497	1035.90497
25	43	961.904972	961.904972	961.904972	961.904972
26	58	868.904972	868.904972	868.904972	868.904972
27	64	807.904972	807.904972	807.904972	807.904972
28	18	838.904972	838.904972	838.904972	838.904972
29	64	760.904972	760.904972	760.904972	760.904972
30	58	676.904972	676.904972	676.904972	676.904972
31	89	552.904972	552.904972	552.904972	552.904972
32	75	530.904972	530.904972	530.904972	530.904972
33	25	560.904972	560.904972	560.904972	560.904972
34	43	524.904972	524.904972	524.904972	517.904972
35	44	423.904972	423.904972	423.904972	473.904972
36	19	379.904972	379.904972	404.904972	1363.80994
37	140	212.904972	239.904972	264.904972	1187.80994
38	320	0	879.809944	879.809944	879.809944
39	64	110.904972	1131.80994	1131.80994	1131.80994
40	27	83.9049718	1094.80994	1094.80994	1094.80994
41	59	969.809944	969.809944	969.809944	969.809944
42	52	915.809944	915.809944	915.809944	915.809944
43	59	939.809944	939.809944	939.809944	939.809944
44	46	874.809944	874.809944	874.809944	874.809944
45	16	820.809944	820.809944	820.809944	820.809944
46	89	623.809944	623.809944	623.809944	623.809944

DAYS	PRODUCT 1 FLOURS	INITIAL PRODUCT 1	PRODUCT 1 REORDER R 90%	PRODUCT 1 REORDER R 95%	PRODUCT 1 REORDER R 99%
47	20	670.809944	670.809944	670.809944	670.809944
48	68	652.809944	652.809944	652.809944	652.809944
49	50	634.809944	634.809944	634.809944	627.809944
50	66	517.809944	517.809944	517.809944	567.809944
51	49	490.809944	490.809944	515.809944	518.809944
52	23	349.809944	376.809944	401.809944	1324.71492
53	13	146.904972	1026.71492	1026.71492	1026.71492
54	79	191.809944	947.714915	1212.71492	1212.71492
55	55	188.809944	892.714915	1199.71492	1199.71492
56	39	149.809944	1090.71492	1090.71492	1090.71492
57	60	89.8099436	1015.71492	1015.71492	1015.71492
58	20	69.8099436	1079.71492	1079.71492	1079.71492
59	90	944.714915	944.714915	944.714915	944.714915
60	69	911.714915	911.714915	911.714915	911.714915
61	52	731.714915	731.714915	731.714915	731.714915
62	56	774.714915	774.714915	774.714915	774.714915
63	21	791.714915	791.714915	791.714915	791.714915
64	64	730.714915	730.714915	730.714915	723.714915
65	27	650.714915	650.714915	650.714915	700.714915
66	97	553.714915	553.714915	578.714915	581.714915
67	49	460.714915	487.714915	512.714915	532.714915
68	30	276.809944	1156.61989	1156.61989	1156.61989
69	88	263.714915	1019.61989	1068.61989	1284.61989
70	30	318.714915	1022.61989	1038.61989	1329.61989
71	51	258.714915	971.619887	1199.61989	1199.61989
72	69	180.714915	1106.61989	1106.61989	1106.61989
73	55	174.714915	1184.61989	1184.61989	1184.61989
74	98	76.7149153	1006.61989	1006.61989	1006.61989
75	50	26.7149153	1021.61989	1021.61989	1021.61989
76	82	809.619887	809.619887	809.619887	809.619887
77	40	894.619887	894.619887	894.619887	894.619887
78	85	866.619887	866.619887	866.619887	866.619887
79	23	867.619887	867.619887	867.619887	860.619887
80	97	713.619887	713.619887	713.619887	763.619887
81	66	647.619887	647.619887	672.619887	675.619887
82	43	577.619887	604.619887	629.619887	649.619887
83	140	296.714915	464.619887	489.619887	1176.52486
84	61	362.619887	1118.52486	1167.52486	1115.52486
85	20	458.619887	1162.52486	1178.52486	1095.52486
86	90	328.619887	1041.52486	1088.52486	1269.52486
87	66	274.619887	975.524859	1200.52486	1200.52486
88	20	314.619887	955.524859	1180.52486	1324.52486
89	32	204.619887	1134.52486	1134.52486	1134.52486
90	67	119.619887	1114.52486	1114.52486	1114.52486

Tabla 5 shows the behavior of the second product (Creams), where the same formula was used as the previous one, only considering the corresponding data for each product. The day the order arrives at the company was also marked.

Tabla 5 Product behavior 2 with reorden

DAYS	PRODUCT 2 CREAMS	INITIAL PRODUCT 2	Product 2 Reorder R 90%	Product 2 Reorder R 95%	Product 2 Reorder R 99%
1	64	286	286	286	286
2	45	241	241	241	241
3	87	154	154	154	154
4	19	135	135	135	135
5	20	115	115	115	115
6	6	109	109	109	109
7	20	89	89	89	89
8	32	57	57	57	57
9	42	370.40886	370.40886	370.40886	370.4088
10	32	335.40886	335.40886	335.40886	335.4088
11	73	207.40886	207.40886	207.40886	207.40886
12	61	200.40886	200.40886	200.40886	200.4088
13	12	229.40886	229.40886	229.40886	229.4088
14	10	225.40886	225.40886	225.40886	225.40886
15	73	142.40886	142.40886	142.40886	142.40886
16	56	127.40886	127.40886	127.40886	127.40886
17	53	74.408860	443.817721	443.817721	443.81772
18	22	52.408860	439.817721	439.817721	439.81772
19	14	319.817721	319.817721	319.817721	319.81772
20	15	311.817721	311.817721	311.817721	311.81772
21	74	281.817721	281.817721	281.817721	281.81772
22	38	313.817721	313.817721	313.817721	313.81772
23	25	243.817721	243.817721	243.817721	243.81772
24	62	191.817721	191.817721	191.817721	191.81772
25	43	961.904972	961.904972	961.904972	961.90497
26	22	156.817721	84.8177209	84.8177209	84.817720
27	42	114.817721	404.226581	404.226581	404.22658
28	64	50.8177209	374.226581	374.226581	374.22658
29	36	372.226581	372.226581	372.226581	372.22658
30	16	356.22658	424.226581	424.226581	424.22658
31	45	325.226581	325.226581	325.226581	325.22658
32	26	292.226581	292.226581	292.226581	292.22658
33	74	168.226581	159.226581	159.226581	159.22658
34	24	259.226581	187.226581	187.226581	187.22658
35	43	198.226581	144.226581	144.226581	487.63544
36	34	143.226581	110.226581	466.635442	466.63544
37	34	109.226581	76.2265813	464.635442	464.63544
38	26	83.226581	50.2265813	438.635442	524.63544
39	44	39.226581	407.635442	407.635442	407.63544
40	62	356.63544	356.635442	356.635442	356.63544
41	58	236.63544	227.635442	227.635442	227.63544
42	28	357.63544	285.635442	285.635442	285.63544
43	46	278.63544	224.635442	224.635442	239.63544
44	40	229.63544	196.635442	184.635442	199.63544

DAYS	PRODUCT 2 CREAMS	INITIAL PRODUCT 2	Product 2 Reorder R 90%	Product 2 Reorder R 95%	Product 2 Reorder R 99%
45	63	172.635442	139.635442	121.635442	136.63544
46	24	185.635442	152.635442	97.6354418	112.63544
47	23	142.635442	129.635442	74.6354418	511.04430
48	20	122.635442	463.044302	463.044302	463.04430
49	12	351.044302	342.044302	342.044302	342.04430
50	15	336.04430	397.044302	397.044302	397.04430
51	23	382.044302	328.044302	328.044302	343.04430
52	23	333.044302	300.044302	288.044302	303.0443
53	56	243.044302	210.044302	192.044302	207.04430
54	53	259.044302	226.044302	171.044302	186.04430
55	24	245.044302	232.044302	177.044302	162.04430
56	20	229.044302	212.044302	157.044302	142.04430
57	64	165.044302	404.453163	404.453163	404.45316
58	45	120.044302	359.453163	359.453163	478.45316
59	15	105.044302	439.453163	439.453163	454.45316
60	22	83.044302	404.453163	392.453163	407.45316
61	53	316.453163	283.453163	265.453163	280.45316
62	24	361.453163	328.453163	273.453163	288.45316
63	25	346.453163	333.453163	278.453163	263.45316
64	26	329.45316	312.453163	257.453163	242.45316
65	25	266.45316	287.453163	232.453163	505.86202
66	27	219.453163	458.862023	458.862023	478.86202
67	52	179.453163	406.862023	406.862023	426.86202
68	73	136.453163	333.86202	445.862023	460.86202
69	52	84.4531627	357.862023	339.86202	354.86202
70	67	17.4531627	387.862023	332.862023	347.86202
71	77	0	382.862023	327.862023	312.86202
72	15	0	423.862023	368.86202	353.86202
73	62	330.86202	351.862023	296.862023	291.86202
74	47	298.86202	304.862023	249.862023	244.86202
75	14	291.86202	290.862023	235.862023	539.27088
76	26	236.86202	434.270884	209.862023	513.27088
77	10	200.86202	474.270884	456.270884	471.27088
78	5	138.86202	469.270884	454.270884	469.27088
79	63	63.408860	406.270884	391.270884	376.27088
80	38	88.408860	368.270884	457.270884	442.27088
81	52	36.408860	426.270884	371.270884	366.27088
82	20	16.408860	411.270884	356.270884	351.27088
83	22	396.27088	395.270884	340.270884	329.27088
84	10	353.27088	385.270884	326.270884	319.27088
85	16	311.270884	369.270884	310.270884	303.27088
86	18	247.27088	351.270884	292.270884	285.27088
87	11	178.817721	340.270884	506.679744	491.67974
88	20	194.817721	474.679744	486.679744	471.67974
89	20	142.817721	454.679744	477.679744	472.67974
90	53	89.8177209	401.679744	429.679744	424.67974

Table 6 shows the behavior of the third product (cartons), where the same formula was used, only considering the corresponding data for each product. The day the order arrives at the company was also marked.

Table 6 Product behavior 3 witch reorder

DAYS	PRODUCT 3 CARTONS	INITIAL PRODUCT 3	PRODUCT 3 REORDER R 90%	PRODUCT 3 REORDER R 95%	PRODUCT 3 REORDER R 99%.
1	26	304	304	304	304
2	10	294	294	294	294
3	23	271	271	271	271
4	13	258	258	258	258
5	30	228	228	228	228
6	21	207	207	207	207
7	15	192	192	192	192
8	15	177	177	177	177
9	42	135	135	135	135
10	16	119	119	119	119
11	4	115	115	115	115
12	23	92	92	92	92
13	19	73	73	73	73
14	42	31	31	31	31
15	13	18	18	18	18
16	15	3	380.363012	380.363012	380.363012
17	20	0	365.363012	365.363012	365.363012
18	11	351.363012	351.363012	351.363012	351.363012
19	14	335.36301	335.363012	335.363012	335.363012
20	15	304.36301	304.363012	304.363012	304.363012
21	35	263.36301	263.363012	263.363012	263.363012
22	62	221.363012	221.363012	221.363012	221.363012
23	17	251.363012	251.363012	251.363012	251.363012
24	23	203.36301	203.363012	203.363012	203.363012
25	15	195.363012	195.363012	195.363012	195.363012
26	23	183.363012	183.363012	183.363012	183.363012
27	22	161.363012	161.363012	161.363012	161.363012
28	10	154.363012	154.363012	154.363012	154.363012
29	13	109.363012	109.363012	109.363012	109.363012
30	23	86.363012	86.3630122	86.3630122	86.3630122
31	20	74.3630122	66.3630122	66.3630122	451.726024
32	24	67.3630122	42.3630122	42.3630122	432.726024
33	13	54.3630122	29.3630122	429.726024	429.726024
34	16	38.363012	410.726024	410.726024	410.726024
35	60	0	335.726024	335.726024	335.726024
36	12	342.726024	342.726024	342.726024	342.726024
37	14	298.726024	298.726024	298.726024	298.726024
38	6	336.726024	336.726024	336.726024	336.726024
39	22	272.726024	272.726024	272.726024	272.726024
40	21	265.726024	265.726024	265.726024	265.726024
41	14	260.726024	260.726024	260.726024	260.726024
42	23	229.72602	229.726024	229.726024	229.726024

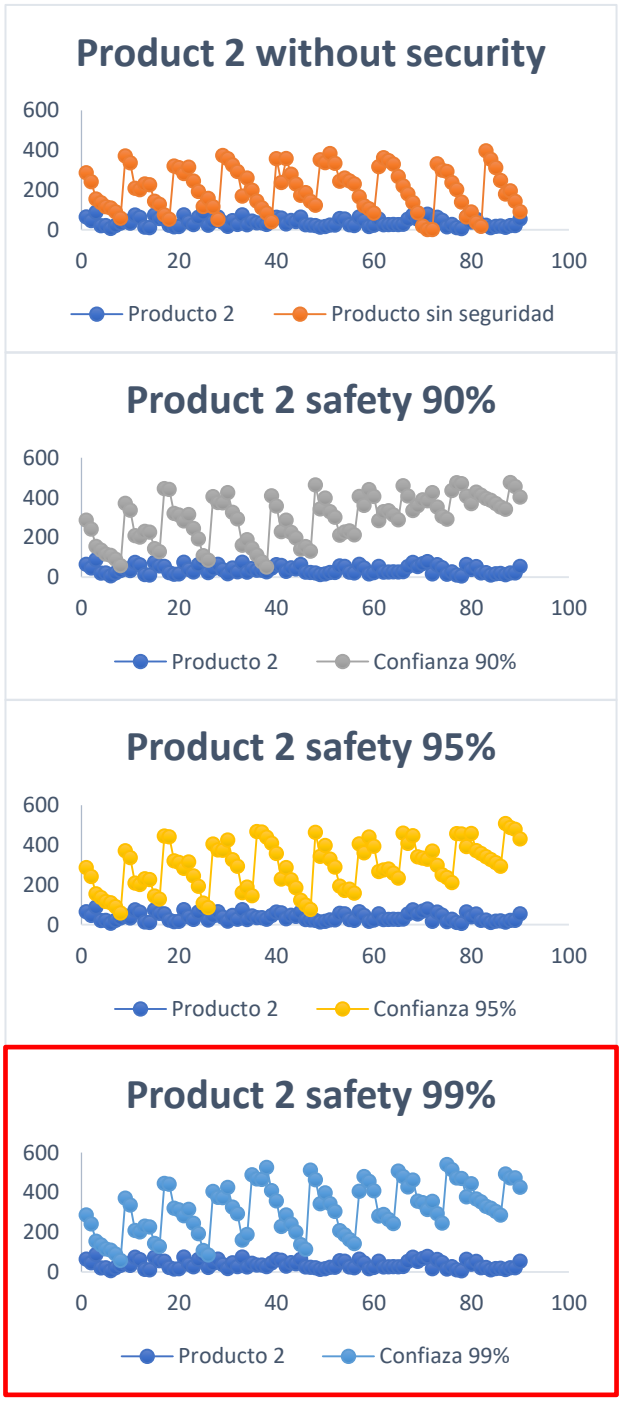
DAYS	PRODUCT 3 CARTONS	INITIAL PRODUCT 3	PRODUCT 3 REORDER R 90%	PRODUCT 3 REORDER R 95%	PRODUCT 3 REORDER R 99%.
43	11	234.72602	234.726024	234.726024	234.726024
44	21	179.726024	179.726024	179.726024	179.726024
45	26	151.726024	151.726024	151.726024	151.726024
46	42	123.726024	115.726024	115.726024	109.726024
47	11	147.726024	122.726024	122.726024	98.7260244
48	14	131.726024	106.726024	108.726024	84.7260244
49	24	105.726024	82.7260244	84.7260244	60.7260244
50	10	81.3630122	417.089037	417.089037	417.089037
51	6	75.3630122	428.089037	428.089037	428.089037
52	22	53.363012	368.08903	368.08903	368.08903
53	21	32.363012	407.089037	407.089037	407.089037
54	10	354.08903	354.089037	354.089037	354.089037
55	22	335.08903	335.08903	335.08903	335.08903
56	13	339.08903	339.08903	339.08903	339.08903
57	22	299.08903	299.08903	299.08903	299.08903
58	10	316.08903	316.089037	316.089037	316.089037
59	20	251.08903	251.089037	251.089037	251.089037
60	9	234.08903	234.089037	234.089037	234.089037
61	5	210.08903	202.089037	202.089037	196.089037
62	19	220.08903	195.089037	195.089037	171.089037
63	20	203.08903	178.089037	180.089037	156.089037
64	14	183.08903	160.089037	162.089037	138.089037
65	22	150.726024	138.089037	140.089037	116.089037
66	25	141.726024	113.089037	115.089037	91.0890366
67	5	139.726024	108.089037	110.089037	454.452049
68	11	112.726024	97.089036	99.089036	443.452049
69	26	86.726024	71.0890366	419.452049	419.452049
70	4	82.726024	422.452049	422.452049	422.452049
71	35	47.726024	395.452049	395.452049	395.452049
72	19	28.726024	371.452049	371.452049	371.452049
73	21	7.7260244	386.452049	386.452049	386.452049
74	22	320.45204	320.452049	320.452049	320.452049
75	15	310.452049	310.452049	310.452049	310.452049
76	21	280.45204	272.452049	272.452049	266.452049
77	5	306.45204	281.452049	281.452049	257.452049
78	22	272.45204	247.452049	249.452049	225.452049
79	14	260.45204	237.452049	239.452049	215.452049
80	22	220.08903	207.452049	209.452049	185.452049
81	32	201.08903	172.452049	174.452049	150.452049
82	10	221.089037	189.452049	191.452049	140.452049
83	15	189.089037	173.452049	175.452049	125.452049
84	11	167.089037	151.452049	164.452049	114.452049
85	9	165.089037	142.452049	155.452049	105.452049
86	21	118.089037	121.452049	134.452049	84.4520488
87	26	94.089036	95.4520488	108.452049	436.815061
88	24	75.089036	71.4520488	84.4520488	453.815061
89	5	70.089036	406.815061	406.815061	406.815061
90	50	20.089036	351.815061	351.815061	351.815061

Subsequently, a series of graphs were made, where we can analyze the demand behavior of each of the products by applying the corresponding confidence level.

To make the graphs, the data for the corresponding product were taken; in this case, for the first graph, 90 days and product 1 without security were considered. For the second graph we took the data for 90 days and the 90% confidence level, for the third graph, 90 days and the 95% confidence level, and for the last graph, 90 days and the 99% confidence level. See Graph 1

Graph 1 Product behavior 1 with confidence level

Subsequently, the graphs of product 2 were made, where we can analyze the behavior by applying the corresponding confidence level. Taking into account the same procedure. See Graph 2



Graph 2 Product behavior 2 with confidence level

Next, the graphs of product 3 were made, where we can analyze the behavior by applying the corresponding confidence level. Taking into account the same procedure. See Graph 3

Graph 3 Product behavior 3 with confidence level

V. CONCLUSIONS

This research work was developed in the company Candle Cake, with the purpose of implementing a Q-type inventory model and thus, provide the company with an important tool to have a better control and organization within the company.

Once the behavior of the company's products was developed and compared, the following conclusions were reached:

This research was carried out thanks to the support of the owners of Candle Cake, a company located in Uriangato, Gto. which provided us with very

important information about the demand for the products we worked with to analyze the demand.

The Q-type inventory model was developed using Microsoft Excel, since it is easier to manipulate the numerical data and make graphs to analyze the behavior of the demand.

A simulator was also carried out where some random data were recorded in order to see how the data behave in the face of different product demands.

It was possible to analyze in the development of the research, the importance of making an inventory system. This in order to have a better control in the database that the company uses.

When observing and analyzing the 5 products, a series of graphs were made where we applied a confidence level of 90%, 95% and 99% in order to see how they behave.

From the graphs we can see that most of the products work best at 90% and 99% confidence level at which a good demand is obtained.

With the graphs that were made, it was possible to study the behavior of the products and to see how much investment the owners of the company make.

VI. REFERENCIAS

[1] J. L. Montes, Gestión de inventarios, España: ELEARNING S.L, 2014.

[2] Y. Duran, "Inventory management: key element for the optimization of profits in companies," *VisionGerencial*, pp. 55-78, 2012.

[3] C. Zapata, «Importance of inventory management in Manufacturing company,» *BILO*, pp. 37-42, 2021.

[4] J. E. M. H. y. R. A. Rivera, «SMEs as a tool in the economy of Mexico and in the creation of jobs,» *Journal Contributions to Social Sciences*, pp. 22-66, 2017.

[5] L. Aitor, Product inventory management in the food sector, Spain: Mathematics Section, 2019.

[6] C. Cárdenas, «Procedure for the management of inventories of medicamenros in the pharmacy Nuestra Señora de Regla,» *Central University*, pp. 1-75, 2017.

[7] P. Csplinter, "Web system for the inventory control process in the company RX TECOMPANY," pp. 1-103, 2018.

[8] P. L. Chumpitaz, Proposal of a maintenance inventory policy for the weaving area of a textile company, Lima-Peru, 2011.

[9] A. Paredes, V. Chud and C. Osorio, «Fuzzy multicriteria inventory control system for spare parts,» *Scientia et Technica*, pp. 595-603, 2019.

[10] N. Pech, «Implementation of a computerized inventory system of the health center of Nicolás Bravo,» *Secretariat of public education*, pp. 1-67, 2014.

[11] A. Pilataxi, "Application of an inventory system with independent demand for the control and storage of products in the foundation of huancavilca,» *National Repository in Science and Technology*, p. 64, 2020.

[12] A. Serrano, «Implementation of an inventory system in the company Valor en Franquicias SAS,» *Uniminuto corporación Universitaria Minuto de Dios* , pp. 9-48, 2019.

[13] J. Tineo, "Development of a web system to improve the management of inventories of computer goods and support services in the municipality of Tambopata 2018," pp. 1-63, 2020.

[14] R. Vélez and G. Pérez, «Methodological proposal for inventory management in a beverage company by the just-in-time method,» *Saber, Ciencia y Libertad*, pp. 91-99, 2013.