

# **The Production and Marketing Reality of the Kirkuk Cement Factory in the Kirkuk Governorate for the Period (2000-2020)**

## **A study in industrial geography**

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### **Abstract**

*The research dealt with the role of industrial settlement factors in locating the Kirkuk cement factory, as well as the production departments in the factory. Besides, it tried to analyze the production and marketing reality in the factory for the period (2000-2020) based on the statistical fact (SPSS). It also dealt with the problems facing the production process and from the most important of these problems is the failure to equip the factory with sufficient electrical power, as well as the stoppage of production in the factory for the year 2003 due to the US war on Iraq.*

### **INTRODUCTION:**

Kirkuk cement factory is one of the important factories at the level of Iraq, as the location of the factory was chosen depending on the raw materials close to the factory site and the electrical energy available in the electric power station in Kirkuk, which is 75 kilometers away. The factory began production and marketing in 1989, but during the production and marketing process, the factory faced many difficulties and obstacles in the sense that raw materials lose their weight of 200 kilograms in the manufacturing process (Al-Mousawi, 1997). That coincided with the wars that have exhausted Iraq economically and socially. The Iraqi engineering effort during the past two decades has tried to make every possible effort to reach production quantities to a certain level through which it can fill the local need, but to no avail, as evidenced by the local market being filled with imported cement from multiple origins. The origin of the word (cement) is ancient Roman, and the word (cementum) was used by the Romans to refer to those mixtures that, when added to limestone, acquire the properties of contact and cohesion and become solid.

This study is used to analyze the production and marketing reality through four topics. The first topic dealt with the most important factors that pushed towards the localization of the Kirkuk cement factory in its current location. The second topic was presented to the production departments of the factory, while the third topic discussed the reality of the factory's production and marketing during the period 2000-2020. As for the fourth topic, it dealt with the problems and obstacles that faced the production process.

**Research problem:**

When the problem is an unanswered question, namely:

What is the production reality of Kirkuk cement factory? Does the factory suffer from problems in production and marketing?

**Research hypothesis:**

Since the hypothesis is a relationship between two variables most often in a way that provides temporary explanations or reasonable solutions to the problem, the following hypothesis emerged:

Production in Kirkuk cement factory is characterized by fluctuation during the years of study, due to the presence of many problems and obstacles that led to a fluctuation in the quantities of production and marketing.

**Research goal:**

The research aims to identify the production and marketing reality during the approved period and the change in these quantities to diagnose the reasons that led to the decrease in production quantities to address them in the way available and raise the factors that led their role in increasing the quantities of production and marketing towards their development in the service of the development process that declined due to security circumstances and wars that times on Iraq.

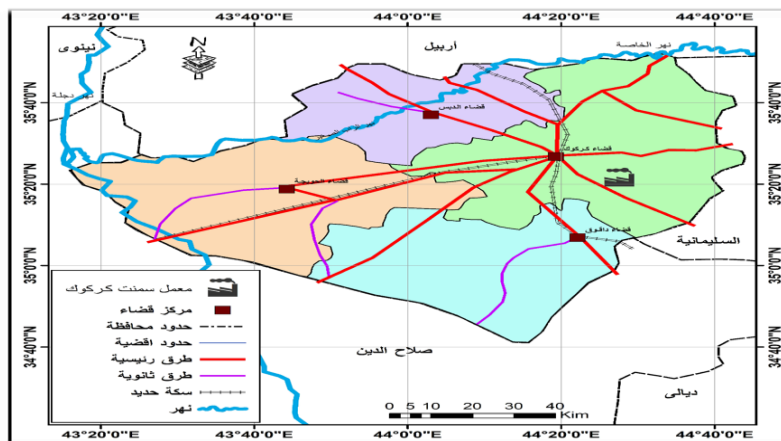
**Research Methodology :**

The study relied on field visits to the site of the study area, as well as the use of statistical programs such as the SPSS program.

**The Scope of the study:**

The factory is located in the Kirkuk governorate, which has an area of (20,000) km<sup>2</sup> in northern Iraq, which lies between two latitudes (45°- 44 °) north and longitude (34°- 36 °) east, and the factory is 2 km away from Laylan (the nearest population cluster). The lab coordinates were according to

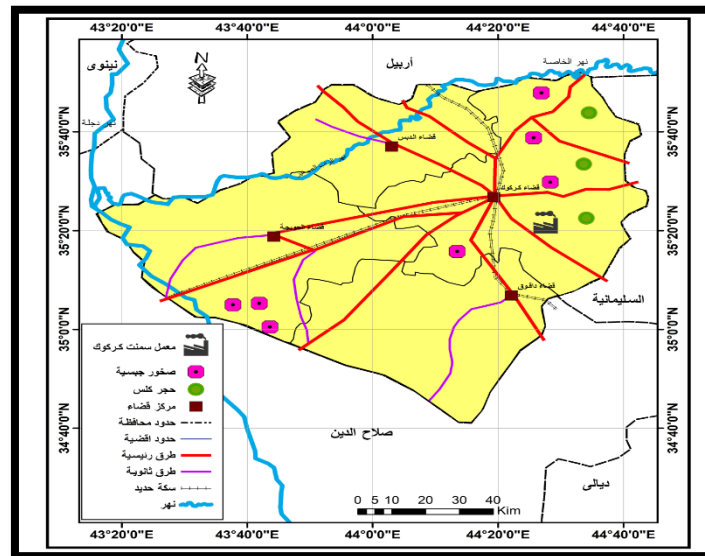
GPS data (34206 N 35) (47828 044 E) Map (1)



On this basis, the Kirkuk cement factory was established in its current location to be close to the raw materials shown in the map (No. 2), as follows:

- 1- Limestone: This material is present in large quantities in the Laylan district, located at a distance of 35 km, and limestone is used in 60% of the total raw materials in the cement industry.
- 2- Sedimentary iron: It is used at a rate of 35% of the general total of raw materials in the production process
- 3- Gypsum stone (calcium sulfate): which is used by 5% of the total raw materials (Al-Dulaimi, 2003) and is obtained from the Laylan area at a distance of 75 km and since the percentage of this material is low, the matter of its distance from the factory site is considered inexpensive when it is transported at this distance, considering that the percentage of the substance used in the industrial process is small when compared to the last two materials.

Map - 2: The Kirkuk Governorate map showing the location of the Kirkuk cement plant and the raw materials that contribute to production.



Source: From the researcher's work based on the Kirkuk administrative map for the year 2000, scale 1/2000000.

### The first topic / the role of industrial settlement factors in locating the Kirkuk cement factory:

The selection of Kirkuk cement factory depended on many factors that are in harmony with the conditions of the factory, and the focus was on the most important factors in the subject of the study, as follows:

#### First: Raw Materials:

The advantage of proximity to raw materials is one of the factors that affect the choice of the industrial location when those materials are large in size, heavy in weight, and inexpensive and lose a lot of their weight and volume during the manufacturing process. This leads to reducing the cost of transporting these materials and thus reducing production costs to achieve The largest possible profit return (El-Hadithi, 1966). This advantage is evident if we know that producing one ton of cement requires 1,200 kilograms of raw materials.

#### Second: the Manpower

The skilled manpower plays an important role in operating the industrial facility and reducing the price of the final product, and since the cement industry requires workers who are not highly skilled, it can be obtained simply and trained to be able to operate the machines and equipment of the factory. The Kirkuk factory employs 773 workers for whom a housing complex was constructed to house them and their families (field study 2020). The population growth rate is the highest recorded during the period 2000-2020. Researchers have confirmed that the population

increase occurred from the arrivals to the governorate from the central and southern Iraqi governorates, especially the governorates of Baghdad and Erbil. This indicates the role of industrial establishments, if they are located in fluctuated areas, they operate their work in the presence of growth poles that attract the population, especially the young working group among them to work in these institutions (Al Shamaa, 1980).

### **Third: Governmental Directive:**

The governmental directive aims at selecting and signing industrial projects based on many considerations, not the direct return only. It is taken into consideration when the government directive chooses the location of the production unit, including the impact of industry and its influence on the existing industrial units and its relations with other economic activities in the region and the future of the region as a whole as well as its ability to limit differences between economic and social development between rural and urban areas, achieving economic integration in the region, in addition to achieving a rational balance of the workforce between different regions (Al Sammak 2012). Government directives often plan industrial projects in empty areas. And since large industrial establishments need huge money amount, seven large governmental industrial establishments have been located in Kirkuk governorate, namely the North Oil Company and North Gas Company (Kirkuk governorate center), the phosphate production plant in Debs district, the brick production factory in Laylan district, and the construction materials industry and industry factories. Gas filling and oil refineries, including Shwan refinery and Kirkuk refinery in the Kirkuk district. However, the state, through the Industrial Development Corporation and the Industrial Bank, supported the private industrial sector, which focused its efforts on establishing small industrial enterprises. And due to the presence of a set of encouraging factors, the state proceeded to establish a Kirkuk cement factory in this location to achieve some kind of industrial development in the Kirkuk district.

### **Fourth: Transportation and the market**

The industrial activity is among the most economic activities related to the transportation component and its costs, as the optimal location for the industrial project is at the point where the transportation cost reaches its lowest levels, and the market must also be on the road that delivers the final product at a price that the consumer can pay (Al-Samarrai, 1996). The site of the Kirkuk cement factory has benefited from the advantages provided by the North Oil Company, represented by the international highway and the Baghdad-Kirkuk road that connects the city of Kirkuk with the cities of Kirkuk governorate and the rest of Iraq, Map (1), which helped facilitate the processing of the factory with the raw materials in the province and then marketing the product is made to the cities and villages of the province and the vast Iraqi market represented in the city of Baghdad.

**Fifth: the driving forces**

In the cement industry, electric energy is used to operate the equipment and machinery and rotate the factory furnaces, while the fuel is used to burn raw materials, as the production of every one ton of cement requires 150 kilowatts of electrical energy and 160 liters of white oil (Personal Interview, 2020).

And since the planned production capacity of the factory reaches (980,000) tons annually, it needs 28 megawatts of electric power and 139 million liters of white oil, and the factory was getting its need of electrical energy from the hydroelectric station located in the district of Debs, whose production reached before the year 2000 to 690 megawatts, while fuel is obtained from the Kirkuk refinery. Except that the oil installations are exposed to serious aggression by the American forces and ISIS had a negative impact on the factory's electrical energy and fuel supplies, which prompted the reduction of production lines due to the factory's purchase of fuel from the black market at prices of up to 1500 Iraqi dinars per liter to operate the electrical generators needed to move the plant's machinery, equipment and furnaces. These costly treatments were reflected in the consumer who arrives. Kirkuk cement of good quality at a price that cannot compete with imported cement.

**The second topic/production departments in Kirkuk cement factory: -**

The production process of Kirkuk cement factory passes through several stages, starting with bringing the raw materials from its quarries through the process of grinding and burning and ending with the packing and bagging stage, which are the following: -

In general, cement plants are divided into several sections according to the stages of preparing the raw materials, which are as follows: -

- 1- Quarry: - After conducting general geological surveys to find out the existing quantities of limestone material in a specific area, the quarry is located and then the road opening operations begin to reach the concerned area, usually at the foot of a mountain and it needs to open a road that secures the movement of large mechanisms and uprooting operations which is usually carried out by blasting and which has been replaced recently by quarrying with huge mechanisms and loading them directly. Therefore, in the study area, two production lines (the first line) are to bring raw materials from the main quarries as limestone is extracted from their quarries by drilling the rocks with holes deep into (10 m) and a diameter of up to (6 cm). Then the holes are filled with explosive materials, and they are detonated by electrocution to turn into piles of stones of different sizes. As for the (second line), it is called (the crusher) that transports the product from the stones by means of trough wheels running on a railway that can carry (70 tons) to break it in sizes not exceeding (5 - 2 cm). After, the crushing process, the mixture is transported to the storage site for the mixture that can expand To (30,000) tons of these materials.

**2- The crusher:** - In the Kirkuk cement factory, the quarry is located close to the plant, the stone coming from the quarry is thrown into the hopper feeding the crusher and mixed directly with the dirt inside the hopper, after breaking the stone in the crushers and mixing it with dirt, it is delivered by a large rubber conveyor to the raw materials store. on the way, samples are taken that represents the chemical composition of each of the limestone and the dirt mixed with it that is put into the store, by means of an automated model station that works continuously and takes samples every minute for a period of one second, collects and grinds them, then takes a sample of up to 100 grams in a capsule (representing a comprehensive representation of each of the stone the crusher and the dirt mixed with it in that period are sent to the X-ray room in the central control to indicate the percentage of chemical compounds present in both the stone and the dirt. as for the process of distributing the output of the crusher in the raw materials store by means of a moving arm, regular movement (stacker) and with it a skimmer device (Reclaimer) Which collects materials from all parts and areas and puts them in the middle of the warehouse center to put them on a rubber conveyor that transfers them to bankers at the top of the material mill, then is taken by weighing conveyors. Feeders are controlled into the mill inside Picture No. (1).

Photo No. (1) the crusher in the factory



Source: Field Study, 2020.

**3- Raw materials mill:** - In the mill of the Kirkuk cement factory, the materials are smoothed and grinded by the dry method (in modern laboratories), then they are mixed again, and the grinding process is in the form of (a closed circuit ) to return the coarse from it and grind it again, then the milled materials are deposited The primary silo is in a concrete vertical silo equipped with continuous ventilation from the bottom to ensure homogeneity and non-agglomeration, then the materials are taken from the silo and it is called (Raw meal) ready to feed the oven by weighing conveyor and it is fed to the oven from the highest point. Image No. (2).



Picture (2) the electric windmill



Source: Field Study, 2020

4- Furnaces: - The furnaces of the Kirkuk cement factory are equipped with cyclones of early heating (preheaters), and in the Kirkuk factory these cyclones are of the type (RSP) forced (preheater Rian suspension)) equipped with additional incinerators except for the hot air coming through the furnace that passes through the cyclones. In Kirkuk cement factory, early calcination occurs before the materials enter the rotary kiln, as temperatures approach 1000 m when the materials enter the rotary kiln. Inside the rotary kiln, all chemical processes take place starting from the loss of fractionation heat, decomposition, then combining and forming a clinker complex. After checking the occurrence of all chemical processes inside the oven with accurate and continuous control over the type of flame, temperature, pressure, constant feeding, ensuring airflow and controlling the rotation speed of the oven. The materials advance inside the furnace to reach the materials to the end of the furnace and after that, the sudden cooling process begins with the flow of air coming from the collars, and to ensure the flow of relatively cold air over the hot clinker, the air must be in control of its quantity and temperature. After the clinker falls on the collars and their exit from the oven it is passed on an iron network of moving bridges to complete cooling through several stages, where cold air penetrates it from under the iron networks that allow the clinker to move outside and the air rises to the top, then it passes through a rotary hammer crusher to break the large pieces of clinker falling from the furnace to cool it and its ease of movement and protect the bucket conveyors from melting in the stage after the crusher, the temperature of the clinker on the iron conveyors should be around 100 m in the best case, then the product is thrown into the uncovered clinker store that is exposed to the nature of the weather in the open picture No. (3).



**Photo (No. 3) of the heating tower**



Source: Field Study, 2020

**5- Cement mills:** - The clinker is pulled out of the store by means of earth vibrators in the form of holes in the clinker yard that are controlled to drop them on rubber conveyors through a shot to the cement mills section. the clinker is milled by cylindrical cement mills and the horizontal pillar and rotary to obtain fine cement and that is in a closed circuit, as in material mills.

However, in cement mills, the clinker is cooled during the grinding process to prevent high temperatures harmful to the steel balls, liners, mill body, and the clinker itself.

During the grinding process, crushed gypsum stone is added and prepared in hoppers over cement mills by 2-5%, from the amount of clinker as a delaying factor for the initial hardening of the cement during the initial knocking process after grinding and reaching the required smoothness. The cement is transferred to a vertical concrete silo similar to the silo material.

In order to reach the required smoothness, the cement is transferred to a vertical concrete silo that resembles the raw materials silo and is provided with continuous ventilation to ensure that the cement does not clump and is easy to transport to the packing section.

**6- Filling and preparing:** - The cement is withdrawn from the silo from the lower point to two points. The first of which is the direct filling of the pelvic cars (filling the jelly) where the cement falls directly into the inside of the cars and the car is weighed before and after the filling to know the amount of cement contained in it.

For the second point, it is the bagged packing, in which the cement is taken and transferred to a hopper, directly underneath the rotary packing machine equipped with eight circular moving arms. An empty cement bag is installed on the rotor arm, after which the cement starts to descend and when the cycle is completed, the bag is filled with approximately 50 kg, then the bag falls on the Rubber conveyor then to trucks to be transported, as shown in picture No. (4).

Picture (4) cement filling



Source: Field Study, 2020.

### **The third topic / analysis of the production and marketing reality for the period (2000-2020):**

Through the data of Table (1), we were able to conduct an analysis and correlation using the statistical percentage (SPSS), where the minimum and maximum quantities of production and marketing in the Kirkuk cement factory were extracted for the duration of the study in addition to extracting production rates and standard deviation, and this is what the tables clarify later in addition to the graphs. That shows the quantities of production and marketing.

Table No. (1)

Production and marketing quantities of Kirkuk cement factory for the period 2000-2020.

Year Production quantities Marketing Year Production quantities Marketing

Mrketing	Production Quantity	Year	Mrketing	Production Quantity	Year
159900	178905	2011	350000	370000	2000
231330	268326	2012	170000	207000	2001
423622	423787	2013	320000	370000	2002
367470	371491	2014	270000	2250000	2004
212421	223843	2015	480000	50064	2005
122575	135746	2016	670000	73675	2006
123765	123282	2017	4000000	43007	2007
134653	135377	2018	6700000	77664	2008
161890	172108	2019	1900000	283502	2009
153572	138762	2020	900000	156025	2010

The Source: Kirkuk Cement Factory, Production and Marketing Department (unpublished data).

Table (2) shows a description of the quantities of production and marketing (in tons) for the period between 2000 and 2020. It is clear from the table that the production and marketing rates are 2,250,000 and 6,700,000. The value of the indicated standard deviation against each of them is a clear indication of fluctuation in production and marketing. This is indicated by the readings of the lower and upper values of both variables.

**Table-2: Maximum, minimum, and standard deviation for production and marketing.**

Marketing	Production quantities	Year
350000	370000	2000
170000	207000	2001
320000	370000	2002
270000	2250000	2004
480000	50064	2005
670000	73675	2006
4000000	43007	2007
6700000	77664	2008
1900000	283502	2009
900000	156025	2010
159900	178905	2011
231330	268326	2012
423622	423787	2013
367470	371491	2014
212421	223843	2015
122575	135746	2016
123765	123282	2017
134653	135377	2018
161890	172108	2019
153572	138762	2020
17851198	6052564	المجموع
6700000	2250000	The maximum value
122575	43007	The minimum value

Source: The researcher's organization based on the outputs of the statistical package of the SPSS 21 program

Table No. (3) represents the correlation coefficient between production and marketing, and the value of this coefficient indicates that it is significant at the level (1%). This means that the institution does not have marketing problems and that it spends what it produces in direct proportion to production rates.

**Table (3) the correlational relationship of production and marketing quantities****Correlations coefficient of correlation**

Sig. (2-tailed) Statistical significance level 0.471

N Number of years 20 20

Marketing Pearson Correlation 0.17-1

Sig. (2-tailed) Statistical significance level 0.471

N Number of years 20 20

Source: spss21 program output and table (1) data

Variables that were used in production and marketing		Production	Marketing
Production	Pearson Correlation	1	0.17-
	Sig. (2-tailed) Statistical significance level		0.471
	N number of years	20	20
Marketing	Pearson Correlation	0.17-	1
	Sig. (2-tailed) Statistical significance level	0.471	
	N number of years	20	20

Table (4) shows a description of the production and marketing quantities (in tons) for the period between 2000-2020 and it is clear from the table that the production and marketing rates are (302628.2) (892559.9) respectively and that the value of the standard deviation indicated against each of them is nothing but clear evidence of fluctuation in Production and Marketing. The readings of the minimum and highest values of both variables indicate through the table data and the disclosure of the correlational relationship of the production and marketing quantities. Because the production quantities are higher than the marketing quantities and this is outside the normal distribution of the normality test values. In addition, the rise in the value of the statistical significance to greater than 0.05, and this explains the nature of the inverse relationship to the variables.

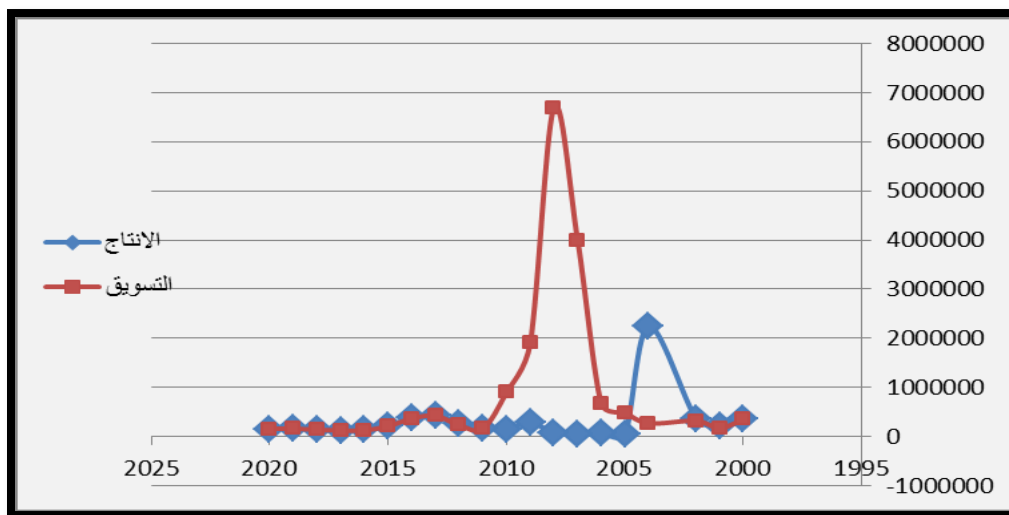
**Table (4) Extraction of the rate and standard deviation of production and marketing quantities****Year quantities of marketing production**

Production	quantities of production	Year
350000	370000	2000
170000	207000	2001
320000	370000	2002
270000	2250000	2004
480000	50064	2005
670000	73675	2006
4000000	43007	2007
6700000	77664	2008
1900000	283502	2009
900000	156025	2010
159900	178905	2011
231330	268326	2012
423622	423787	2013
367470	371491	2014
212421	223843	2015
122575	135746	2016
123765	123282	2017
134653	135377	2018
161890	172108	2019
153572	138762	2020
17851198	6052564	المجموع
892559.9	302628.2	Average
1595614.257	460464.2372	Standard deviation

Source: The researcher's organization based on the outputs of the statistical package of the spss21 program

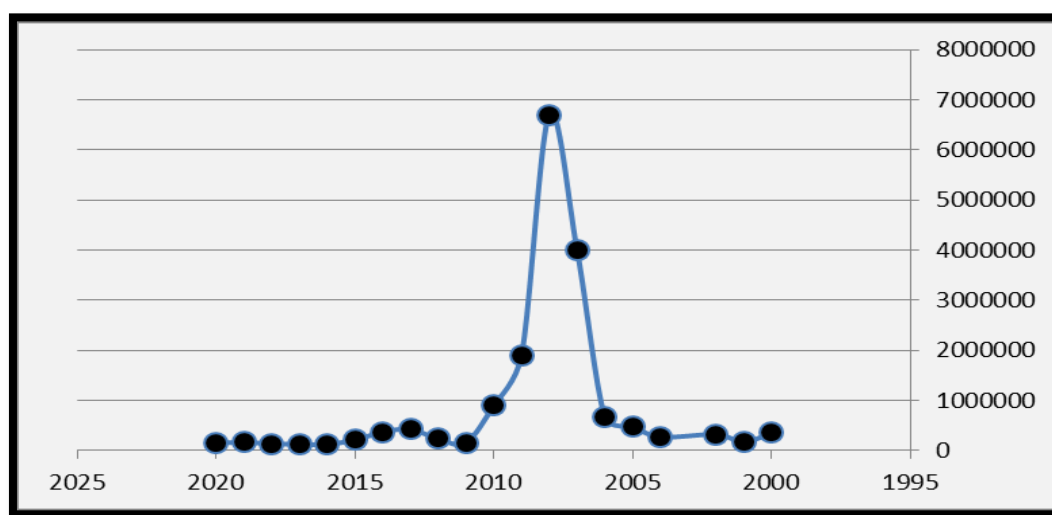
Figure (1) represents the time change of both production and marketing during the aforementioned period. It is clear from this figure that the marketing was not proportional to the volume of production. While the corporation recorded demand for its product or marketed higher rates than its production for the years 2000 and 2005. This behavior indicates that the demand for this product accelerated to increase after 2003 at rates that the producer may not have expected. Consequently, it became necessary to know the general direction of production to formulate a marketing policy in light of the general trend line.

Figure (1) graphic intersection of production and marketing quantities



Source: SPSS program through table (1) data

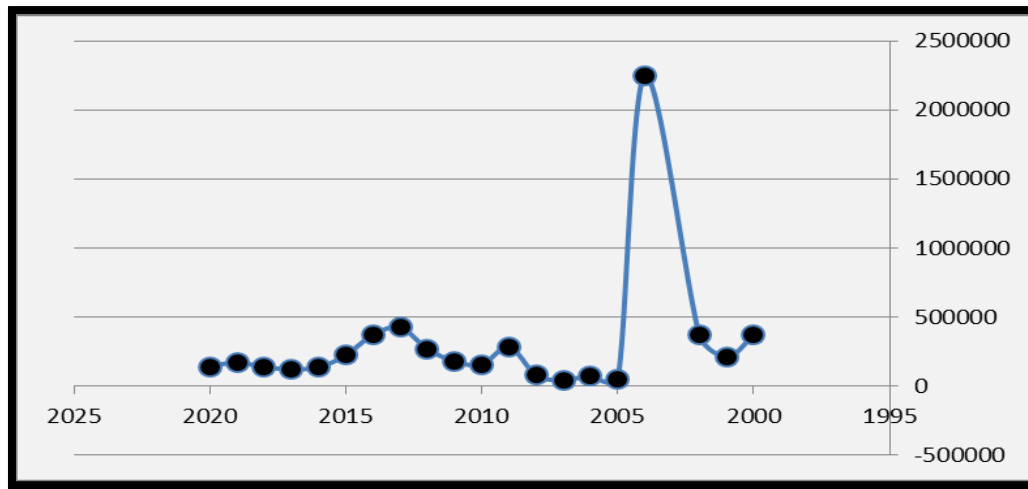
Figure (2) Graphic Marketing Distribution



Source: SPSS program through table (1) data

Figure (3) shows a general trend line for the period between the years 2000-2005 that represents a decline in production rates represented by the blue line when production takes one year to the next. To avoid the change in production, we have taken a moving average over the four-year period and re-analyzed on this basis to find that the rates Production is not linear over the years, but rather undergoes many changes (Figure 3).



**Figure (3) the graphic distribution of production quantities**

Source: SPSS program through table (1) data

Through the analysis, correlation and variation in the quantities of production from year to year with the presence of demand for the product and the absence of accumulation of the product within the industrial establishment and the production is being marketed very quickly. We can attribute the reason for the fluctuation of production in the Kirkuk cement factory to its connection with the political, economic and military conditions in the country. During this period, which was reflected in production and demand, and through the graph (No. 1) it is clear that the period (2000-2005) has recorded the highest levels in terms of production and marketing, as well as the start of the factory's operation during this period. While the period (2005-2010) recorded the lowest level in production and demand for it, and this is due to the peculiarity of this stage in the history of Iraq, which witnessed political and economic developments as these events reflected negatively on the economic sector in general and the industrial sector in particular in many aspects that can be summarized as follows:

1- The destruction suffered by most of the large industrial establishments, which led to the cessation of many of them totally or partially, which led to a decline in production levels.

2- The acute shortage of spare parts and technical expertise, the crisis and the difficulty in obtaining them and the lack of hard currency, which contributed to the weak production efficiency of industrial activities. All these factors collectively reflected on the decline in production during this period, especially since the economic reality of the country witnessed the emergence of the phenomenon of economic inflation and weak purchasing power for the whole of society. The reality of production and the demand for it witnessed a remarkable relative development compared to the previous period due to some relative political stability and

openness to neighboring countries and the signing of the so-called Memorandum of Understanding between Iraq and the United Nations (oil for food), while the period (2003-2007) witnessed, especially after the occupation of Iraq in April 2003. And what was accompanied by the great and dangerous deterioration of all political, economic and security levels until now, in addition to the unprecedented destruction of industrial facilities, acts of sabotage and weak government support due to the emergence of a trend towards the application of the privatization system for public sector institutions, in implementation of the conditions of the World Bank? The decline in production and demand for it, especially the Kirkuk cement factory, which suffered from major technical problems after the occupation. In general, we find that the production curve coincides with the demand curve during the various stages, and if the Kirkuk cement factory suffers from its production problems, it does not suffer from marketing problems, but the Iraqi market needs double the current production of salt-resistant cement.

### **The fourth topic/problems facing the Kirkuk cement factory**

#### **First: - Production:**

The industrial establishment, represented by the Kirkuk cement factory, suffers from production problems that began two years after the factory was operational when the economic blockade was imposed on Iraq in 1990, and we can address these problems through the following axes:

##### **1: Electric Power:**

Supplying factories with electric energy is one of the most obstacles that hinder the production process in all Iraqi factories. This problem was exacerbated after the US bombing of Iraq in 1991, which affected the electric power networks, as the Kirkuk cement factory needs (45) megawatts for all sections to work. The factory, while only (10) megawatts are currently available, forces the technical staff to partially operate the factory, and this, in turn, affects the production quantity of the plant.

##### **2: Technical Experience:**

Whereas, the factory's staff was managed by foreign experts to operate the equipment imported from abroad and train the Iraqi workers. After the siege, these cadres returned to their original home, and the Kirkuk cement factory remained 100% Iraqi, which in turn suffered from the operation of the factory and some lines of production stopped. For a long time, until the cadres were able to find appropriate solutions and operate the factory with all its production lines.

##### **3: Difficulty in providing raw materials:**

The provision of raw materials has become an obstacle to the production process in the factory due to the difficulty of obtaining them due to the security conditions that the country is going through, including the governorate of Kirkuk, especially after the US occupation of Iraq, as well as the presence of some areas in which these indigenous materials are available only under the control of terrorist groups, so it is difficult to access to them.

#### **4: High fuel price:**

The price of fuel increased very significantly, especially between the period 2008-2013, when the price of a liter of gasoline exceeded (1000) Iraqi dinars, noting that gasoline is used to operate the generator for electric current and burn raw materials. If the gas cannot be obtained, as the matter was reflected in the final price per ton where the price ranges a ton before 2003 was between (40,000 to 50,000) dinars, while it now exceeds (200,000) dinars.

#### **5: Marketing:**

The marketing process is of great importance in the growth and development of the industry, through selling industrial products to consumers. However, the market for industrial products differs from one industry to another. The food industry, such as bread and pastries, is linked to the city's local market (perishable). While there are industries that go beyond the city market to reach wider regional borders, and despite the presence of markets in the cities of Kirkuk Governorate, such as the districts of Debs, Hawija and Kirkuk, where the offices of distributing industrial products of the Kirkuk cement plant are spread. However, it has limited impact due to the overlap between the country's markets, as well as the flexibility of the movement of industrial products towards the broad and main markets that are led by Baghdad with a high population density compared to the cities of Kirkuk Governorate.

#### **6- Modern laboratories:**

The factory needs to provide laboratories with modern equipment in order to examine the materials involved in the production of cement material, as well as the final examination of cement after the process of mixing the materials.

### **Conclusions and recommendations:**

#### **Conclusions:**

After reviewing the study subject of the four topics, the following conclusions were reached:

- 1- The production quantities for the period 2000-2020 did not reach the planned production capacity of 980,000 tons per year due to the succession of wars that led to the devastation and destruction of the country's economic structure.
- 2- It was found that there is a direct proportionality between the quantities of production and marketing, with the existence of years, of which the marketing quantities increased from the produced quantities due to the presence of rotating storage for previous years.
- 3- Lack of personal protection and safety equipment for workers, especially in the packing unit.
- 4- The state supported the factory with material and technical capabilities despite the difficult conditions it is going through. Therefore, the price of one ton of cement did not exceed 30,000

dinars before 2003, while it rose after 2003 to 200,000 dinars due to the lack of government support and the deteriorating economic and security conditions.

5- The factory suffers from a shortage of electric power, as the equipped power does not exceed 10 megawatts.

6- The factory does not have the means by which to limit the pollutants emitted from the plant that affect the surrounding environment.

### **Recommendations:**

After presenting the conclusions, the following recommendations are given:

1- Working on developing the factory by importing modern equipment, as well as extending railways and roadways, in order to reduce production costs.

2- Providing adequate electrical energy as well as equipping the factory with electrical generators to ensure the operation of the furnaces to avoid interruptions in the factory due to the shortage of electricity supply.

3- It is necessary for full government support to the factory so that it can return to the production to reach the planned production capacity.

4- Working on marketing the product to other governorates at reasonable prices to compete with imported cement.

5- Providing oil derivatives at subsidized prices by the state to the Kirkuk cement plant to maintain the stability of prices and not to fluctuate them, especially since gasoline is used to burn raw materials and operate the electric current generator.

6- Move substantially to increase production and flood the Iraqi market with this substance, and quantities above the market's need can be exported to neighboring countries.

7- The optimum use of quarries of raw materials and depths from 11-13 m instead of withdrawing the surface layer only to a depth of 3 m, in order to ensure optimum utilization of raw material sources.

8- Coordination with the Ministry of Planning and the Ministry of Oil to exploit other energy sources instead of black oil, as well as to work on developing the plant by coordinating with international companies to send experts to supervise the training of plant cadres.

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