

Determining the sources of growth of the cement industry in Iraq (analytical study for the period 1990-2014)

Sawsan Ali Mahmood/ College of Nursing / University of Baghdad
Sawsanhassani@yahoo.com



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Abstract

The objective of this study is to determine the sources of growth of the cement industry in Iraq for the period 1990-2014 and to indicate the nature of the technological progress used in it. To achieve this objective we have built an econometric model, by adapting the production function constant elasticity for substitution, using multiple regression, and enforcement, SPSS program, and using the ordinary least squares method (OLS). The results showed that quantitative factors (labour and capital) are the main sources of growth the cement industry in Iraq, and the qualitative factors (technological progress) did not contribute effectively to achieve this growth. And that the production techniques adopted in the cement industry in Iraq are labour intensive we recommend to raise the level of technology used in this industry and creating the cadres capable of dealing with this advanced technology, which requires changing some aspects of educational systems in the direction of vocational education.

Keywords: cement industry, CES, growth sources.





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1 Introduction:

The cement industry has taken a prominent place in the construction industry in particular, the manufacturing industry in general, it is considered one of the important strategic industries for any developing country such as Iraq, by supporting the process of economic development, being, directly related with the construction works and is one, of the most important materials used in the construction industry and reconstruction, which have an important role in the development of the infrastructure of the country.

Given the role of the cement industry in economical development, it became necessary to raise the degree of exploitation of the productive potential of this industry of the resources available to it. To achieve this requires the knowledge of the extent of the contribution of each element of production in the production process, and know the technological pattern of this industry and whether it is characterized by capital intensity or labour-intensive

The objective of this research:

The research aims to:

1- Analysis of the sources of growth of the cement industry in Iraq by determining the relationship between the output and materials used in those industries.

2 - Statement the nature of technological progress used in this industry

The problem of the research:

The cement industry in Iraq is one of the oldest and most advanced industries , The , as that the availability of raw materials and manpower, as well as the existence of strong markets to absorb Iraqi production, led to the success of this industry in Iraq, and despite the availability of the elements of the success of this industry, but the productivity of the element of work and the element of capital still in declining, for this why the research seeks to answer the following questions:

- Is technological change affects the growth of the cement industry in Iraq?1

2- Is there an optimal utilization of the economic resources available to the cement industry in Iraq or is there the presence of wastefulness and disruption, in these resources?

Research hypothesis:

"The quantitative factors (labour and capital) are the main sources to growth the output of the cement industry in Iraq as a developing country and the qualitative factors (technological progress) did not have an active contribution to achieving this growth during the period studied"

The spatial and temporal dimension of the research:

The research covered the cement industry in Iraq as a whole. Where they included 21 factories distributed throughout Iraq, including the cement factories for the private sector, the public sector factories of the general company for Iraqi cement, the general company for northern cement and the general



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company for southern cement. The cement industry is a homogeneous industry in terms of its products so it will be studied as a whole (Aggregate).

For the temporal dimension, the duration was included (1990-2014) was included. This period is of exceptional importance in the Iraqi economy because of the international sanctions and economic fluctuations associated with oil revenues, which are mainly related to international market fluctuations.

Structure of research:

In order to achieve the research objective, and to verify the hypothesis established it was divided into the following axes: the first axis, including the reality of the cement industry in Iraq. While the second axis was devoted to the evolution of some economic indicators for the cement industry in Iraq, as for the third axis included the theoretical aspect of the production function constant elasticity for substitution, and the fourth axis was allocated to, estimate the model and analysis the results. The research ended with a set of conclusions and recommendations that we believe should be taken by industrial planners

2 The reality of the cement industry in Iraq:

The cement industry is one of the oldest manufacturing industries in Iraq. It was founded in 1936 by name the Iraqi cement company. Because of the circumstances of the second world war, some of its operating lines ceased and industrial production began in 1949 at the Baghdad cement plant (in one kiln in a wet way). Baghdad cement factory was expanded by adding three new production lines in 1955, with a design capacity of 400,000 tons per year. In 1964, the company was renamed the general company for Iraqi cement, the company is currently "manages and operates several plants for the production of cement types (Iraqi Ministry of Industry & Minerals, 2010).

The cement industry is one of the leading and strategic industries and a pillar of construction and construction. In addition, it is one of the distinctive investment options to attract investors as a result for what Iraq enjoys the availability of natural resources (raw materials), and appropriate conditions for production and increasing domestic demand for the products of this industry to meet the requirements of construction and reconstruction. The industry has spread over a wide area from Iraq, there are currently 21 cement factories, 17 of which are owned by the state and 4 are owned by the private sector. The cement companies of the Ministry of Industry and Minerals were as follows (Iraqi Ministry of Industry, 2014) :

- 1- General company for southern cement.
- 2- The general company for Iraqi cement.
- 3- The general company for northern cement.

The factories of these companies are distributed on the territory of Iraq in general⁽¹⁾.

⁽¹⁾ For more information on this topic, see:

1 -Al - Baaj, T. J. (2012). Evaluation of the economic performance of Basra cement factory, [Master Thesis]. Basra: University of Basra.



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These companies represent self-financed economic units "and enjoy moral personality and financial and administrative independence and are governed by the Public Companies Law No. 22 of 1997. These companies have set their objectives according to their internal regulations.

As for the factories of the private sector of cement, where most of them are located in northern Iraq and in the province of Sulaymaniyah specifically. "In addition to the existence of some of them in other provinces, These factories are as follows: United cement factory , Almas cement factory, Taslojh cement plant. and cement factory Aldooh.

The cement industry in Iraq has received special attention and the reason for the emergence of this industry and its development come back to the following: (Al-Mafarji & Abdul-Jabbar, 2009)

1- The high purchasing cost of imported cement due to high transport costs, as the cost of transporting cement to the consumer centres, is a large part of its total value. So, that the produced cement, his qualitative weight is high and the cost of production is relatively low.

2- Availability of raw materials in good quality and quantities available will would facilitate the establishment for the cement industry, and competitive quality to foreign product

3- The availability of local markets, for the use of cement in all areas of construction and construction, especially as Iraq needs to build and rebuild the infrastructure destroyed by successive wars.

4 - Working hands provide, wan the cement industry in general, does not need skilled labour, as most of the workers in cement factories are semi-skilled workers. This will reduce the costs of training and rehabilitation, which ultimately affect the costs of the cement industry and then its prices.

5- The cement industry contributes to the economic development process, especially in the country whose infrastructure is shattered with a gap estimated at 2.5 million housing units., so cement is the backbone every of, building, reconstruction, and development.

6- The cement industry has front, and rear links with many industrial and service activities, thus it has the ability to move the indirect demand on employment, absorb unemployment and create demand for various crafts, that contribute to the reconstruction of infrastructure in the housing sector.

7 - The cement industry from the heavy industries in terms of participation of capital in the process of production and the magnitude of inputs and outputs in them. which makes their competitive advantages go to, near the mines of raw

2. Ministry of Industry and Minerals , General Company for Northern Cement,(2017). Ministry of Industry Publications, Retrieved from: www.nesc-iraq.gov.



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materials, and Iraq has the ability to produce the best type of cement, in addition to the presence of large demand and large markets.

Therefore, the cement industry in Iraq is one of the large industries and enjoys a high degree of concentration compared to other industries. And the Iraqi market needs for cement is increasing in the coming years. As a result of the implementation of Iraq reconstruction plan projects. In addition to the growing population movement and the need to build housing units to meet domestic demand, where the future demand for cement in Iraq is estimated at about (30 - 25) million tons annually if the state began to implement its development projects. (Iraqi Ministry of Industry & Minerals, 2013).

3 The development of some economic indicators for the cement industry in Iraq:

3.1 Gross value added:

The value-added index is a measure of the net development effort achieved in the cement industry, table (1) shows the decrease in the total value added at constant prices for 1988 from (489.2) thousand dinars in 1990 to (25.9) thousand dinars in 1994 with a negative compound annual growth rate (-64.7%), see table (2) This is due to the circumstances experienced by Iraq during the period of the economic blockade imposed by the united nations in 1991.

Table (1)

Gross value-added, fixed capital formation, and gross capital stock, accumulated, at constant prices for (1988) for the cement industry in Iraq for the period(1990-2014)

(thousand dinars)

Gross capital stock, accumulated,	Fixed capital formation	Gross value added	Years
721186	4290.2	489.2	1990
788101	75.6	25.96	1994
704190	18.8	16.4	1995
1374394	2967.3	117.0	1999
3055175	9308.6	259.5	2000
64689139	97357.4	488.5	2004
87977229	120205.5	544.7	2005
209067294	124081.4	241.9	2009
217171802	115099.9	245.9	2010
350440594	120132.3	179.9	2014
Compound annual		growth rate %	
1.0		64.7-	1994-1990
14.8		42.0	1999-1995
74.2		5.6	2004-2000
23.2		19.6-	2009-2005
11.9		6.5-	2014-2010
33.4		6.0	2014-1990



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Source: (1).Central Bureau of Statistics and Information Technology Iraqi,(2016), Final Accounts of Cement Companies in Iraq for the Period (2014-1990), p. 77.

(2) The Iraqi ministry of industry and minerals,(2016). Final Accounts of Cement Companies in Iraq for Various years

(3) of the work of the researcher based on the following formula (Nazir, 2015 , p. 87)

$$K_{(t)} = P_{(t)} / \lambda P_{(t)} - (P_{(t)} (1-d)^{T-t}) \cdot \sum_{j=t}^{T-1} I_j (1-d)^{T-j-1}$$

$P_{(t)}$ = output in the cement industry at the beginning of the time period for making the estimates.

$P_{(T)}$ = output in the cement industry at the end of the period of time for the estimation of the accumulated capital.

I_j = gross fixed capital formation during the period studied to make to estimate the accumulated capital

d = the rate of capital expenditures during the specified period (estimated at 5%).

λ = utilization rate of production capacity and in this model is assumed to be equal to (100%)

While the value-added during the period (1995-1999) increased from (16.4) to (117) thousand dinars, and by a CAGR of (42%) as shown in Table (2). The value-added continued to increase during the period (2000-2004), by (229) thousand dinars and by a CAGR of (5.6%) (see table 2). And from the same table, we find there is a sharp and noticeable, decrease in the growth rate of total value-added, reflecting the exceptional situation in the Iraqi economy in general and the cement industry especially during the periods 2005-2009 and 2010-2014 this is confirmed by negative compound annual growth rates (-19.6%) (-6.5%), respectively, and (table 1) shows the fluctuation of the total value added during the period studied (1990-2014). Thus achieving CAGR by 6%(table2).

3. 2Gross capital stock accumulated:

The accumulated capital is the sum of investments realized over a specified period of time. As the investment also refers to the amount by which capital accumulation changes. Table (1) shows that the stock of fixed capital increased to (788101) thousand dinars in 1994 after it was (721186) thousand dinars in 1990 it achieved a compound annual growth rate by 1% (see table 2). This inventory continued to increase during the periods (1995-1999), (2000-2014),(2005-2009),(2010-2014), an increase of (670204), (61633964), (121090065), and (133268792) thousand dinars, at compound annual growth rate of (14.8%) , (74.2%), (23.2%), (11.9%), respectively. As for the during the period as a whole (2014-1990), the cumulative fixed capital formation at fixed prices for 1988 increased at a CAGR of 33.4% as shown in Table (2).



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Table (2)

The compound annual growth rate of added value, gross capital stock accumulated, salaries and wages at constant prices for (1988) and number of workers in the cement industry in Iraq

Compound annual growth rate %				
Number of workers	Salaries and wages	Gross capital stock accumulated,	Added value	The periods
1.0	60.1-	1.0	64.7-	1994-1990
1.0	37.4	14.8	42.0	1999-1995
10.6	17.9	74.2	5.6	2004-2000
10.1	49.2	23.2	19.6-	2009-2005
11.1-	3.4-	11.9	6.5-	2014-2010
3.7	13.9	33.4	6.0	2014-1990

Source: From the work of the researcher based on the data of tables (1) and (3).

The compound annual growth rate was calculated according to the following formula:

$$Y = Airtel$$

Y = the variable to calculate its growth rate, r = annual growth rate, t = time, A = constant,

e = natural logarithm = (2.718), u = error limit. This function is estimated by taking the logarithmic formula which takes the following form (Alpha Chiang, 1995) :

$$\text{Log}Y = \text{Log} A + rt$$

3. 3 Salaries and wages:

Wages and salaries include cash paid on structured time periods, including bonuses for extra work or allowances granted as a result of difficult and dangerous working conditions, in addition to the cash bonuses organized as cash allowances as well as amounts owed to employees during their normal vacations, incentives and gratuity

Table (3)

The salaries and wages, at constant prices for (1988) and the number of workers in the cement industry in Iraq for the period (1990-2014)

Number of workers (2)	Salaries and wages (thousand dinars) (1)	Years
7878	15019	1990
8197	923	1994
8279	520	1995
8615	2675	1999
6901	9660	2000
10915	24177	2004
11783	26175	2005
19165	274894	2009
18603	24912	2010
11919	21729	2014

Source: (1) of the work of the researcher depending on Annex (1)



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(2). Iraqi ministry industry and minerals, (2016). *Publications of the Information Section*, scattered pages.

Table data indicate (3) that the wages and salaries at constant prices have been fluctuating between the decline and the rise. Where it amounted the year 1990, (15019) thousand dinars and fell to (923) thousand dinars in 1994, achieving a compound annual growth rate negative (-60.1%) for the same period as shown in table 2, this confirms that wages and salaries, were not sufficient to meet the requirements living of workers in this industry, and after that rose to reach (2675) thousand dinars in 1999, after it was (520) thousand dinars in 1995, achieving a compound annual growth rate by (37.4%), and continued to increase during the two periods (2000-2004) and (2005-2009) by (14517), (248719) thousand dinars and a compound annual growth rate (17.9%) and (49.2%) respectively, see table (2) this indicates a remarkable development in wages and salaries in this industry. And in the same table, we find that wages and salaries have declined at a negative annual growth rate, by (-3.4%) for the period(2010-2014). As for the period studied, wages and salaries increased slightly achieving CAGR of (13.9%).

3.4 Number of workers:

The work component is one of the factors of production that interact with other production elements to achieve the final output, the efficiency of this component is increased through training, education and rehabilitation programs and thus achieving greater production.

Table (3) indicates that the number of workers in the cement industry increased from (7878) workers in 1990 to (8197) workers in 1994 with an estimated growth rate (1%) for the same period as, in the table (2), and from the same table. we find the period(1995-1999) has achieved the same rate of annual compound growth (1%), a low rate, as the economic blockade had negative repercussions in employment and work in the sectors of the state during this period.

As for the period (2000-2004), the number of employees increased to reach (10915) workers in 2004 after it was (6901) workers in 2000 with a compound annual growth rate (10.6%). The number of workers continued to increase during the period (2005-2009), the increase was (7382) workers achieved, CAGR, (10.1%) see table 2.

For the period (2010-2014), the number of employees decreased from (18603) workers to (11919) workers respectively, the negative compound annual growth rate of (-11.1%) this is due to the difficult circumstances experienced by the country during that period. As for the period 1990-2014, the number of workers in the cement industry increased to (4041) workers and at a CAGR of (3.7%) as shown in table (2).



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4 The production function, constant elasticity for substitution (CES)⁽²⁾:

The production function expresses the relationship between the number of goods produced and the means of production used to produce this quantity (Al-Shukri, 2004). It also expresses the mathematical relationship between input and output, so that show the largest amount can be produced using a certain amount of production elements.

The production function, constant elasticity, for substitution is a special case of the Cob-Douglas that function which is the starting point for most applied studies that attempted to estimate the production function. but this function is based on the assumption that the elasticity of the substitution of the element of work in place of capital is always equal to the correct one, if not this assumption is true, the results will be higher than the real values, which leads to the inaccuracy of statistical tests (Griffith, Hill & Judge, 1993). Given the difficulty of predetermining whether the substitution elasticity, is equal to one true or no so, therefore, we must choose another function he has done every of "Arrow-Chenery-Minhas-Solow" (Arrow, Chenery, Minhas & Solow, 1961) With an estimation, production function it called by acronym "ACMS" which can be represented as follows:

$$Y = A \left[\delta K^{-\rho} + (1 - \delta) L^{-\rho} \right]^{-\frac{r}{\rho}} e^u \quad \dots\dots\dots(1)$$

Where:

Y = Production, measured by (Value added)

L = The represents the labour component

K = capital element represents, measured by, gross capital stock accumulated.

A = Static the function, it's called efficiency coefficient and reflects the efficient use of the production elements, and the theory predicts that the coefficient of efficiency is positive.

δ = Distribution coefficient, where it shows the contribution of both capital and work in production and usually the value of this coefficient between the unit and zero ($0 \leq \delta \leq 1$)

ρ = Substitution coefficient, shows the elasticity of substitution between resources and its value is greater or equals minus one true, ($\rho \geq -1$).

r = Homogeneity coefficient, reflect production flexibility for all production elements, which is a positive value.

e^u = The amount of error for the industry

⁽²⁾ For more information about the properties of this function, see:

1 -. Ali, K. J.(2011). Evaluation of the production of the general company for battery industry for the period 1992-2002 using the production function model, published research, *Diyal Journal For Pure Sciences*,7 (1), 1992-0784.

2-.20 - Shehata ,E. A. (2006). The role of technological change in the demand for agricultural labor in Egypt, published paper, *Egyptian Journal of Agricultural Economics*, 16(4), 1170-1155, 3-18.



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In order to estimate the function (1), it must be converted to a linear function. This is done by taking the natural logarithm of both ends, we get :

$$\ln Y = \ln A - \frac{r}{p} \ln[\delta K^{-p} + (1 - \delta)L^{-p}] + u \dots \dots (2)$$

Using a series (unscrewed) Taylor to approximate function (2) to be the substitution coefficient (P = zero) to become linear in the coefficients, we obtain the following function (Kmenta, 1971):

$$\ln Y = A + r\delta \ln(K) + r(1 - \delta)\ln(L) - \frac{pr(1 - \delta)}{2} [\ln(K) - \ln(L)]^2 + u \dots \dots (3)$$

The above function can be redrafted as follows:

$$\ln Y = B_0 + B_1 \ln(K) + B_2 \ln(L) + B_3 [\ln(K) - \ln(L)]^2 + u \dots \dots (4)$$

It should be noted here that, based on the results of equation (4), it is possible to determine whether the Cob-Douglas function is the accepted form of representation of the relationship between production and its components (Jia. 1991) through testing the statistical significance of the coefficient of the variable $[\ln(K) - \ln(L)]^2$,if the estimated coefficient is statistically unacceptable , in the sense that no different from zero, the equation becomes a function as, Cob-Douglas.

To illustrate the effect of technological changes, we have adopted two types, the first (T) refers to technological progress neutral (Disembodied), by adding the time variable to the (CES) function, the second is (T2) and refers to the changing and continuous technological changes, over time and it reflects the technological changes that take the form of instability (Weitzman, 1979), thus, the function becomes as follows:

$$\ln Y = a_0 + a_1 \ln(K) + a_2 \ln(L) + a_3 [\ln(K) - \ln(L)]^2 + T + T^2 + u \dots \dots (5)$$

- Model estimation and analyzing and discussing results :5

Through the use of using the ordinary least squares method (OLS),and enforcement, SPSS program. To estimate the coefficients of the production function No. (4), it was adopted the statistical, economic tests were adopted, the results of the estimate were as shown in Table (4).

Table (4)

Results of the function estimate for (CES₄) the cement industry in Iraq for the period (1990-2014)

Estimated parameter	estimated value	T-test
Constant	-1.851722	-2.012
LnK	0.082721	1.849
LnL	0.602765	2.210
$[\ln(K) - \ln(L)]^2$	-0.013141	-2.776
$R^2 = 0.739$ $R^2 = 0.702$ F = 19.856 D.W = 1.469		

Source: From the work of the researcher



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The results of the above, equation are shown its to be of high statistical significance, this is illustrated by the calculated value of (f) which were (19.856) which is higher than the tabular value at a significant level 5% and the estimated model, expound 70% of changes taking place in the cement industry in Iraq, while the remaining 30% was due to other independent variables that were not taken in the model, therefore, they are reflected in the error limit, on the other hand, the t-test reflects the significance of the estimated to parameters, at a significant level 1% and 5%.

Through testing of Durbin Watson (D.W) and its value(1.469) pointing to, that the function is free from the autocorrelation problem between the random errors.

Estimates obtained from the function were employed (CES₄) to estimate the flexibility of substitution, has been installed in the table (5).

Table (5)

The values of the coefficients of the estimated production elements of the production function, constant elasticity for substitution, of the cement industry in Iraq for the period (1990-2014)

The coefficient value	The coefficient
0.156967	<i>Effectiveness : A</i>
0.120675	<i>δ :Distribution</i>
0.685486	<i>r : Homogeneity</i>
0.361321	<i>Substitution: ρ</i>
0.7345806	<i>The elasticity of Substitution: σ</i>

Source: From the work of the researcher depending on the estimated results, for the function (CES₄)

Table (5) shows that Iraq's cement industry production efficiency not too bad, and for the distribution coefficient which was (0.120675) show implies that production expansion will be greater through investment in labour-intensive production techniques. As for homogeneity, the homogenization coefficient (0.685486) shows that the cement industry in Iraq characterized by diminishing the size returns, the results also showed the possibility of substitution and exchange between the production of the elements, in the cement industry in Iraq, according to the coefficient substitution and substitution elasticity, and that the flexibility of substitution σ , that is called the name of this model is not negative and less than one.

As previously stated in the function (5),that we can statement effect of technological changes on the cement industry in Iraq by adding the technological progress disembodied (T), and the variable technological variables that were expressed in the variable (T2). And results of the function were obtained as shown in the table (6).



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Table (6)

Results of the function estimate for)CES₅(the cement industry in Iraq for the period (1990-2014)

Estimated parameter	estimated value	T-test
Constant	-1.90323	1.163
LnK	0.04361	6.171
LnL	0.21859	5.078
[ln(K) - ln(L)] ²	-0.01051	-4.721
T	-0.05959	-3.571
T ²	0.00122	2.925
R ² = 0.842 R ⁻² = 0.801 F = 27.547 D.W = 1.278		

Source: From the work of the researcher

The results showed of the estimation, of the function shown in table (6) that the model was able to explain 80% of the changes, and the high value of the (F) test, where she was (27.547) reflects the explanatory power to the whole model at a significant level of 1% and 5%, on the other hand, the t-test reflects the significance of the estimated parameters at a significant level of 1% and 5%. The results showed that the function was free of the self-correlation problem through the (D.W) test (1.278), which is located in the Inconclusive region.

Table (7)

The values of the coefficients of the estimated production elements of the production function, constant elasticity for substitution, of the cement industry in Iraq for the period (1990-2014)

The coefficient value	The coefficient
0.14908629	<i>Effectiveness : A</i>
0.16632342	<i>δ :Distribution</i>
0.2622	<i>r : Homogeneity</i>
0.57816131	<i>Substitution: ρ</i>
0.63364879	<i>The elasticity of Substitution: σ</i>
-0.05959	<i>T</i>
0.00122	<i>T2</i>

Source: From the work of the researcher depending on the estimated results, for the function (CES₅)

It is clear from table (7) that all the results, were fully consistent with the basic function hypotheses, the coefficient of efficiency is greater than zero, the distribution coefficient was also greater than zero and less than one, the coefficient of homogeneity is greater than zero, the substitution coefficient is greater than the one negative, the elasticity of substitution is less than the one, this indicates the cement industry in Iraq tends to use labour instead of capital, any weakness of the possibility of substituting the element of capital lieu element



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work, which confirms this, is the value of the distribution coefficient, which indicates that the production method employed in this industry is relatively labour-intensive.

The negative value of the rate of the technological progress (T) (disembodied technological progress), which amounted to (-5.96%), indicates that there is no abstract technological progress in the cement industry in Iraq, while the positive value (T2) indicates that technological changes take the form of instability and change takes the form of leaps obtained through the introduction of advanced technology or access to inventive and inventions.

6. Conclusions and recommendations

6.1 Conclusions

1- The results of the study showed that the production function, constant elasticity for substitution, is the acceptable form to represent the relationship between production and its components and the analysis of the changes in the Iraqi cement industry. This was confirmed by the statistical significance of $(\ln K - \ln L)^2$ in the estimated model

2- The study showed that quantitative factors (labour and capital) are the main sources of growth in the output of the cement industry in Iraq, and the qualitative factors (technological progress) did not contribute effectively to achieving this growth.

3- The study pointed out that the cement industry in Iraq is going through stage, profligacy and wasting resources, and therefore the increase the volume of production for this industry will be accompanied by an increase in the average cost of production being, it, works in the stage of diminishing the yield. 4-It was also found that the elasticity of production for the labour component, was higher than the elasticity of production for the capital component, which confirms that the expansion of production will be greater through investment in labour-intensive production techniques. In other words, the contribution of the labour component is greater than the capital contribution in the production process.

5- The results showed that the model of constant elasticity, for substitution and with technological changes changing, has a high potential in describing and representing the production process of the cement industry in Iraq.

6- Results of the estimate indicate that the technological progress in this industry was not positive " in the sense that this industry does not keep up with the technological development that is taking place at the global level, they still rely on traditional methods in this industry.

6.2 Recommendations

1 - The need to focus efforts on the cement factories in Iraq and work to increase the concentration of investments directed at them in order to develop the industry and increase productivity instead of expanding them.



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2- Organizing the management of the production process and raising the performance which contributes to increasing the exploitation of existing production capacity and this will lead to a lift, increase the productivity of production factors through legislation regulating the process of granting bonuses in ways that lead to maintaining capital while increasing productivity.

3- Raise the level of technology used in the cement industry in Iraq and the creation of cadres working can deal with this advanced technology, which requires to change some aspects of education systems in the direction of vocational and scientific education

4-Training of manpower in the cement industry in Iraq, and rehabilitation them as required by production processes by urging employees to participate in training courses as well as linking wages to productivity.

5- Reviewing the strategies adopted in the cement industry in Iraq and encouraging them by providing support and protection for this industry and adopting an efficient pricing policy that ensures the development of this industry.

Sources and references:

Arrow, K., Chenery, H. B., Minhas, B. & Solow, R. M. (1961). Capital-labor substitution and economic efficiency, *Rev. Econ Stat.*, 43(3), 225-250.

Alpha Chiang,(1995). *Basic Methods in Mathematical Economics, Part I*, Arabization of Ne'matullah Najib, Dar Al-Marikh Publishing, Riyadh, Saudi Arabia,p419 .

Al-Mafarji, H. J. & Abdul-Jabbar, S. (2009). Estimation and analysis of production function in Karbala cement factory, 1995-2006, *Ahl al-Bayt Magazine*,11 (8), 204-217.

Ali, K. J. (2011). Evaluation of the production of the general company for battery industry for the period 1992 - 2002 using the production function model, published research, *Diyal Journal For Pure Sciences*, 7 (1), 1992-0784.

Al-Shukhari, O. (2004). *Principles of Microeconomics*, Algeria, university publications, ed. 6, p. 17.

Al - Baaj, T. J. (2012). Evaluation of the economic performance of Basrah cement factory, [Master Thesis]. Basrah: University of Basrah.

Central Bureau of Statistics and Information Technology Iraqi,(2016), *Final Accounts of Cement Companies in Iraq for the Period (2014-1990)*, p. 77.

Central Organization for statistics and information technology, *industrial statistics, final accounts of cement companies in Iraq for various years.*

Faiz , S.(2014).*The Reality of the Cement Industry in Iraq*, The Second Conference of the Cement Industry in Iraq - Sulaymaniyah, publications of the Ministry of Industry, pp. 21-29.

Griffith,W., Hill, R. & Judge, G. (1993). *Learning and Practicing Econometrics*, New York.

The Iraqi ministry of industry and minerals,(2016). *Final Accounts of Cement Companies in Iraq for Various years.*



Determining the sources of growth of the cement industry in Iraq (analytical study for the period 1990-2014)

The Iraqi ministry of planning, (2016). Central organization for statistics - directorate of standard numbers, various publications.

The Iraqi ministry of industry, (2014). Cement Industry in Iraq, publications of the ministry of industry and minerals.

Iraqi ministry industry and minerals, (2013). Publications of the Information Section, scattered pages.

The Iraqi ministry of industry and minerals, (2010). Publications of the Information Section, scattered pages.

Iraqi ministry industry and minerals, (2016). Publications of the Information Section, scattered pages.

Jia, L.(1991).A quantitative analysis of Chinese's industrial structure and technological change, *Applied Economics*, 23, 1733-1740.

Kmenta, J. (1971). *Elements of Econometrics*, Macmillan, New York.

Kementa, J. (1967) .On the Estimation of the CES Production Function, *International Economic Review*, Vol.8, 180-189.

Ministry of Industry and Minerals , General Company for Northern Cement,(2017). Ministry of Industry Publications, Retrieved from [www. ncsc - Iraq.gov](http://www.ncsc-Iraq.gov) .

Nazir , E. M. (2015). Building a standard model for estimating and analyzing the utilization rates of production capacities in the cement industry in Iraq for the period 1990 - 2013 , [Master Thesis].Baghdad: Faculty of Management and Economics, University of Mustansiriya.

Pappas, J. & Hirschey M. (1987). *Managerial Economics*, Dryden, N.Y..

Shehata ,E. A. (2006). The role of technological change in the demand for agricultural labour in Egypt, published the paper, *Egyptian Journal of Agricultural Economics*, 16(4), 1170-1155, 3-18.

Weitzman, M.L. (1979) . Technology transfer to the USSR, an economic analysis, *Journal of Comparative Economics*, 3(2).



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Annexe (1)

Gross value-added, wages and salaries at current prices in the cement industry in Iraq for the period (1990-2014)

(thousand dinars)

(3) Consumer Price Index	(2) Wages and salaries at current prices	(1) Gross value added at current prices	Years
161.2	24211	78859	1990
15461.6	142771	401399	1994
69792.1	362835	1143014	1995
93816.2	2509233	10976841	1999
98486.4	9514032	25562813.5	2000
230184.1	55650494	112437195	2004
315259.0	82520015	171721737	2005
63078.1	173397802	152582978	2009
646208.1	160985396	158914787	2010
753651.8	163760999	135581959	2014

Source: (1) Central Organization for statistics and information technology, industrial statistics, final accounts of cement companies in Iraq for various years.

(2) The Iraqi ministry of industry and minerals, (2016) , final accounts of cement companies in Iraq for various years.

(3) The Iraqi ministry of planning, (2016). Central organization for statistics - directorate of standard numbers, various publications.



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تحديد مصادر نمو صناعة الاسمنت في العراق (دراسة تحليلية للفترة 1990-2014)
د.سوسن علي محمود / كلية التمريض / جامعة بغداد

الخلاصة

الهدف من هذه الدراسة هو تحديد مصادر نمو صناعة الاسمنت في العراق للفترة 1990-2014، والإشارة إلى طبيعة التقدم التكنولوجي المستخدم فيها. ولتحقيق هذا الهدف، قمنا ببناء نموذج اقتصادي قياسي، من خلال تكييف دالة الإنتاج ذات المرونة الثابتة للإحلال، باستخدام الانحدار المتعدد، وتطبيق برنامج SPSS، واستخدام طريقة المربعات الصغرى العادية (OLS). وأظهرت النتائج أن العوامل الكمية (العمالة ورأس المال) هي المصدر الرئيسي لنمو صناعة الأسمنت في العراق، والعوامل النوعية (التقدم التكنولوجي) لم تسهم بفعالية في تحقيق هذا النمو. وأن تقنيات الإنتاج المعتمدة في صناعة الأسمنت في العراق هي كثيفة العمل. نوصي برفع مستوى التكنولوجيا المستخدمة في هذه الصناعة وخلق الكوادر القادرة على التعامل مع هذه التقنية المتقدمة، الأمر الذي يتطلب تغيير بعض جوانب النظم التعليمية في اتجاه التعليم المهني. المصطلحات الرئيسية للبحث/ صناعة الاسمنت ، دالة انتاج المرونة الثابتة للإحلال ، مصادر نمو.