



ESTIMATION OF PRODUCTION FUNCTION AND FINANCIAL ANALYSIS OF WHEAT CROP WASIT GOVERNORATE - ALHAFRIAN APPLIED MODEL.

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Abstract

Production function is one of the most important methods in the analysis of production components, Therefore, the research aims to study the effect of the productive factors in wheat production, as well as the financial analysis of the sample farms to determine the economic efficiency of wheat production, the results of the research were collected and analyzed according to questionnaire information that included 74 farmers which Specialists in wheat production, in Al-Hafriya district of Wasit governorate, the sample represented 5% of the study population, The double logarithmic function was one of the best estimated functions to express the relationship among wheat production, fertilizer, seeds, cultivated area and manual labor as independent variables, the results showed that the increase in fertilizer, cultivated area and seeds by 1% led to an increase in wheat production by 0.225, 0.620 and 0.525 respectively, this means also these resources were used in the second stage of production, while increasing manual labor by 1% caused a reduction of production by 0.17, and this resource was used in the final stage of production.

The total elasticity is the sum of the productive elasticities of the used factors which are equal to one, or increase or decrease, and expressed by the relative change in production as a result of the relative change in the total productive factors, which amounted to 1.19 and indicate that the increase in the production factors by (1%) leads to increase the production of the crop by (1.19), the criteria of financial evaluation were applied, including profit, net income, simple rate of return, return of the invested dinar, as well as the period of capital recovery, all these criteriaes indicate that wheat production is a profitable business with economic efficiency and economic efficiency, the research recommended the adoption of modern methods that contribute to increasing productivity and raising the efficiency of the agricultural worker through training.

Key words: wheat crop ; financial analysis and production function

Introduction

Wheat is one of the most important crops economically and strategically because it is linked to national food security and has contributions to the gross domestic product. Iraq is one of the first centers of wheat crop origin and has the factors of success of wheat cultivation and production, but the production of this crop is still low for several reasons such as not using modern technologies in crop management (Arhoma and Faisal 1998), the average of production per hectare in Iraq for the period 1959-1989 was (680 kg) (Barbaz, 2012), which is much lower compared to the global production rates and neighboring countries, for example the average of wheat production in China 6000 kg.h⁻¹ and in Egypt 8000

kg.h⁻¹ (Al-Roys, 2009), the wheat crop is also a staple in human food, due to the annual increase in population, we note the increasing need of this crop year after year, this requires additional efforts to maintain the balance between output and demand through the adoption of new scientific methods to develop the cultivation of wheat crop and exploitation of the available resources and factors of production such as land, water, seeds and fertilizers to reach the best production in quantity and quality (Al-Remaoy, 1996).

The expansion of the area cultivated with wheat crop and the increase in the productivity of the area unit of this crop led to increase the general output, which are two main objectives for each worker in this field, the use of advanced scientific methods in agriculture and the

management of the crop well in all stages of growth, (cultivation of high yielding cultivars according to their environmental requirements for each cultivar, attention to necessary management and necessary production factors such as recommended fertilizers, recommended irrigation, timely harvesting and pest control), the adoption of these factors achieves higher production (Zabon and Al-Healfy, 2014).

The role of global wheat crop production is important and effective in terms of area and food supply, and the economic reality of developing countries indicates that it suffers from the problem of the grain crops scarcity, especially wheat crop, and that the gap between agricultural production and local demand has increased over time, the cause of this problem is the presence of some economic constraints that limit the increase of production and the misuse of economic resources, so the subject of agricultural, especially grain crops, including wheat crop, an important topics confirmed by several studies, the problem of research is that Iraq suffers from a lack of production of wheat crop, and not meet the local demand in most years, which led to increased imports to meet this need, wheat crop has been selected because it one of the most consumed crops, flour is made from it, which is the basis of loaf of bread, which is the basis of the meal of most countries of the world (Al-Azzy, 1989).

Research problem

Although Iraq is considered an agricultural country, but it is facing a serious challenge now, as such as the shortfall in food production, especially in grain crops and compensation through the importation of most of the needed quantities for local consumption, Iraq has large areas suitable for agriculture, especially the wheat crop, but it has not been exploited due to the lack of production and high production costs, as well as the reluctance of many farmers to cultivate this important strategic crop because of the low returns achieved as a result of the use of traditional methods in agriculture, so must use advanced scientific methods that achieve the high productivity and the exploitation of the available resources and tools in the best way to reach the best quality and quantity of production.

Research objective

The research aims to:

1. Study the factors which effect on the wheat crop production in Wasit Governorate by estimating and analysis the production function.
2. Conduct a financial and economic evaluation of the

study sample.

Search Hypothesis

Iraq faces the problem of low production of wheat crop compared to advanced and developing countries, the failure of this production to meet the needs of the local market despite the increasing need for this crop year after year, as well as the lack of optimal use of economic resources, which has reduced the level of economic efficiency than required.

Materials and methods

The data were obtained by using a questionnaire form that prepared for this purpose, the data were collected from 74 farmers by random sampling method, which represented 5% of the farmers in the study area (Wasit governorate, Al-Hafria district) and the personal interview, the economic and social characteristics of the research sample will be explained later, the study adopted the quantitative method in estimating the function of the production by using the Ordinary Least Squares (OLS) method and using several statistical formulas using the statistical program (SPSS), as well as the use of financial analysis tools, which include some criteria of evaluating projects using Excel program.

Results and discussion

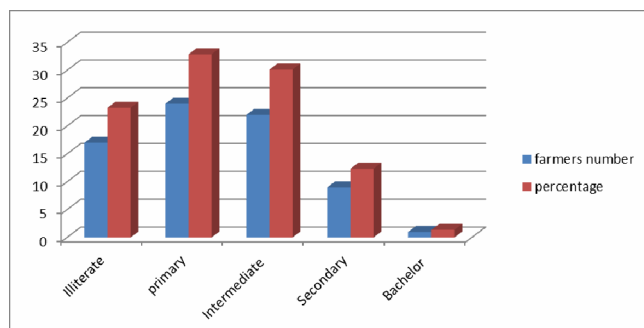
First: the economic and social characteristics of the farmers of the research sample.

The educational level of the farmers of the research sample:

It is scientifically proven that the productivity of the worker increases with his educational level increase, the education is of great importance and an important role in increasing production. In order to identify the educational level of the research sample, farmers were divided into “illiteracy, primary school education, intermediate school education, secondary school education and bachelor’s degree” to identify the educational level of the research sample, the results of fig. 1 show that the level of education is low in the research sample, most of the farmers are primary certificate holders by (32.29)%, followed by the intermediate school education class by (30.88)%, then the uneducated farmers by (23.29)%, then secondary school education by (12.33)%, finally the university education level by (1.37)%.

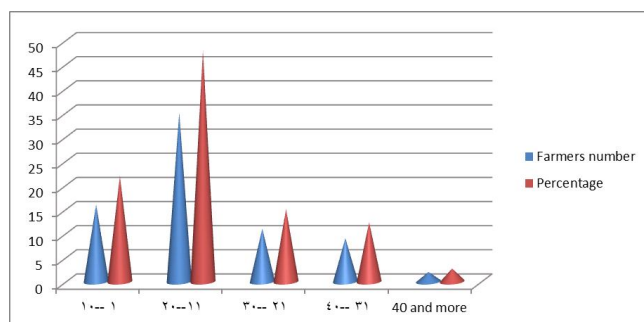
Experience and practice in crop cultivation

Agriculture is the main resource which the people depend on it and effective if its resources used in the best way, also the development of the human can only be achieved through education and knowledge and transfer



Reference: calculated by the researcher according to the questionnaire using excel program.

Fig. 1: educational level of research sample



Reference: calculated by the researcher according to the questionnaire using excel program.

Fig. 2: Years of Experience of sample farmers

of the latest scientific research results in agriculture to increase productivity and improve the level of agricultural knowledge and modernize the methods of the farmers performance in the agricultural work, the skill and experience used in the agricultural production process aims to diversify production on one hand and reduce production costs on the other, in order to identify farmers' experience in agriculture, the farmers were divided into categories representing the years of experience (1-10)

years, (11-20 years), (21-30 years), (31-40 years), (41 years) as shown in fig. 2, this shows the frequency distribution of years of experience among farmers, which indicated that the highest percentage was (47.94%) of the research sample farmers have experience in producing the crop was within the second category (11-20) years of experience, the highest percentage of farmers have experience in this crop production, this confirms that the wheat crop of basic crops, which have been cultivated for a long time in this Governorate.

Second: Financial analysis.

The financial analysis is a major part of the researchers and specialists interest, because it is one of the important administrative topics of the institution to know its financial position and address weaknesses according to the results of this analysis and making the right decisions, therefore, the financial analysis is a science that has rules, criteria and bases that deal with the data and information related to the financial statements of the establishment and the necessary classification, then subject them to a detailed study to find the link and the relationship among them (4), a number of criteria were applied for this analysis, including :

Costs:

There is no production process for goods without spending money to purchase and process production resources or factors of production which contribute in the production process (land, labor, equity capital, management), Production costs are one of the important elements in determining the amount of profit that the producer seeks to obtain through the production process, costs can be expressed in general term as the product's total cost of producing goods and it is usually expressed in cash, which is the total amount spent by the production

Table 1: Costs items of the study sample and its averages (IQD).

Categories (donum)	Average of variable costs IQD.donum ⁻¹	Total variable costs IQD	Average of fixed costs IQD.donum ⁻¹	Total fixed costs IQD	Average of total costs IQD.donum-1	Total costs IQD	Average cost of ton production
1-10	319.901	2271000	70.281	4990000	390183.12	27703000	517.813
11-20	272.702	6299500	56.199	12980000	328896.93	75975000	424.441
21-30	236.089	5548100	39.255	9225000	275344.31	64706000	365.570
31-40	284.515	53489000	39.680	7460000	324196.51	60949000	444.883
41-50	236.089	103058000	33.094	10389000	243972.17	113447000	351.229
51-60	220.816	154130000	35.133	24523000	255949.26	178653000	437.875
61-70	383.145	260539000	24.588	16720000	460019.45	277259000	407.734
71-80	186.062	29770000	9.193	1471000	195256.82	31241000	205.532
81-90	250.312	44055000	31.426	5531000	281738.31	49586000	538.978
91-100	409.576	120825000	19.572	5774000	429149.15	126599000	870.207

Reference: calculated by the researcher according to the questionnaire using excel program.

establishment to purchase input used in the goods production (output) (Zabon and Al-Healfy, 2014), the results of table 1 shows the variable and fixed cost items and their average, the total variable costs (942609000) IQD and the fixed costs (99063000) IQD and the total costs amounted to (1041672000) IQD, and the lowest cost of the unit area of category 71-80 donums, this category was distinguished because the production factors are benefiting from the expansion of the size of ownership, while the cost average of production per ton reached highest value in the last category (870.20) IQD, due to the large cultivated areas and the lack of feasibility of large areas, which resulted in the weakness of management and the inability to reduce the average cost with the expansion of area in this category, which range from (91-100) donums, which makes the cost average of ton production is higher compared to other ownerships categories which have less area.

Net income criteria :

The net farm income is one of the main criteria which used to measuring the farm economic efficiency and is an important indicator used to formulate economic policies in the agricultural sector (Al-Azzy, 1989), when calculating this criterion at the level of the sample groups as shown in table 2, which shows that the total farm net income amounted (537715000) IQD, while the average of farm net income per donum (1956053.96) IQD, the average of net farm income increased to (506937.50) IQD in the eighth category, This is due to the fact that the farms in this category achieved the highest productivity in the research sample by (0.8) ton.donum⁻¹, as mentioned earlier that land ownership is reflected positively on the income per donum thus on the rate of farm net income per donum, while it decreased to

Table 2: total farm net income and its average (IQD).

Categories (donums)	Average of donum income IQD.donum ⁻¹	Average of variable costs IQD.donum ⁻¹	Total income (IQD)	Variable costs (IQD)	Farm net income	
					average	total
1-10	500.633	319.901	35545000	22713000	180732.39	12832000
11-20	501.536	272.702	115855000	62995000	228831.16	52860000
21-30	388.808	236.089	91370000	55481000	152719.15	35889000
31-40	544.574	284.515	102380000	53489000	260058.51	48891000
41-50	491.139	236.089	228380000	103058000	269509.67	125322000
51-60	374.727	220.816	261560000	154130000	153911.17	107430000
61-70	446.897	383.145	303890000	260539000	63751.47	43351000
71-80	693.000	186.062	110880000	29770000	506937.50	81110000
81-90	344.034	250.312	60550000	44055000	93721.59	16495000
91-100	455.457	409.576	134360000	120825000	45881.35	13535000
Total	4740.805	2962.378	1444770000	942609000	1956053.96	537715000

Reference: calculated by the researcher according to the questionnaire.

(45881.35) IQD in the tenth category with the lowest yield rate (0.5) tons.donum⁻¹.

Economic profit criterion :

It is not an exaggeration to confirmation on the importance of profits in the economy, which is based mainly on the private project, because of the hope of profit and the fear of loss which is the main objective of the producers, and on the basis of profits the decisions are made (Fayad, 2013), one of the basic assumptions which the producers are based on it to achieve them objectives , this objective is achieved when the difference between gross revenue and total cost is increased (Al-Qaissy, 2011a), It is one of the reliable criteria to determine the success of the project or its failure to achieve the largest possible profit within the financial analysis of

Table 3: economic profit of research sample.

Categories (donums)	Average of donum income IQD.donum ⁻¹	Average of total costs IQD.donum ⁻¹	Total income (IQD)	Total costs (IQD)	Economic Profit	
					average	total
1-10	500.633	390183.12	35545000	27703000	110450.7	7842000
11-20	501.536	328896.93	115855000	75975000	172640.7	39880000
21-30	388.808	275344.31	91370000	64706000	113463.8	26664000
31-40	544.574	324196.51	102380000	60949000	220377.6	41431000
41-50	491.139	243972.17	228380000	113447000	247167.7	114933000
51-60	374.727	255949.26	261560000	178653000	118777.9	82907000
61-70	446.897	407733.82	303890000	277259000	39163.2	26631000
71-80	693.000	195256.82	110880000	31241000	497743.7	79639000
81-90	344.034	281738.31	60550000	49586000	62295.4	10964000
91-100	455.457	429149.15	134360000	126599000	26308.4	7761000
Total	4740.805	3132420.4	1444770000	1006118000	1608389.1	438652000

Reference: calculated by the researcher according to the questionnaire.

projects, which is the main objective of any project. Table 3 shows that all ownerships categories achieved a positive different profit among them when applying the criterion of economic profit as shown in Table 3, The average economic profit was the largest in category 8 because this category achieved the highest productivity which was (0.8) ton.donum⁻¹, the increase in profits is due to the efficiency of investment of available resources and the increase in the output value as well as the decrease in fixed costs, including land rent, while the tenth category achieved the lowest profit (26308.4) IQD per donum.

Capital Recovery Period: The capital recovery period is the expected period of recovery of the original expenditure during this period, on this basis, the project which cash inflows cover the value of capital expenditure is faster than the project that takes longer (Al-Qaissy, 2011b), The results of table 4 showed that the period of capital recovery was (0.69) year at the level of the studied sample and ranged (0.94) as a maximum in tenth category and (0.28) as lowest in eighth category, all sample categories were able to recover their capital during nine months, which is less than one year, this corresponds to the nature of wheat crop cultivation and the duration of its stay in the land, the capital recovery period for all sample groups is excellent for encouraging of investment in this sector and the cultivation of such strategic crops, especially that the crop of subsidized crops as its price is determined by the state and this contributes to reduce the price risk and contributes in achievement of guaranteed profits for farmers, whatever the quantities of them production despite the existence of administrative and marketing complications in the marketing path of the wheat crop.

Simple rate of return : The simple rate of return is

Table 4: Capital Recovery Period of research sample (IQD).

Categories (donums)	Total costs	Economic profit	Capital Recovery Period
1-10	27703000	7842000	0.78
11-20	75975000	39880000	0.65
21-30	64706000	26664000	0.70
31-40	60949000	41431000	0.59
41-50	113447000	114933000	0.49
51-60	178653000	82907000	0.68
61-70	277259000	26631000	0.91
71-80	31241000	79639000	0.28
81-90	49586000	10964000	0.81
91-100	126599000	7761000	0.94
Total	1006118000	438652000	0.69

Reference: calculated by the researcher according to the questionnaire.

one of the traditional financial valuation criteria that does not take into account the time value of money, it is calculated according to the following equation:

$$\text{Simple rate of return} = \frac{\text{average annual profit}}{\text{investment expenses}} \times 100$$
 When comparing the projects with each other, the project that achieves a higher return average is preferred and provided that the simple rate of return exceeds the cost of capital or equal with it when the project is accepted, while if the project achieves a lower rate of return than the conventional interest rate at the banks, the project will be rejected (Al-Mashhadany, 2002), the results of table 5 show that the simple rate of return was 43% in the research sample, the eighth category gave the highest percentage by (254%), and because it has achieved the highest return compared to other categories are preferred, while the results of the same table show that the tenth category achieved the lowest rate by (6.15%).

Table 5 : Simple rate of return of research sample

Categories (donums)	Economic profit (IQD)	Total costs (IQD)	% of simple rate of return
1-10	7842000	27703000	28%
11-20	39880000	75975000	52%
21-30	26664000	64706000	41%
31-40	41431000	60949000	67%
41-50	114933000	113447000	10%
51-60	82907000	178653000	73%
61-70	26631000	277259000	9.6%
71-80	79639000	31241000	254%
81-90	10964000	49586000	22%
91-100	7761000	126599000	601%
Total	438652000	1006118000	43%

Reference: calculated by the researcher according to the questionnaire.

The return of the invested dinar : The return of the invested dinar is one of the used criteria as an indicator of the financial evaluation of the production units performance, it is no different from the net present value of investment in its uses, in terms of the required information for evaluation of past perform and looking through indicators to correct financial problems, and supporting the positive factors in the project's practices financially (Case *et al.*, 1999), the return of the invested dinar is calculated by dividing the annual revenues of the project by the annual costs of the project, when the ratio of return to cost is greater than one, the projects are economically feasible and mean the financial success of the production unit (Mashhadani, 213,2002), table 6 shows that all categories achieved a return more than one, it reached in the studied sample (1.435) and the best return

of the invested dinar in eighth category (3.549), while the lowest return of the invested dinar was in the tenth category (1.061), we can note from the above that all groups of the research sample achieved profits and was characterized by economic feasibility according to the results of the criteria of return of the invested dinar.

Table 6 : The return of the invested dinar of research sample.

Categories (donums)	Return of the invested dinar
1-10	1.283
11-20	1.549
21-30	1.412
31-40	1.679
41-50	2.013
51-60	1.464
61-70	1.096
71-80	3.549
81-90	1.221
91-100	1.061
Total	1.435

Reference: calculated by the researcher according to the questionnaire.

Third : production function.

The producers in the market economy are responsible for making decisions in the manner of using the available resources, the importance of these decisions is not only related to the producers, but also it has impact on the society, because the rational exploitation of the enterprise and the development of production techniques increase production and income and contribute to increasing the welfare of society, production theory is a planning tool used in the management of enterprises that contribute to the rationalization of decisions which taken by producers on the basis of the principles and criteria of methodology and objectivity rather than relying on the trial and error approach, including the production function which represents the quantitative relationship between production factor services and the produced products by any project within a specified period (Debertin, 1986), it shows the number of produced units as a function of the used units for productive resources (Doll, 1978), the output function shows the advantage of the technique in specified period, this meaning that we can represent the technical state of the output unit in the output function (Donald and Malone, 1981).

Several mathematical models have been formulated to represent the relationship between the total output of wheat yield (in Alhafrea district) as a dependent variable and the independent variables, including the linear function, the double logarithmic function, and the inverse logarithmic function, for the purpose of obtaining the model which

used in study of production function by using the Ordinary Least Squares (OLS), The results of the study showed that the double logarithmic function is one of the best functions in terms of evaluation of the estimated treatments and the representation of the productive relationship according to the logic of economic theory as well as passing the statistical and standard tests table 7. The function formula was as follows:

$$\ln Y = \ln B_0 + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4$$

Y= Dependent variable that represents the production of the wheat yield (ton).

X₁= represents field labor and includes worked hours (hours).

X₂= Fertilizers (kg).

X₃= The cultivated (donum).

X₄ = the seeds (kg).

B₀ = fixed factor.

B_s = function treatments which will be estimated.

U_i = random variable includes other related variables that did not placed in the model.

Table 7: Parameters of the dual logarithmic output function of wheat crop.

Variables	Parameters	T-test	Sig
ln B ₀	0.288	-0.174	0.836
lnX ₁	-0.172	-2.95	0.004**
lnX ₂	0.225	2.96	0.004**
lnX ₃	0.620	1.53	0.029*
lnX ₄	0.525	1.23	0.222
R ²	0.869		
Adjusted R	0.861		
F	105.93		
r	0.93		
D.W	2.097		
VIF	7.14		

Reference: calculated by the researcher according to the results of the estimated function using the statistical program SPSS.

*= significant at level (0.05) . **= significant at level (0.01).

Economic Analysis :

All the studied variables were compatible in terms of values with economic logic, which proves a positive relationship among them and the quantities produced except field labor, the negative sign is pointing to the inverse relationship between labor and wheat production, this is of course contrary with the logic of economic theory, this is due to the use of manual labor by a large percentage especially family work, which is a surplus also it caused disguised unemployment on the one hand and it is an unskilled work on the other hand, the value of

the parameter in the double logarithmic function represents the production elasticity, this means that the increase in fertilizer, cultivated area and seeds by 1% led to increase wheat production by (0.225, 0.620, 0.525) respectively and also means that these resources were used in the second stage of production, but the increase of manual labor by 1% leads to production decrease by 0.17 and this resource used in final stage of production stages, the total elasticity is the sum of the productive elasticities of the used resources, which equals the one, or more or less, and is expressed by the relative change in production as a result of the relative change in the total productive resources, which amounted 1.19 also it indicates that the increase of used resources by (1%) leads to an increase in crop production by 1.19 which means that it is possible to increase the total production incrementally by adding the used resources at fixed rates, in other words, the increase in the used resources leads to production increased, that's means the producer can add a new units of these resources to obtain an increase in total production is greater than the increase in rate of added resources (FAO, 2003).

Statistically, the results of the table showed that there is significant differences in the labor and fertilizer variables at the level (0.01) and the cultivated area variable is significant but at the level 0.05, as well as when the test of function according to F test which reached (105.93), it was significant as a whole at the level (0.01), this indicates to the importance of the independent variables included in the model on the one hand and the reality of the function on the other hand, The value of the (R Square Adjusted) R^2 (0.869) indicates that about (87%) of the fluctuations in the total output of the wheat crop are due to the independent variables in the model, while (13%) of the fluctuations are due to other variables not included in the model, and its effect appeared in the random variable.

Standard Analysis:

The problem of Auto-Correlation:

One of the important assumptions on which the Ordinary Least Squares (OLS) model is based is the independence of random error limits values, in the case of non-independence of the error limits, this means auto-correlation.

Durbin Watson test is used to detect this problem, the results of the test showed that there was no auto-correlation among the values of the Residuals according to the (D.W) test, The calculated value of (d^*) was 2.09 which is greater than the (d_u) 1.58 and less than the (d_{4-4}) value (1.91), ($2.09 < 1.58 < 1.91$) at the level (0.01), indicating that it occurred in the rejection area of the

alternative hypothesis and accepting the null hypothesis.

The problem of Heteroskedasticity:

The Ordinary Least Squares (OLS) method assumes that the probability distribution of the random variable (U_i) remains the same unchanged around all (X) values, meaning that the (U_i) variation is constant for all values of the explanatory variables (Gujarati, 2004).

$$\text{Var}(U) = E[U_i - E(U_i)]^2 = E(U_i)^2 = 6^2u \text{ (constant)}$$

This hypothesis is characterized by the constant variance of (U_i) values, the failure to achieve this hypothesis means that the error variance is not homogeneous, so the values of the random variable are heterogeneous (Khan *et al.*, 2010), When the (Park test) was applied to detect this problem, it was clear that it did not exist in this model.

Mean square error test with the variable logarithm:

$$\text{Ln}u_i^2 = 3.6 + 1.85\text{ln}x_1$$

$$T(1.103)$$

$$\text{Ln}u_i^2 = 11.03 - 0.745\text{ln}x_2$$

$$T(0.592)$$

$$\text{Ln}u_i^2 = 10.06 - 0.627\text{ln}x_3$$

$$T(0.585)$$

$$\text{Ln}u_i^2 = 8.67 - 0.914\text{ln}x_4$$

$$T(0.717)$$

The problem of Multicollinearity:

This problem was detected using a Variance Inflation Factor (VIF) test that reached 7.1 and it indicated that there was no problem of Multicollinearity and the logarithmic formula reduced its appearance (Food and Agriculture Organization, 2011).

Conclusions and recommendations

The research concluded that there is a clear effect of ownership on the costs average, this average decreased in the category 71-80 donums, all the criteria were positive and confirmed that wheat cultivation is a profitable activity with rapid economic return, as well as the cultivated area, seeds and fertilizers positively affected on the quantity of wheat production, While manual labor had negative effect because of its disguised unemployment and lack of skill (Mansfield, 1970).

Therefore, the study recommends to adoption of modern production methods that contribute to increasing productivity such as cultivating improved cultivars and introducing modern technology in wheat cultivation, and develop the administrative capacity of farmers through courses and arts to make them able to mix elements of

production, the government support must also continue to support the prices of the crop as well as provide the production requirements, especially the fertilizers with appropriate quantities and dates (Kout, S. 1977).

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