TECHNICAL EFFICIENCY ANALYSIS FOR WHEAT PRODUCTION IN EGYPT

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تحليل الكفاءة الفنية لإنتاج القمح في مصر

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ABSTRACT

This study has focused on estimate the technical efficiency of the main governorates of wheat production in Egypt during the time period 1990-2012. We apply the stochastic frontier approach for efficiency measurement. The specifications of Battese and Coelli (1992) is employed. The results indicate that the levels of technical efficiency vary among the different governorates of wheat production in Egypt.

Keywords: wheat, stochastic model, efficiency, Egypt

الملخّص

هذه الدراسةِ ركّزتْ على تقدير الكفاءة الفنية للمحافظات الرئيسيةِ لإنتاج القمح في مصر أثناء الفترة الزمنية 1990-2012. فى هذة الدراسة نطبق نظرية استوكاستك ((Battese and Coelli (1992)). تُشيرُ النَتائِجُ إلى َتفاوتُ مستويات الكفاءة الفنية بين المحافظاتِ الرئيسيةِ لإنتاجِ القمح في مصر.

INTRODUCTION

Egypt occupies the north-east corner of Africa and lies between latitudes 22°N and 32°N and longitudes 25°E and 36°E. Most of the country has a hot sub-tropical desert climate. Winters are without frost, but sufficiently cool for wheat. Rainfall is negligible. No crop can be grown in this climate without irrigation. The mean daily temperature during the wheat growing period range from 15.7°C to 21.4°C. In Egypt wheat is the most important winter crop grown. It is produced widely in both the older farming lands of the Delta and in the newly-farmed lands reclaimed from the desert. For over 97% of the total wheat crop, the soft varieties dominate domestic production. The exception to this is found in the southern governorates of Assuit, Menia, and Suhag, where some hard to extra-hard types (durum) of wheat are grown (Tyner et al., 1999).

Total planted area grew due mainly to an increase in government procurement prices, the improved profitability of wheat-based rotation, the implementation of more productive cultural practices, and more liberal policy environment, which allowed farmers to base their crop planting decisions on market forces and provided them with an incentive to adopt modern technology. All these factors reinforced each other in making investment in wheat production a more attractive and lucrative enterprise (USDA, 1997; Kherallah et al., 2000). The vast majority of Egyptian wheat farms are small, irrigated, and owner-operated. Irrigation is almost universal in Egyptian agriculture, allowing the cultivation of summer and winter crops. In the frontier, irrigation water comes from wells. Wheat plays an important role in farmers' crop rotations. The most common winter-summer rotations are wheat-rice, clover-cotton, wheat-maize, and clover-maize (Kherallah et al., 2000).

Egypt has one of the largest per capita consumption levels of wheat in the world, and it is one of the world's largest importers of wheat. Two major factors are seriously increasing the rate of change in domestic wheat consumption; the rate of population growth and the rate of growth in wheat consumption per capita. These two factors are, consequently, affected by numerous other factors such as the adopted economic policies, income and its distribution among individuals, and the rate of change in prices (Tyner et al., 1999). The Government of Egypt (GOE) does continue to intervene in several markets, including the wheat market. At the same time policy makers try to look ahead to design new policies which aim to achieve greater food security. On the supply side, GOE policy is to achieve the highest possible self-sufficiency in wheat, basically to avoid international risks in wheat markets. Government procurement is typically at prices that are mostly higher than world equivalent prices. A further important contributing factor was raising yields after 1986 due to the diffusion of high-yielding long-spike varieties. Government intervention aimed at increasing self-sufficiency in wheat, thus reducing dependency on imports through support prices provided to wheat farmers and expansion of wheat area (Croppenstedt et al., 2006).

The technical efficiency of wheat production in Egypt is very important indicator because it provides more precise information about what happen in the production process. The objective of this study is to examine the input-output relationship of wheat production and estimate the technical efficiency of the main governorates of wheat production in Egypt during the time period 1990-2012.

The paper is organized as follows: the next section presents the literature review; Section 3 contains the methodology; Section 4 explains the empirical model. Section 5 describes the data; Section 6 indicates the results, and the final section presents the conclusions.

Literature Review

Two approaches can be applied to estimate the technical efficiency, the Stochastic Frontier Analysis (SFA), which is parametric, and Data Envelopment Analysis (DEA), which is nonparametric. The two alternative approaches have different strengths and weaknesses (Hossain et al., 2012). The main advantages of DEA are its computational simplicity and DEA-based estimate not require any information more than output and input quantities. However DEA is sensitive to measurement errors or other noise in the data because DEA is deterministic and attributes all deviations from the frontier to inefficiencies. The main advantages of SFA are that it considers stochastic noise in data and also allows for the statistical testing of hypothesis concerning production structure and degree of inefficiency. The main weaknesses are that it requires an explicit imposition of a particular parametric functional form representing the underlying technology and also an explicit distributional assumption for the inefficiency terms. However, from the most recent works in the agricultural field we can observe an increasing in the use of SFA. The reason is that most of the initial disadvantages of SFA have been overcome (Headey et al., 2010). The prior specification of the functional form is no longer a major issue as a number of flexible forms, such as the translog, provides suitable second-order approximations. Another potentially restrictive feature is that SFA can only handle single-output and multiple-input production processes, but this is no longer a critical constraint because of techniques that designed to directly estimate the input and output distance functions. These distance functions by definition are very general and provide a stochastic alternative to their computation using DEA (Coelli and Perelman, 2000; and O'Donnell and Coelli, 2005). Moreover, these distance functions can be estimated using standard software like FRONTIER program (Coelli et al., 2005), so computational complexity is no longer an issue. In addition that SFA has overcome some of the initial disadvantage, from the empirical point of view it is highlighted that the most important potential advantage of SFA is that it can separate noise in the data from genuine variations in efficiency, whereas DEA attributes all measurement errors or omitted variable effects to inefficiency. This can lead to DEA results are difficult to interpret. Furthermore, with SFA the variability in production data is captured in standard errors around the estimated efficiency scores, allowing saying something about confidence intervals (Headey et al., 2010).

There have been many applications of frontier production functions to agricultural production over the years. Battese and Coelli (1995) applied the stochastic frontier production function (Cobb-Douglas form) for panel data of paddy farmers from the Indian village of Aurepalle. These data were collected by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) from 1975-76 to 1984-85. The output was the total value of output, while the inputs were land, the proportion of the operated land that was irrigated, labor, bullock labor, costs (refers to the value of fertilizer, manure, pesticides, machinery, etc), age, and schooling. The results indicated that the model for the technical inefficiency effects, involving a constant term, age and schooling of farmers and year of observation, was a significant component in the stochastic frontier production function. The application also illustrated that the model specification permits the estimation of both technical change and time-varying technical inefficiency, given that inefficiency effects were stochastic and had a known distribution.

Coelli and Battese (1996) applied the stochastic frontier production function model (Cobb-Douglas form), and used the specification of Battese and Coelli (1995) on the three villages of Aurepalle, Kanzara and Shirapur, which were selected by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) for the in-depth study of the farming operations involved because they were considered broadly representative of the semi-arid tropics of India. The numbers of farmers involved in survey at the three villages are 34, 33 and 35 for Aurepalle, Kanzara and Shirapur, respectively. The output was the total value of output from the crops which were grown, while the inputs were land, labor, bullock labor, cost of other inputs, age of farmer, and schooling of farmer. The results indicated that the efficiencies differ substantially within each village. They ranged from quite small values of less than 0.1 to values in excess of 0.9. The mean efficiencies of the farmers in the three villages did not appear to differ substantially. They were 0.747 for Aurepalle, 0.738 for Kanzara and 0.71 1 for Shirapur.

Goyal and Suhag (2003) examined the technical efficiency of wheat farmers in Haryana state of India. They estimated a stochastic frontier production function of Cobb-Douglas form for three years from 1996-97 to 1998-99, and they used the specification of Battese and Coelli (1992). The farm level panel data was collected from 200 farmers spread over in each year. The output was the quantity of wheat while the inputs were human labor, quantity of fertilizer, irrigation expenditure, value of seeds, land area, and capital expenditure. Results indicated that technical efficiencies were time varying and declined over time. The mean technical efficiency declined from 0.92 in the first year to 0.90 in the third year.

Hassan and Ahmad (2005) estimated the technical efficiency of wheat farmers in the mixed farming system of the Punjab, Pakistan by using stochastic frontier production function, incorporating technical inefficiency effect model. The study used the primary data which were collected from 112 wheat farmers. The Cobb Douglas production function was found to be an adequate representation of the data, and they implemented the specification of Battese and Coelli (1995). The mean technical efficiency of wheat farmers was 0.936 ranging between 0.58 and 0.985. The results of frontier model indicated that wheat production could be increased by increasing wheat area, weedicide, cultivations and fertilizer use. The results of the inefficiency effect model indicated that the technical inefficiency could be reduced by sowing the crop in time, increasing education of the farmers, providing credit to the farmers and sowing the crop by drill method. The shortage of the canal water on the other hand increased the inefficiency of the wheat farmers in the mixed farming system of the Punjab. The individual impacts of some variables in the inefficiency effect model were non-significant, but the combined influence of all the variables (wheat area, irrigation, weedicide, cultivation, fertilizer, manure, family labor, and seeds) was significant in reducing the inefficiency of the wheat farmers in the mixed farming system of the Punjab.

Covaci and Sojková (2006) explained the technical efficiency among farms in Slovakia. The data employed for the stochastic frontier model (translog functional form) are taken from a sample of farm data obtained from the Research Institute of Agricultural Economics and Nutrition in Bratislava (VÚEPP) from 2000-2004. Two stochastic frontier model specifications were employed, the Battese and Coelli (1992), and the Battese and Coelli (1995). The output was the wheat production and the inputs comprised seed, fertilizers, chemicals, and land. Technical efficiencies of wheat production were 0.7587, 0.9086, 0.7764, 0.6141, and 0.8655 respectively for the period from 2000 to 2004.

Kachrooa et al. (2010) estimated the technical efficiency of wheat farmers under dryland and irrigated conditions in the Jammu district of Jammu and Kashmir state, India for the year 2006 in a Cobb-Douglas production function, and they applied the specification of Battese and Coelli (1992). The information was collected by interviewing the farmers personally and the farmers were selected by simple random sampling to constitute the sample of 200 farmers from the whole area under study. The output was the quantity of wheat yield and the inputs were wheat area, quantity of seeds, quantity of fertilizers, and labor. The stochastic frontier production function has been used to estimate the technical efficiency of these farmers. The estimated mean technical efficiency of wheat farmers under dry condition has been found to be 0.84, indicating 84 percent efficiency in their use of production inputs, and for irrigated condition it has been found to be 0.88, that means the average output of wheat could be increased by 12 percent by adopting technology properly.

Kaur et al. (2010) analyzed the technical efficiency in wheat production across different regions of the Punjab state, India. It is based on the cross sectional data collected from a random sample of 564 farm households comprising 58, 318, and 188 households from semi-hilly, central and south-western regions for the year 2005-06. The study implemented the stochastic frontier production approach, in the Cobb-Douglas production function, and they used the specification of Battese and Coelli (1992). The output was the quantity of wheat and the inputs were wheat area, expenditure on plant protection chemicals, irrigation, human labor, machine labor, quantity of chemical fertilizer, and regional dummies. The mean technical efficiency of wheat production has been found 87 percent, 94 percent, 86 percent and 87 percent in semi-hilly, central, south-western and Punjab state as a whole, respectively. The results signified that farmers of the central region do not have much scope to increase productivity of wheat through technical efficiency improvement under the existing conditions of input-use and technology. In the semi-hilly and south-western regions, the yield of wheat can be improved to the extent of 13 percent and 14 percent, respectively through adoption of better practices of technology.

Reddy (2012) applied the stochastic frontier production function (Cobb-Douglas form) for panel data on districts at Orissa state in India. The author used the specification of Battese and Coelli (1995). The database of the International Crops Research Institute for Semi-arid Tropics (ICRISAT) district level from 1971 to 2008 is used for the study. The whole study period from 1971 to 2008 is divided into two periods (period-I: 1971-1990 representing pre-liberalization of Indian economy; period-II: 1991-2008 representing post-liberalization). The analysis is done for the old undivided 13 districts. The output was the Gross Value of Agricultural Production (GVAP), while the inputs were gross cropped area, gross irrigated area, rural agricultural workers, total adult male buffalo and cattle population, number of tractors, quantity of fertilizer, area under high yield varieties, and time variable. The variables which may influence the efficiency of a district are loans, rainfall, rural literates, length of roads, pulses area, oilseeds area, high value crops (HVCs) area (sugarcane, cotton, fruits, vegetables and spices), central table land dummy, eastern Ghat dummy, and coastal plain dummy. The results revealed that the Gross Cropped Area (GCA), cattle population and number of rural agricultural workers have positive and significant influence on district level GVAP. Time is not significant, which infer that there is no significant technological progress during the past 37 years. Inefficiency of district crop production is negatively affected by rainfall, number of rural literates, and area under pulses, oilseeds and HVCs.

We did not find sufficient empirical works that estimate the technical efficiency of wheat production on the level of governorates in Egypt. Therefore, from this perspective this is a novel work. From the point of view of establishing an agricultural policy for Egypt, the contributions of this work are important because it provides recommendations for improvement.

Methodology

Technical efficiency (TE) represents the capacity and willingness of an economic unit to produce the maximum attainable output from a given set of inputs and technology (Koopmans, 1951). Technical efficiency can be estimated by employing different approaches and these include stochastic production frontier (parametric approach) and data envelopment analysis (nonparametric approach). Data envelopment analysis works under the assumption of no random shocks in the data set. Farmers always operate under uncertainty and therefore, the present study employs a stochastic production frontier approach introduced by Aigner *et al.* (1977); and Meeusen and Broeck (1977). Following their specification, the stochastic production frontier can be written as:

$$y_{it} = f(x_{it}, t; \beta)\,e^{\varepsilon_{it}}$$

where y_{it} is the output of the *i*-th firm (*i* = 1, 2…,*N*) in period *t* = 1,2…,*T;* x_{it} is a vector of inputs quantities of *i-th* firm in period *t*; t is the time variable; β is a vector of unknown parameters to be estimated; and ε_{it} is an error term. The stochastic production frontier is also called composed error model, because it postulates that the error term ε_{it} is decomposed into two components: stochastic random error component (random shocks) and technical inefficiency component as follows:

$$\varepsilon_{it} = v_{it} - u_{it}$$

where v_{it} is a symmetrical two sided normally distributed random error that captures the stochastic effects outside the firm's control, measurement errors, and other statistical noise. It is assumed to be independently and identically distributed iid $N(0, \sigma_v^2)$. u_{it} is a vector of independently distributed and non-negative random disturbances that are associated with output-oriented technical inefficiency. Specifically, u_{it} measures the extent to which actual production falls short of maximum attainable output. The Battese and Coelli (1992) stochastic frontier production model for panel data where technological inefficiencies of firms may vary systematically over time, this model defines inefficiency coefficients as an exponential function of time (Coelli et al., 2005). In the model specification of Battese and Coelli (1995), technical inefficiency effects are explicitly expressed as a function of a vector of firm-specific variables and random error, and are integrated in the stochastic frontier model. This one-stage model is recognized as one which provides more efficient estimates than those which could be obtained using the two-stage estimation procedure. Another reason for estimating all parameters in one stage is that, in general, it is hard to distinguish between a variable that belongs to the production function and explanatory variables of the inefficiency model. In the one-stage model, explanatory variables directly influence the transformation of inputs and efficiency is estimated, controlling the influence of explanatory variables of technological inefficiency. This reduces the omitted variable problem in the two-stage estimation.

Empirical Model

The translogarithmic function and the Cobb-Douglas functional form are the two most common functional forms which have been used not only in empirical studies on frontier production, but in the studies on production behavior in general. The Cobb-Douglas production function is an adequate representation of our data. The Cobb-Douglas production function can be defined as:

$$\ln y_{it} = \beta_0 + \sum_{j=1}^{3} \beta_j \ln \mathrm{x}_{jit} + \beta_t t + v_{it} - u_{it} \tag{1}$$

where y_{it} is the wheat production of the *i-th* governorate at the *t-th* time period; x_{jit} is the *j-th* input of the *i-th* governorate at *t-th* time period; β is unknown parameter to be estimated; *t* is the time variable; v_{it} is a vector of random errors that are assumed to be independently and identically distributed iid $N(0, \sigma_v^2)$; and u_{it} is a one sided (u_{it} ≥ 0) efficiency component that captures the technical inefficiency of the *i-th* governorate. The two error components (v_{it} and u_{it}) are independent of each other.

As defined by Battese and Coelli (1992), the non-negative inefficiency effect u_{it} is an exponential function of time. Considering the condition of the analyzed time period, the systemically time-varying inefficiency model can be written into an equation:

$$u_{it} = u_i \exp(-\eta(t - T)) \tag{2}$$

where the distribution of u_i is taken to be the non-negative truncation of the normal distribution $N(\mu, \sigma_u^2)$ and η is a parameter that represents the rate of change in technical inefficiency. A positive value $(\eta > 0)$ is associated with the improvement of governorate' technical efficiency over time.

The Maximum Likelihood estimates for the parameters of the stochastic frontier model, defined by equations (1) and (2) can be obtained by using the FRONTIER 4.1 program, in which the variance parameters are expressed in terms of (Coelli, 1996):

$$\sigma_s^2 = \sigma_u^2 + \sigma_v^2 \; ; \gamma = \frac{\sigma_u^2}{\sigma_s^2} \; and \; 0 \le \gamma \le 1 \; .$$

The technical efficiency level of the *i-th* governorate at the *t-th* time period (TE_{it}) is defined as the ratio of the actual output to the maximum potential output as follows:

$$TE_{it} = \exp(-u_{it}) .$$

Data

The data employed for the stochastic frontier analysis are taken from the Ministry of Agriculture and Land Reclamation (MALR), Egypt. The panel data composed of 253 observations for eleven governorates represents the main governorates of wheat production in Egypt during the time period 1990-2012. The summary statistics for the variables used in the analysis are presented in Table 1. The production inputs comprise three input variables (land, labor and machinery) while there is only one output (wheat production). Wheat production is expressed in thousand tons and land in thousand hectares. Labor and machinery have been estimated in thousand hours.

Table 1. Summary statistics for variables in the stochastic frontier production function.

Variables	Units	Maximum	Minimum	Mean	Std. Dev.
Output (y_{it})	Tons (thousands)	1144.62	195.00	474.46	192.47
Land (x_{1it})	Hectares (thousands)	178.52	20.92	74.46	29.22
Labor (x_{2it})	Hours (thousands)	110466.20	13191.72	46973.43	18421.22
Machinery (x_{3it})	Hours (thousands)	12321.23	1045.38	4325.39	1799.44

Source: Own elaboration from the data (Ministry of Agriculture and Land Reclamation, Egypt)

Results

The Maximum Likelihood estimates of Battese and Coelli (1992) specification for the main governorates of wheat production in Egypt are presented in Table 2. The coefficients of the Cobb-Douglas production function can be directly illustrated as production elasticities of inputs in the production process. The Maximum Likelihood estimates of Battese and Coelli (1992) specification for the main governorates of wheat production in Egypt shows that the coefficient of land is positive and significant according to the prior expectations. The coefficient of labor is positive and significant. The coefficient of machinery is negative and insignificant. This may be due to that the average farm size in Egypt is about 0.6 hectare (FAO, 2006). In the small farm size, machinery cannot work efficiently and this requires the implementation of land consolidation system (Hõna, 2005) to increase the efficiency of machinery and reduce costs. The technical change coefficient is positive and insignificant.

Table 2. Maximum Likelihood estimates of the Cobb-Douglas stochastic frontier production function.

Variables	Coefficients	Standard error
Constant	0.5802	(0.9777)
x_{1it}	0.5798	(0.2838)*
x_{2it}	0.3379	(0.1540)**
x_{3it}	-0.0611	(0.1297)
t	0.0071	(0.0128)
σ^2	0.0068	(0.0087)
γ	0.0940	(0.7604)
μ	0.0064	(0.6163)
η	0.0737	(0.2720)
Log likelihood function	264.3412	
LR test	19.8840***	
Total number of observations	253	

Source: Own elaboration
***, ** and * indicates significance at 1, 5 and 10% level, respectively
All the variables are in log form except time

Table 3. Technical efficiency by year.

Year	Technical efficiency	Year	Technical efficiency
1990	0.8922	2002	0.9533
1991	0.8993	2003	0.9566
1992	0.9059	2004	0.9596
1993	0.9122	2005	0.9624
1994	0.9181	2006	0.9650
1995	0.9236	2007	0.9674
1996	0.9287	2008	0.9697
1997	0.9335	2009	0.9718
1998	0.9381	2010	0.9737
1999	0.9421	2011	0.9756
2000	0.9462	2012	0.9773

2001	0.9499
Mean (1990-2012)	0.9444
Rate[a]	0.4150

Source: Own elaboration
([a]) Annual average percentage growth rate (1990-2012)

Table 3 shows the annual levels of technical efficiency of the total sample. The mean of technical efficiency for the time period 1990-2012 vary from a minimum level of 0.8922 in 1990 to a maximum level of 0.9773 in 2012 and the mean of the period is 0.9444. The annual average percentage growth rate is 0.4150%. The technical efficiency makes clear improving in the levels of technical efficiency during the time period 1990-2012.

Table 4 presents the mean of technical efficiency for the different governorates during the time period 1990-2012. Fayoum governorate has the minimum level of technical efficiency (0.8924), while Dakahlia governorate has the maximum level of technical efficiency (0.9908).

Table 4. Technical efficiency by governorate[a].

Governorate	Technical efficiency
Sharkia	0.9705
Dakahlia	0.9908
Behairah	0.9725
Menia	0.9804
Fayoum	0.8924
Assuit	0.9296
Suhag	0.9089
Gharbia	0.9243
Beni Suef	0.9328
Menoufia	0.9199
Kafr Elshikh	0.9668

Source: Own elaboration
([a]) Mean of the time period (1990-2012)

Conclusions

This paper aims to examine the input-output relationship of wheat production and estimate the technical efficiency of the main governorates of wheat production in Egypt during the time period 1990-2012. The data used in this study is a panel data at the governorates level, it represents the time period 1990-2012 and taken from the Ministry of Agriculture and Land Reclamation, Egypt. We apply the stochastic frontier approach for efficiency measurement and the Cobb-Douglas production function is used. The specifications of

Battese and Coelli (1992) is employed. The coefficient of land is positive and significant, implying that increasing the wheat area could significantly enhance the production of wheat. The coefficient of labor is positive and significant. The coefficient of machinery is negative and insignificant, therefore the implementation of land consolidation system could significantly decrease the inefficiency of machinery. The technical change coefficient is positive and insignificant. The levels of technical efficiency vary among the different governorates the minimum mean level of technical efficiency is 89.24% at Fayoum governorate, while the maximum mean level of technical efficiency is 99.08% at Dakahlia governorate. The technical efficiency takes an average value of 94.44%, this implying that little potential exists to improve resource use efficiency in wheat production. From this work we suggest the following recommendations, increase the area of wheat production through the reclaimed agricultural areas; implement the land consolidation system to increase the efficiency and reduce the costs; improve and increase the training of labor, especially the skills of cultivation and harvesting of wheat; improve the technology of wheat production; and increase the research with the purpose of taking advantage of genetic improvements, which should enable the introduction of new wheat varieties with higher productivity.

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الملخّص

ركّزتْ هذه الدراسةِ على تقدير الكفاءة الفنية للمحافظات الرئيسيةِ لإنتاجِ القمح في مصر. بياناتَ هذه الدراسةِ (panel data) علي مستوى المحافظاتَ و تمثّلُ الفترةَ الزمنية 1990-2012 وجمعت مِنْ وزارةِ الزراعة وإستصلاح الأراضي فى مصر. فى هذة الدراسة نطبق نظرية استوكاستك (Battese and Coelli 1992) لقياسِ الكفاءة الفنية وتم استعمال دالة إنتاج كوب دوجلاسِ. إنّ معاملَ الأرضِ إيجابيُ ومعنوي، و يُشير إلى أنَّ زيَاْدَة المساحة المزروعة تؤدى الى تُحسّنَ إنتاجَ االقمح بشكل ملحوظ. معاملَ العملِ إيجابيُ ومعنوي. معاملَ المكائنِ سلبيُ وغير معنوي، لذا فان تطبيق نظامِ تجميع الأراضى الزراعية يُمْكِنُ أَنْ

يقلل عدمَ الكفاءة بشكل ملحوظ. معاملَ التغيير التقني إيجابيُ ومعنوي. متوسط الكفاءة الفنية لانتاج القمح 94.44 %، وذلك يشير الى وجود امكانية بسيطة لتَحسين الكفاءة الفنية لإنتاجِ القمح في مصر (5.56 %). تَتفاوتُ مستويات الكفاءة الفنية لانتاج القمح في مصر بين المحافظاتِ المختلفةِ، حيث محافظةِ الفيوم لها المستوى المتوسط الأدنى للكفاءة الفنية (89.24 %) ، بينما المستوى المتوسط الأقصى للكفاءة الفنية في محافظةِ الدقهلية (99.08 %). مِنْ خلال هذا العملِ نَقترحُ التوصياتَ التاليةَ، زيادة إنتاجِ االقمح في مصر من خلال التوسع في زراعتة بالاراضي الزراعيةِ الجديدة؛ تطبيق نظامُ تجميع الأراضي الزراعية لزيَادَة الكفاءةِ وتقليل التكلفة؛ تحسين وزيادة تدريب االعمالة؛ زيادة التكنولوجيا في عملية انتاج القمح واستخدام الاصناف ذات الانتاجية العالية.