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# A Review of Literature of Technical Efficiency Analyses of Mena and Gulf of Guinea African Countries' Agricultural Productivity

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***Abstract*** **- Agricultural efficiency is important because it enhances productivity which is the major interest of any economy as it is an essential source of overall growth in an economy. In this study, a total of fourteen (14) studies related to technical efficiency analyses on eleven (11) different countries agricultural productivity were reviewed. The discussions of the studies were divided into two (2) regions of Middle East and North African (MENA), and Gulf of Guinea Africa Countries (GGAC) based on their geographical location. MENA was mostly represented by six countries while GGAC was represented by five countries. World Development Indicators (2015) from World Bank National Accounts Data and OECD National Accounts Data files indicate that the contribution of agriculture to the GDP in MENA and Gulf of Guinea African countries is very low comparing the majority of the labour force in agricultural sector in both regions over the period of years reviewed. On the average, the overall share of agriculture to GDP of both regions combined together was 21.7%. The overall technical efficiency score for both regions was 77%, this suggest that there can be an increase to their agricultural output through improved technical efficiency with the best combination of inputs without changing the existing technology. The study suggest that government and private sectors should help in strengthening the research and innovation centres to develop and offer affordable and quality seeds and other agricultural inputs, and also to provide trainings for the farmers on how to be more efficient in their productivity. It was also recommended that there should be more orientation and enlightenment to encourage investment in agricultural venture as well as labour saving technology to allow surplus labour to earn more off farm income to support farming.**

***Keywords*** **- Agricultural Productivity, Technical Efficiency, MENA and Gulf of Guinea African Countries.**

## I. INTRODUCTION

Agriculture has continued to play a dominant role in the provision of food, raw material for industries. In Africa, its role in employment for the majority, and foreign earnings, which are used in financing development activities, cannot be overemphasized. Africans' source of livelihood depends majorly on agriculture. Agriculture plays an important role in the economies of most of the countries in the Middle East and North Africa (MENA) region and African countries as a whole. Despite the fact that MENA most land is desert (water scarce) and dry region in the world, many countries in the region, highly depend on agriculture.

MENA and Gulf of Guinea African countries' (GGAC) agriculture is quite a diverse sector whose contribution to economic development is important considering the stage of development in which the countries of the region are. Despite the fact that countries in both regions are oil wealth nations which contribute majorly to their national incomes (more than half of the GDP), majority of the population about 70% to 80% rely majorly on agriculture as source of livelihood and also depend on agriculture for employment. The regions' agriculture contribution to GDP is relatively diverse ranging from a high of more than 20% for Syria and Morocco to a low of less than 6% for Jordan and Libya in MENA region and also its contribution to that of Gulf of Guinea African countries like Nigeria and Ghana, cannot be overlooked (Parinaz, Javad and Zainab, 2013). This relatively limited contribution to GDP does not reflect the true importance of agriculture in employment and as source of livelihood.

| COUNTRY | 1996-2000 | 2001-2005 | 2006-2010 | 2011-2015 | Average |
|---|---|---|---|---|---|
| **GGAC** | | | | | |
| Cameroun | 23.6 | 23.2 | 22.9 | 22.2 | **22.9** |
| Cote D'vore | 26.7 | 22.5 | 22.1 | 22.4 | **23.4** |
| Ghana | 26 | 23.6 | 23.2 | 22.4 | **23.8** |
| Nigeria | 22.3 | 22.1 | 21 | 20.2 | **21.4** |
| Togo | 30.8 | 42.1 | 31.4 | 41.7 | **36.5** |
| **Average** | **25.8** | **26.7** | **24.1** | **25.7** | **25.6** |
| **MENA** | | | | | |
| Sudan | 25.4 | 28.8 | 29.2 | 29.2 | **28.1** |

| COUNTRY | 1996-2000 | 2001-2005 | 2006-2010 | 2011-2015 | Average |
|---|---|---|---|---|---|
| Morocco | 14.2 | 13.4 | 14.7 | 12 | **13.5** |
| Egypt | 14.5 | 28.8 | 29.2 | 29.2 | **25.4** |
| Turkey | 9 | 8.8 | 8.9 | 8 | **8.6** |
| Syria | 27.4 | 24.1 | 18.5 | 16.9 | **21.7** |
| Algeria | 8.6 | 9.4 | 10.6 | 11.1 | **9.9** |
| **Average** | **16.5** | **18.8** | **18.5** | **17.7** | **17.8** |
| | | | | | |

Source: World Development Indicators (2015) from World Bank National Accounts Data and OECD National Accounts Data files.

*Table I: Gulf of Guinea African countries (GGAC) and MENA countries share of agriculture in the GDP*

As illustrated in Table I, Gulf of Guinea African countries share of agriculture in GDP fluctuates over the four year groups. Year group 2001-2005 had the highest share of agriculture in GDP with 26.7%. Year groups 1996-200, 2006-2010, and 2011-1015 had 25.8%, 24.1% and 25.7% respectively, the latest two year groups 2006-2010 and 2011-2015 were not up to the year group 2001-2005 with a rate of 26.7% the region had an average share of 25.6% of agriculture in the GDP over the whole period of years. Togo had the highest share of agriculture in the GDP in the entire regions of MENA and GGAC, with 30.8%, 42.1%, 31.4% and 41.7% in the year groups 1996-2000, 2001-2005, 2006-2010 and 2011-2015 respectively and also had the highest average share of 36.5% in GDP of both regions.

Also MENA regional share of agriculture in the GDP had a dwindling rate of 16.5%, 18.8%, 18.5% and 17.7% in the year groups 1996-2000, 2001-2005, 2006-2010 and 2011-2015 respectively with constant fall in its agricultural contribution to GDP from 18.8% in the year group 2001-2005 to 18.5% and 17.7% in 2006-2010 and 2011-2015 respectively. MENA had an average contribution of 17.8% of agriculture to GDP which is lower to that of GGAC region. Sudan had the highest contribution to GDP in the four year group in MENA region with 25.4%, 28.8%, 29.2% and 29.2% group as confirmed by the previous research paper titled Measuring Agricultural Productivity Growth in MENA Countries by Mounir and Mohammed (2009 using the world development indicators (2004) database. Sudan also had an average contribution of agriculture to national GDP over the period with a rate of 28.1%.

It is widely agreed that increase in the productivity, arising from innovation and changes in technology is the main contributor of economic growth. As agriculture develops, it releases resources to other sectors of the economy. This has been the base of successful industrialization in now developed economies such as the Unites States, Japan or countries in the European Union (USDA, 2015). The productivity of a production unit can be measured by the ratio of its output to its input. However productivity varies according to differences in production technology, production process and differences in the environment in which production occurs.

But productivity in these regions (MENA and Gulf of Guinea African countries) still lag considerably behind that of other developed countries especially in other continents, as well as the regions' potential. According to the FAO (2005), on average, about 65% of the labour force in Africa is employed in agriculture, yet about 32% of GDP is accountable to agriculture, showing relatively low productivity (World Bank, 2013). Africa's rural population, therefore, has been unable to move out of poverty principally because of inability to transform their basic economic activity of agriculture to high productivity levels. Due to its contribution to the economy, the agriculture sector's poor performance is one of the major reasons to low development on the African continent and even countries in the Middle East. It is important to take cognisance of agriculture in improving the economies of the developing countries thereby improve the welfare of the rural poor through the sustained improvements and development in agricultural productivity.

Efficiency is one part of productivity performance, it also entails the effectiveness of the production process and the degree to which a system achieves programmes and policy objectives in terms of outcomes, accessibility, quality and appropriateness [Worthington and Dollery, 2000]. Efficiency can be defined as the extent to which a decision-making unit (DMU) can increase its outputs without increasing its inputs, or reduce its inputs without reducing its outputs. Efficiency can be divided into allocative (or price) and technical efficiency. Allocative efficiency which refers to the ability to combine inputs and outputs in optimal proportions in the light of prevailing prices, and is measured in terms of behavioural goal of the production unit like observed versus optimum cost or observed profit versus optimum profit. Technical efficiency is measured as the ratio between the observed output and the maximum output, under the assumption of fixed input, or, alternatively, as the ratio between the observed input and the minimum input under the assumption of fixed output. Therefore, for increased productivity and profitability, farmers need to improve on the management practices through trainings and transfer of knowledge and skills from less to more efficient farmers or increase on adoption of new available technologies (Padilla-Fernandez and Nuthall, 2001).

Studies reviewed in this article employed both parametric and non-parametric methods to measure technical efficiency of agricultural productivity in MENA and GGA countries. The DEA, using the mathematical programming approach to the evaluation of efficiency, goes under certain assumptions that the structure of production technology envelops the data as tightly as possible. The DEA has some advantages over the

parametric approaches (Speelman et al., 2007). Firstly, since it uses linear programming and constructed series of equation there is no need for assumptions set for a DEA production function. The method also gives an allowance for comparing different production frontiers in terms of a performance index. Also, efficiency estimate is not affected significantly when using small sample size. Finally, the DEA gives the freedom of determining efficiencies of the sub-vectors, for example specifying a target resource use, unlike the stochastic production frontier (Speelman et al., 2007).

The Stochastic Frontier Analysis (SFA) widely uses a stochastic procedure for parametric evaluating the frontier and it is based on an econometric regression model. The frontier is smooth and appropriately curved. The approach is stochastic, it considers a random variable. The stochastic frontier approach treats deviations from production function as comprising both random error (white noise) and inefficiency (Mortimer and Peacock 2002). It provides the farm efficiency estimates with much lower variability than any other method due to the error term decomposition (Neff et al., 1991). Because of its ability to decompose errors, this method of estimation is reported to be superior to others.

## II. Empirical Studies of Technical Efficiency of MENA and GGAC Agricultural Productivity

In the study review, Nigeria, Ghana, Cote D'vore, Togo and Cameroun were chosen to represent the Gulf of Guinea African countries (GGAC) due to the scarcity of studies related to technical efficiency of agricultural productivity in the region. Also Turkey, Morocco, Sudan, Egypt, Syria, and Algeria represented the Middle East and North African Countries (MENA) base on the available information on the study area.

In Table II, Gulf of Guinea Africa region had an average of 82% technical efficiency score, thus, the region needs to be 18% technically efficient to maximize its output with the existing technology. Ghana and Cote D'vore had the highest technical efficiency in GGAC region with the score of 96% and 93% respectively. Others have more room to maximize their output with the least combination of inputs trough improved technical efficiency. Nigeria had 73% and 83% under two different reviews, while Togo and Cameroun had 75% and 77% respectively. Gulf of Guinea African countries region with its available inputs and existing technology may boost their productivity and in return contribute more to the total GDP of the economy as a whole, this is expected to reduce the budget allocated for food importation and reduce hunger in the region.

In MENA region on the average, the region had 0.73% technical efficiency score, thus the region needs 27% to be technically efficient to maximize its output with the existing technology. Sudan had the highest technical efficiency with 92% while the other reviewed 70%, which may be due to the geographical location of the sampled farms. Algeria was not efficient in its agricultural productivity with the lowest technical efficiency score of 34% but it has the largest room to maximize its output under the existing technology with the least combination of inputs through improved technical efficiency. Turkey had 77% and 75% technical efficiency. Morocco, Egypt and Syria had 91%, 78% and 59% technical efficiency respectively. On the average, the region with 73% technical efficiency score may boost its productivity and in return contribute more to the economy GDP, reduce the budget allocated for food importation which could be spent on other economic aspects and also make more food available for the people of the region for poverty eradication.

The lower share of agriculture to GDP and technical efficiency of MENA compare to that of Gulf of Guinea African countries regional share of agriculture to GDP and technical efficiency may be due to the water scarce land of the regions as these regions has the most water scarce land in the world, and also the occurrence of religious crisis and terrorist crisis most especially the middle east countries.

| Author (s) | Country | Region | Empirical Method | Average T.E |
|---|---|---|---|---|
| **GGAC** | | | | |
| Ogundare. K., 2009 | Nigeria | GGAC | SFA & DEA | 0.73 |
| Aye G.C & E.D Mungatana, 2010 | Nigeria | GGAC | SFA | 0.83 |
| Andre. C, 2005 | Ghana | GGAC | SFA | 0.96 |
| Wautabouna. O, 2010 | Coe d'vore | GGAC | DEA | 0.93 |
| Kamel. H, Koffi. T, Maha. K, 2014 | Togo | GGAC | SFA | 0.75 |
| Amin. M, & Andrew. O, 2011 | Cameroun | GGAC | DEA | 0.77 |
| **Average T.E.** | | | | **0.82** |
| | | | | |
| **MENA** | | | | |
| Mahmet&Ertugrul (2007) | Turkey | MENA | DEA | 0.77 |
| Hande. E. A. & Pinar. K. S, 2013 | Turkey | MENA | DEA | 0.75 |
| Gh. R. Zamanian, V. Shahabinejad& M. Yaghoubi, 2012 | Morocco | MENA | DEA | 0.78 |
| M. M. Ben Jemaa& M. Adel Dhif, 2006 | Sudan | MENA | SFA | 0.78 |
| Khalid. H. A, &Babiker. I. B, 2011 | Sudan | MENA | DEA | 0.92 |
| M. A. Abboghdady, 2014 | Egypt | MENA | DEA | 0.91 |

| Author (s) | Country | Region | Empirical Method | Average T.E |
|---|---|---|---|---|
| Konstantinos. G., Emma. L., Yves. S, & Konstandinos M, 2006 | Syria | MENA | DEA | 0.59 |
| Nadia. B. H., 2007 | Algeria | MENA | SPF | 0.34 |
| **Average T.E.** | | | | **0.73** |
| **Overall** | | | | **0.77** |

Source: Literature Review, 2016

*Table II: Empirical Estimate of Technical Efficiency of MENA and GGAC Agricultural Productivity*

| Region | List of Countries | Characteristics |
|---|---|---|
| Region 1- MENA | Sudan, Algeria, Egypt, Morocco, Syria, Turkey. | World most water scarce and dry land, with high dependency on climate sensitive agriculture. |
| Region 2 – Gulf of Guinea region of African countries | Cote Devoir, Ghana, Togo, Nigeria, Cameroon. | Great variation in climate, including precipitation. Varied scope for irrigation. |

Source: FAO (2015)

*Table III: countries grouped according to regions with regional characteristics*

## III. Summary and Conclusions

A total of fourteen (14) studies related to technical efficiency analyses on different eleven (11) countries agricultural productivity were reviewed. The discussions of the studies were divided into two (2) regions of Middle East and North African (MENA), and Gulf of Guinea Africa Countries (GGAC) based on their geographical location. MENA was mostly represented by six countries Sudan, Morroco, Egypt, Turkey, Syria and Algeria, while Gulf of Guinea Africa was represented by Cameroun, Cote D'vore, Ghana, Nigeria, and Togo.

World Development Indicators (2015) from World Bank National Accounts Data and OECD National Accounts Data files indicate that the contribution of agriculture to the GDP in MENA and Gulf of Guinea African countries is very low comparing the majority of the labour force in agricultural sector in both regions as there was fluctuation in their contribution over the period of the four year groups. Averagely, Sudan as a country had the highest contribution of 36.5% to her national GDP. The overall average of both regions together was 21.7%. Base on the calculated technical efficiency score presented in the study, Ghana as a country had the overall highest technical efficiency score of 96%. Gulf of Guinea Africa region exhibits higher technical efficiency of 82% compare to that of MENA with the technical efficiency score of 73%, this may be as a result of water scarce land characterized to the region and also religious and terrorist crisis loom in most part of the region. The overall technical efficiency score for both regions was 77%.

Base on the reviewed studies, it can be recommended that more attention should be on improving the technical efficiency of agricultural productivity. With the existing technology and available resources, there is more room to increase and improve the technical efficiency of the countries and of the region as a whole. The government and private sectors should help in strengthening the research and innovation centres to develop and offer affordable and quality seeds and other agricultural inputs, and also to provide trainings for the farmers on how to be more efficient in their productivity. It is also recommended that there should be more orientation and enlightenment to encourage investment in agricultural venture as well as labour saving technology to allow surplus labour to earn more off farm income to support farming. Since agriculture is very important and plays a major role in the economy especially the developing countries, there is need to increase the agricultural productivity through improved technical efficiency and available inputs. This will go a long way in providing more resources for the other sectors, boost economic growth by contributing more to the national GDP, more food with lower prices resulting in improved consumers' welfare, reduce importation of food thereby saving budget and also improve the competitive position of countries' agricultural sector, facilitates rural development, alleviate poverty and ensuring food security.

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