

## **Abstract: Environmental Technology Gaps and Technical Efficiency of Rice Farms in Northern Ghana**

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Cereals constitute the most widely consumed food staples in Ghana and the main cereals produced are maize, rice, millet and sorghum. Besides its importance as a food staple, rice cultivation is a germane source of cash in locales where it is grown and it has also been identified as a strategic food security crop in Ghana. These notwithstanding, Ghana has incessantly witnessed supply shortfalls in domestic rice production leading to massive importation of the commodity to make up for the shortfalls. For instance, in 2013, Ghana imported 644,334Mt of rice valued at \$392.30 million. Such overreliance on rice imports has grave implications for Ghana's strive against food insecurity, low household incomes and high incidence of poverty. It also exerts pressure on Ghana's foreign reserves and restrains investment in other sectors of the economy. The continuous importation of the produce despite Ghana's potential to be self-sufficient in its production is inimical to the country's efforts towards the achievement of the sustainable development goals. Efficiency and productivity improvements on Ghanaian rice farms are crucial for livelihoods improvement in Ghana.

This study examines the relative efficiency and environmental technology gaps of rice producing households, operating in two different production environments in northern Ghana for the purpose of formulating location-based policies aimed at increasing rice production in both agro-ecological zones. The study adopts the stochastic frontier and meta-frontier approaches to determine the productivity of inputs, technical efficiency, technology gaps and technical inefficiency determinants of rice farms in both zones. The study uses primary data collected from 768 rice farms, consisting of 454 and 314 rice farms from the savannah and forest agro-ecological zones, respectively. The results indicate that the main drivers of rice productivity across both agro-ecologies are land size, fertilizer and labour. Rice cultivation in both zones is characterized by decreasing returns to scale, an indication that rice productivity increases less proportionately with a proportionate increase in all farm inputs. At the zonal level, farms in the savannah and forest zones are found to be 82% and 59% technically efficient, respectively. The findings further reveal average environmental technology gaps of 50% and 94% for farms in the savannah and forest zones, respectively. This shows that forest zone farmers are the most closest to the extant industrial meta-technology whilst their counterparts are the most distant. The mean technical efficiency relative to the meta-frontier are estimated to be 41% and 55% for farms in the savannah and forest zones, respectively.

The study further identifies ownership of farm land, participation in rice training programs, access to markets and engagement in other forms of income generating activities inter alia as the key determinants of technical inefficiency in the forest zone.

Inefficiency is however influenced by access to markets, construction of bunds around the rice farms, distance of the farm from the farmer's homestead and ownership of farm land in the savannah zone.

The study therefore concludes that rice farms in both agro-ecological zones are technically less efficient, however farms in the forest zone are technically more efficient than their savannah zone counterparts. The study calls for massive investment in agricultural research so as to develop and disseminate improved rice cultivation technologies such as resilient rice varieties that are adaptable to the harsh climatic conditions of the savannah zone to help bridge the existing technology gaps. Forest zone producers are also encouraged by the study to improve upon their management skills and agronomic practices in order to efficiently utilize the existing technologies at their disposal. Policies that seek to make input and produce markets easily accessible to farmers in both zones should be pursued by stakeholders.