Extended Abstract

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Paper/Poster Title	Technical Efficiency in Organic and Conventional Wheat Farms: Evidence from a Primary Survey from Two Districts of Ganga River Basin, India

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Abstract	***200 words max***
This study applies DEA methodology to measure technical, managerial, and scale efficiencies of conventional and organic wheat farms. The data for the study comes through a primary survey of 579 farms (294 organic and 285 conventional) in two districts of the Ganga River Basin, India. Per hectare wheat production is taken as an output variable, and values of seeds, human labour, machine cost, plant nutrients, farm yard manure, plant protection, and irrigation charges are considered input variables for estimating the farm-level efficiencies. The Tobit regression is applied to determine the efficiency factors. The results show that technical efficiency (TE) is significantly higher in conventional than organic farms due to a higher gap in scale efficiency (SE) rather than managerial efficiency (ME). Further, 9.8% of conventional and only 1.0% of organic farms are found operating at the Most Productive Scale Size, and 99% organic and 81% conventional farms at increasing returns to scale. Organic farms perform better in ME, but their TE is lower than that of conventional farms, mainly due to their relatively lower SE. The paper suggests that TE in organic farms can be increased by upscaling the farm size through incentivizing group/collective farming in clusters.	

Keywords	Organic, Conventional, Technical Efficiency, Determinants, DEA, Tobit regression
JEL Code	Agricultural Economics Q1 see: www.aeaweb.org/jel/guide/jel.php?class=Q)

Introduction	***100 – 250 words***

The conventional way of farming is believed to be responsible for the degradation of soil quality and has adverse environmental effects. One of the ways to reduce its negative externalities is organic farming, as it is believed to be beneficial to the environment (Aldanondo-Ochoa & Almansa-Sáez, 2009; Tuomisto et al., 2012). It was the 1930s and 1940s which saw the beginning of the organic movement, which started as an initiative to reduce the use of chemicals in agriculture (Poudel et al., 2015). Organic farming enables the agroecosystem to have rich biodiversity owing to the decomposition of crop residuals, use of bio-fertilizers, and lower use of nutrients (Hansen et al., 2001). Comparison of organic and conventional farming systems with respect to technical efficiency has become a research interest in recent years (Madau, 2007). The Indian government, with all the potential benefits of organic farming, incentivizes farmers to do organic farming, particularly along the river Ganga, where agriculture is

dominated by water-intensive wheat, sugarcane, and paddy crops under the conventional farming system. It is in this context that this paper examines wheat farms' technical, scale, and managerial efficiencies under organic and conventional farming. It also studies the socio-economic factors that might affect these efficiencies.

Methodology	***100 – 250 words***

The study is based on the primary survey conducted in two districts of the Ganga Basin (India) from July 2021 to August 2021 using a pre-tested questionnaire. Two development blocks were selected randomly for the survey from each select district. Following this, five villages were selected from each block. From each village, 30 farmers were selected as the respondents, among which half were organic, and half were conventional. Since all farmers were not found growing wheat in our sample households, the sample size was reduced from 600 to 579 wheat farmers (294 organic and 285 conventional). We apply DEA methodology to measure the technical efficiency in wheat cultivation under organic and conventional farming systems. DEA is a non-parametric approach, which handle multiple outputs and inputs without assumptions in data distribution, making it an ideal choice for efficiency measurement. Since estimated efficiency scores are censored, we apply the Tobit regression model to find the efficiency determining factors.

Results	***100 – 250 words***

The study finds that conventional farms have better TE, ME, and SE than their organic counterparts. As against 0.898 TE score under conventional farming (CF), in organic farming (OF), it is much lower at 0.736. An average conventional farmer needs to reduce inputs by 10.2% to be technically efficient, while for an organic farmer to become technically efficient, the inputs have to be reduced by 26.4%.

Under the CRS technology assumption, 9.8 percent of conventional farms are found operating at the most productive scale size (MPSS), while the corresponding percentage for organic farms is found to be only one percent. The results show that CF enables more farms to achieve higher SE and ME. Farm size-wise efficiency analysis indicates that the smaller farms under OF are slightly more efficient than their medium and large counterparts.

Tobit regression analysis shows that if OF is practiced, the TE score decreases by 0.138, the ME score by 0.0543, and the SE score by 0.1007. The farm size is found to have a negative impact on the ME only. Variables ‘possession of a smartphone’ and ‘membership in a community-based organization’ have no statistically significant impact on efficiency. The results further show that TE and ME scores are inversely related to the distance of farms from the market and KVKs, implying that larger the distance of a farm from the market and KVK, smaller will be its TE and ME scores.

Discussion and Conclusion	***100 – 250 words***

The study finds that farmers practicing CF have a higher level of TE than OF. A higher percentage of conventional farms are found to be operating at the MPSS. Efficiency analysis with respect to the farm size shows that the lower levels of OTE in OF are mainly due to low SE. Low-scale efficiency can be attributed to the small farm sizes under OF. The gender of the farmer, farming experience, education, possession of a smartphone, and membership in a community-based organization do not have any statistically significant impact on TE scores. Practicing organic farming is found to have a negative impact on technical efficiency. Farm size is inversely related with managerial efficiency. Farm distances from KVK and the market negatively impact the technical and managerial efficiencies but do not impact the scale efficiency. Lower scale efficiency calls for a policy intervention concerning the farm size. If farms are consolidated and the size of the farms is increased, technical efficiency is likely to improve. The study suggests that group farming in clusters can be encouraged as it can help farmers realize economies of scale. If government policies enable the farmers to convert their entire land to OF and increase farm sizes via clustering of organic groups, it can increase overall efficiency of organic farms, which provides several ecosystem services to the local community.