

## Comparing of Economic Efficiency of Different Irrigation Systems of Alfa- Alfa Farms in Qorveh-Dehgolan Plain

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### ABSTRACT

This study aimed to compare the economic efficiency of fixed head classic, center pivot, linear, and tape-drip irrigation systems using DEA with base on two types of constant and variable return to scale in Qorveh- Dehgolan plain for the agricultural year 2017-18 in Kurdistan province. The number of 171 farm selected as sample size through simple random sampling method. The necessary data was collected through interview and filling questionnaire. The results showed that, the average economic efficiency in fixed head classic, center pivot and linear in case of constant and variable return to scale of Alfalfa crop were 0.52, 0.58, 0.71, and 0.60, 0.73, 0.90 respectively. Therefore, it showed that, the economic efficiency of linear irrigation system was higher than center pivot and accordingly center pivot was more than fixed head classic irrigation system. Address to the results, it may recommend the proper study for the preparation of irrigation system change from current situation to linear one.

**Keywords:** Data envelopment analysis, Classic irrigation system, Kurdistan province, Economic efficiency.

### Extended abstract

#### Objectives

Water scarcity as one of the most problem in the world imposed all decision makers to change their view and policy respect to water use specially usage of agricultural sector. Therefore, they tried to manage this problem by introducing advanced irrigation systems for the purpose water save. The average of agricultural crop per water cubic meter at world level is about 5.2 Kilo grams while the same in Iran is about one Kilo gram (Sarafrazi, 2017). The major problem of study area is that, the most type of water use goes to groundwater resources and during last three decades the number of wells either permitted or non-permitted led to increase and it caused significant water table fall. In addition, the major crop produced is potato and it needs huge water while there is no green water in its cultivation time and production procedure. Therefore, the concentration on type of irrigation is quite valuable. In other side, most of farmers use (98.2 per cent) use classic irrigation systems and less than 2 per cent use other irrigation sys. The study aimed to find that whether the farmers of study area should continue the same irrigation type or they may shift to a higher efficient one? The current study attempted to compare economic efficiency of fixed head classic, center pivot, linear, and tape-drip irrigation systems using DEA with base on two types of constant and variable return to scale in Qorveh- Dehgolan plain for the agricultural year 2017-18 in Kurdistan province.

#### Methods

Since the DEA models were first developed, this method of converting multiple inputs into multiple outputs was used to evaluate the performance of business firms, regions, etc. and especially for modelling operational processes in performance evaluations (Cooper, 2011). Due to the specificity of agriculture sector which rely on a limited inputs, an input-orientated model is more appropriate. So our main objective was to measure efficiency under presumption that a

decision making unit (DMU) can produce the same amount of output by using a smaller quantity of inputs. Because each DMU use varying quantity of inputs to produce different levels of output, the method compare each DMU with the most efficient DMU. For this type of analysis, in 1978 was created CCR model under the assumption of constant returns to scale (CRS) (Charnes et al., 1978) which estimates the gross efficiency of a DMU in 1984, the researches were completed by the BCC model which takes in account the assumption of variable returns to scale (VRS) (Banker, 1984) and measures pure technical efficiency.

The study calculated technical, economics and allocative efficiencies all types off irrigation systems to make results comparable and determine the best one respect to given constrains. For this purpose we have selected 171 farmers as samples through simple random sampling. The necessary data was collected through interview and filling questionnaire.

The efficiencies of all types of current irrigation systems used in the selected farms such as fixed head classic and center pivot in case of constant and variable return to scale were calculated.

### Results

The results showed that, the average economic efficiency in fixed head classic, center pivot and linear in case of constant and variable return to scale of Alfalfa crop were 0.52, 0.58, 0.71, and 0.60, 0.73, 0.90 respectively. Therefore, it showed that, the economic efficiency of linear irrigation system was higher than center pivot and accordingly center pivot was more than fixed head classic irrigation system.

The technical, allocative and economic efficiencies 168 of sample farms under Alfa-Alfa crop used fixed head classic irrigation system were calculated and the farm average of technical efficiency in case of constant and variable return to scale were 0.76 and 0.84. in other words according to the results of DEA it may increase the production amount of the studied crop by 0.24 and 0.16 under CRS and VRS without increase of cost. And again since there is difference in efficiency between them we may say that, there is scale inefficient in case of CRS and VRS and it is about 0.9 (table 5). In case of allocative efficiency the average is about 0.68 which means that, the percentage of efficient farms is about 68 per cent. The economic efficiency in case of constant return to scale is 0.52 which showed that only 52 per cent of sampled farms were economically efficient.

Finally, the results showed that, the average economic efficiency in fixed head classic, center pivot and linear in case of constant and variable return to scale of Alfalfa crop were 0.52, 0.58, 0.71, and 0.6, 0.73, 0.9 respectively. Therefore, it showed that, the economic efficiency of linear irrigation system was higher than center pivot and accordingly center pivot was more than fixed head classic irrigation system.

### Discussion

Since the results showed that, the economic efficiency of irrigation systems of center pivot and linear was higher in the study area, the farmer should be encouraged by non-refundable loan to make them able to change their irrigation system for the purpose of getting higher yield as well as save more water. And again we may recommend to help farmer to do land smoothing of farms and prepare for proper irrigation systems. Also, it may recommend the proper study for the preparation of irrigation system change from current situation to linear one.