

## An investigation on effective factors on total productivity of water and wastewater industry using multi-criteria decision-making approach (MCDM) (water and Wastewater Company of West Azerbaijan in Iran)

**Khosro Alinejad\*, Rahim Dabbagh, Nasir haghkish**

\*Khosro Alinejad, MSc student, Department of Industrial Engineering, Urmia University of Technology, Iran

### Abstract

Nowadays, labor relations, production, and resource constraint become complicated, and achieving growth in organizations by enhancing productivity accounted as most important goals of countries, therefore productivity improvement activities depend on organizations. The aim of this research is to evaluate and assess total productivity (efficiency + effectiveness) in water and Wastewater Company of West Azerbaijan estate in Iran during a period from 2005 to 2017. Effectiveness assessed by questionnaire tool using Chi-squared test and Efficiency measured and assessed by a variety of expenses, then they prioritized and weighted using Fuzzy AHP model. Finally, by combining these two indicators, total productivity measured. Results showed that between extents of effectiveness, the significance of test in provided services, reducing unwanted results and negative effects, level of knowledge and improvement and promotion of the company was more than 0.05, therefore zero assumption based on independence of these dimensions from gender accepted. Also, significance for dimensions of application of information technology and perception and satisfaction of the customer was 0.001 and 0.018 correspondingly, which was less than 0.05. This indicates a Relation between these two dimensions and gender of staff. In ranking factors affect efficiency, water costs (0.146) and raw material costs (0.145) variables were prioritized. Over the course, productivity had a lot of changeability with an average of 58 units, the reason of which was efficiency reduction in energy and capital; however labor efficiency and effectiveness indicators had a better status than other indicators and had an improving trend.

Activities of each organization are affected by a set of circumstance and factors that needed to be recognized, investigated and measured to realize goals and optimize activities effectively. Usually, organizations encounter limits like shortage of facilities and resources for their activities. Therefore, they tried to use their limited resources optimally to be capable of competing their rivals and offer their services to customers in low cost with high quality. Since resources are limited and procuring them for organizations is costly, therefore, it is necessary to make the most of using available resources to maximize returns, which is possible with organizational efficiency and productivity, because the main goal of productivity and efficiency is an optimal use of resources and facilities. Nowadays, researchers and investigators believe that a country needs capable

organizations, systems, human resource and proper planning and resources to acquire high levels of productivity and reach their goals. Enhancing productivity is one of the ways to increase production and meet demands of consumer. Productivity is measuring the amount of workforce, energy and other resources in an organization and is the result of efficiency and effectiveness, in which effectiveness is yield level, and efficiency is fraction ratio of return on the given. To achieve high productivity, a certain ceiling cannot be defined, but companies try to reach the optimized point and see that as their future outlook. In corporations, effectiveness has outward and efficiency has inward look to activities, therefore simultaneously computing effectiveness and efficiency and combining them, make productivity more comprehensive. Sewage network is one of most important infrastructures of community health that keep fresh water away from pollution. Water and wastewater companies constitute economy and industry framework of each country, therefore attending to their continuous improvement will lead to national productivity enhance. In recent years, in almost all efforts to study efficiency, effectiveness, and productivity in corporations, researchers considered productivity as quantitative "efficiency" or as qualitative "effectiveness" and these two dimensions are studied separately. In this study, we investigated productivity "efficiency + effectiveness" in urban water and wastewater corporation of West Azerbaijan in Iran. For this purpose, in the next section, theoretical foundations and research background and in the third section method of implementation are introduced. In section four, results are analyzed and evaluated, and final section a summary of research presented and suggestions proposed for future studies.

To achieve productivity, a certain amount and ceiling cannot be defined, but what matters is to reach a milestone that companies are trying to achieve and know it as their prospect. Productivity is the coordination of quality, quantity, and costs in competition, and increasing productivity is one way to increase production and meet demands of people. Productivity measures the status of labor productivity, capital, energy, and other resources of an organization, and is the result of efficiency and effectiveness; effectiveness defined as the level of return, and efficiency is the ratio of output to data. Effectiveness and efficiency are two main dimensions of productivity measurement, none of which alone completes productivity, while in most studies, productivity is only measured through

efficiency. In companies, effectiveness has an extroverted and efficiency has an introverted look to activities, therefore calculating efficiency and effectiveness simultaneously and combining them together make productivity more comprehensive. Effectiveness results in Urban Water and Wastewater Company show that the relationship between gender of employees and the dimensions of effectiveness (knowledge level, improvement and promotion of the company, reducing unwanted results and negative effects and provided services) are known to be independent from gender of individuals. Hence, there is no difference between genders of individuals in creating effectiveness in any of these dimensions. However, there is a significant relationship between gender of staff and use of information technology, and perception and satisfaction of customer's dimensions, which with Kramer's  $\chi^2$  test, the severity of this correlation was respectively obtained

0.93 and 0.85. Inefficiency section, factors affect efficiency prioritized and weighted using the Fuzzy AHP approach, in which water costs (with a weight of 0.146) and raw materials (with 0.145) are in top priority.

Then, using obtained weights, a model for calculating total efficiency presented, which in comparison with other models that calculate efficiency, has this superiority that does not take all the inputs of the company into account with the same importance, and each input introduced(entered) into model according to its effect. Then partial and total efficiency of all factors calculated during the period of 2005 to 2017. The results showed that total efficiency of production factors of the company had fluctuations; an average efficiency of all factors with the effect of fuzzy weights was equal to 0.44 units. Reasons for this decrease are little effectiveness in energy and capital sectors.