

## Prediction of environmental indicators in land leveling using artificial intelligence techniques



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### Abstract

Land leveling is one of the most important steps in soil preparation for agricultural and other purposes. . New techniques based on artificial intelligence, such as Artificial Neural Network, integrating Artificial Neural Network and Imperialist Competitive Algorithm (ICA-ANN), or Genetic Algorithms (GA-ANN), or Particle Swarm Optimization (PSO-ANN) have been employed for developing predictive models to estimate the energy related parameters and the results were compared to SPSS and Sensitivity Analysis results. In this study, several soil properties such as cut/fill volume, compressibility factor, specific gravity, moisture content, slope of the area, sand percent, and swelling index were measured and their effects on energy consumption were investigated. Totally 90 samples were collected from 3 land areas by grid size of 20m×20m. The aim of this work was to develop predictive models based on artificial intelligence techniques to predict the environmental indicators of land levelling. Results of sensitivity analysis illustrated that only three parameters consist of soil density, soil compressibility, and soil cut/fill volume had meaningful effects on energy consumption. Among the proposed methods, the GA-ANN had the most capability in prediction of the environmental energy parameters. However, for prediction of LE and FE the ANN and ICA-ANN algorithms had better performance.

On the other hand, SPSS software had higher R<sup>2</sup> value than Minitab software and sensitivity analysis and in fact close to the ANN values. Keywords: Energy; Imperialist competitive algorithm; Sensitivity analysis; ANN; Land levelling; Environmental indicators.

**Keywords:** Artificial Neural Network; energy; environmental research; Imperialist Competitive Algorithm; Sensitivity Analysis.

**Originality/value – A limited number** of research studies related to energy consumption in land leveling have been done on energy as a function of volume of excavation and embankment. However, in this research, energy and cost of land leveling are shown to be functions of all the properties of the land, including the

slope, coefficient of swelling, density of the soil, soil moisture and special weight dirt.



### Biography:

Isham alzoubi has completed his PhD at the age of 27 years from Doctor of Philosophy Degree in Agricultural Mechanization Engineering (University of Tehran – Iran) University and Postdoctoral Studies from School of Surveying Geospatial Engineering-Department of Surveying and Geomatics Engineering, University of Tehran . Current Job: General commission for scientific Agricultural Research – Damascus – Syria (Mechanical Engineer) He has published more than 16 papers in reputed journals and has been serving as an editorial board member of reputed.

### Speaker Publications:

1. “Prediction of environmental indicators in land leveling using artificial intelligence techniques”; Chemical and Biological Technologies in Agriculture volume 6, Article number: 4 (2019).
2. “Modeling and predict environmental indicators for land leveling using adaptive neuro-fuzzy inference system (ANFIS), and regression”; International Journal of Energy Sector Management Volume 12 Issue 4.
3. “Effect of soil properties for prediction of energy consumption in land levelling irrigation”; International Journal of Ambient Energy Volume 41, 2020 - Issue 4, 2017.
4. “Comparing ANFIS and integrating algorithm models (ICA-ANN, PSO-ANN, and GA-ANN) for prediction of energy consumption for irrigation land leveling”; Geosystem Engineering Volume 21, 2018 - Issue 2, 2017.
5. “Integrating artificial neural network and imperialist competitive algorithm (ICA), to predict the energy consumption for land leveling”; International Journal of Energy Sector Management Volume 11 Issue 4.

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