Practical common weight Maximin approach for technology selection

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Abstract

A practical common weight Maximin approach with an improved discriminating power for technology selection is introduced. The proposed Maximin approach enables the evaluation of the relative efficiency of decision-making units (DMUs) with respect to multiple outputs and a single exact input with common weights. Its robustness and discriminating power are illustrated via a previously reported robot evaluation problem by comparing the ranking obtained by the proposed Maximin approach framework with that obtained by the DEA classic model (CCR model) and Minimax method (Karsak & Ahiska,2005). Because the number of efficient DMUs is reduced so discriminating power of our approach is higher than previous approaches and because Spearman's rank correlation between the ranks obtained from our approach and Minimax approach is high therefore robustness of new approach is justified.

Keywords; Technology selection, Robot selection, Maximin approach, Discriminating power, weight restriction, DEA, common set of weights**.**

1-Introduction

A robot with the capability of affording heavy load at high speed and low repeatability and accuracy will contribute positively to the productivity and flexibility of the manufacturing process, which are of vital importance where rapid changes in customer needs require the introduction of new products into the market very frequently. When product design changes need to be made repeatedly, owning a high-performing robot will avoid replacement or modification. Several works that address the development of a robust decision tool enabling the potential robot user to select a high performing robot have been reported so far. A brief survey on these previous works is given in section 2. This paper contributes to the AMT selection literature by introducing a novel multi-objective decision methodology that can integrate multiple outputs such as various technical characteristics with a single input such as cost. The proposed methodology can be successfully applied, but is not limited to technology selection problems such as the determination of the best industrial robot, CNC machine or flexible manufacturing system from a feasible set of mutually exclusive alternatives.

2- Proposed MCDM model by Karsak and Ahiska

Data envelopment analysis is a mathematical programming-based decision-making technique, which has been widely used to treat decision problems that necessitate the consideration of multiple outputs and multiple inputs to evaluate the relative efficiency of DMUs. While considering multiple inputs in efficiency analysis, DEA makes an implicit assumption that any input can act as a substitute for any other because it uses weighted combination of all the inputs (Tofalis1997). This critical assumption does not hold for cases where