UNIVERSITI TEKNOLOGI MARA

EFFICIENCY AND PRODUCTIVITY MEASUREMENT OF ACADEMIC DEPARTMENTS USING WEIGHT RESTRICTED DEA WITH ASSURANCE REGION AND ANALYTIC HIERARCHY PROCESS

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Thesis submitted in fulfilment of the requirements for the degree of **Doctor of Philosophy**

Faculty of Computer and Mathematical Sciences

July 2019

AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

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		Departments Using Weight Restricted DEA with
		Assurance Region and Analytic Hierarchy Process

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ABSTRACT

Data Envelopment Analysis (DEA) model has been acknowledged as an effective tool that measures relative efficiency of homogeneous units. Nevertheless, due to total weight flexibility in DEA, some inputs and outputs are assigned as zero weight. regardless of their significance. This implies that certain factors are ignored in efficiency evaluation even though they are crucial. This unfortunately leads to poor discrimination ability whereby many decision making units (DMUs) are reckoned as efficient. Therefore, this research investigates on improving discrimination power by incorporating subjective value judgement in standard DEA and applying it to evaluate efficiency of 22 academic departments of a public university in Malaysia from 2008 to 2011. The model proposed in this thesis is called CCR/AR-AHP model and it refers to a hybrid model that integrates Constant Return Scale model of DEA. Assurance Region Type I (ARI) and revised Analytic Hierarchy Process (AHP) method. The input/output variables employed in this study reflect those that contribute towards teaching/learning and research performance of an academic department. University Senate members' opinions on the importance of inputs /outputs were included in the assessment to ascertain that the weightage assigned to each selected input/output is aligned with the direction of the university and Ministry of Higher Education (MOE). Revised AHP method was adopted to elicit priorities from University Senate members pertaining to inputs/outputs. One benefit of performing this method is that it reduces inconsistent pairwise comparison matrices. Then, these priorities were utilised to set lower and upper bounds of both input and output ratios. Moreover, additional weight restriction was incorporated in DEA via ARI approach. Efficiency results and weights obtained through CCR/AR-AHP were compared against scores and weights produced by standard DEA. The outcomes displayed that the CCR/AR-AHP model had enabled elimination of zero weight. This implied that all input and output factors were considered in efficiency assessment, resulting in realistic and sensible findings. Apart from that, the findings showed that CCR/AR-AHP model generated smaller efficiency scores assigned to inefficient departments, and smaller value of mean efficiency scores and smaller number of efficient departments in comparison to standard DEA model. This showed that CCR/AR-AHP model had successfully increased discrimination power in DEA. Furthermore, sensitivity analysis with different weight bounds was conducted. The findings revealed that efficiency results were sensitive to varying weight bounds, thus, signifying that lower and upper bounds must be carefully In addition, empirical results exposed that Business Management cluster outperformed other clusters, in which it emerged as the most efficient cluster in all four years. Next, the Malmouist Productivity Index (MPI) model based on CCR/AR-AHP model was computed to measure productivity of the academic departments. To the best of our knowledge, this is the first study that incorporates value judgement in computing productivity indexes in the context of higher education and firstly applied to evaluate productivity of academic departments under consideration. The results showed that average productivity for the sector progressed from 2008–2009 and 2009–2010. Furthermore, the findings also showed that factor which contributed to productivity change across the sector in 2008-2011 was technological change rather than technical efficiency change. Finally, our model CCR/AR-AHP model can implemented to other academic departments from other higher learning institutions.

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