Editorial: Quantitative approaches in management

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Abstract: A new methodology may lead to new substantive theory (or explanations), new data and new theory. This special issue focuses on "Quantitative Approaches in Management" and eight articles reporting recent research results are preceded by a review of literature on the main topics of management. These eight articles' summary of insights are provided for the readers of *International Journal of Management and Decision Making*.

Keywords: quantitative methodology.

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1   Introduction

Many scholars have recently seen the development of numerous applications for operations research models, algorithms and econometrics in the management world. Integrated methodology expedites the development of complex decision problem. Financial institutions, large corporations, multinational enterprises and research centres are increasingly devoting important resources to research and development in the quantity of decision modelling and optimisation.

Quantitative methods can be classified Multi-Objective Decision Making (MODM) and Multiple Attribute Decision-Making (MADM). MODM methods include subjective and objective optimisation function. MADM methods especially applying in management are a complex decision problem in real life. Decision makers will increase the assessment attributes for raising decision scheme accurately, however, the assessment attributes involve dependent property in MADM. Therefore, the dependent attributes do not follow additive assumption and cause complex decision problem. Chang (2005) presented two types of decision-making (see Figure 1). One is subjective decision-making and the other is objective decision-making.

Figure 1   Quantitative methods of decision-making in management
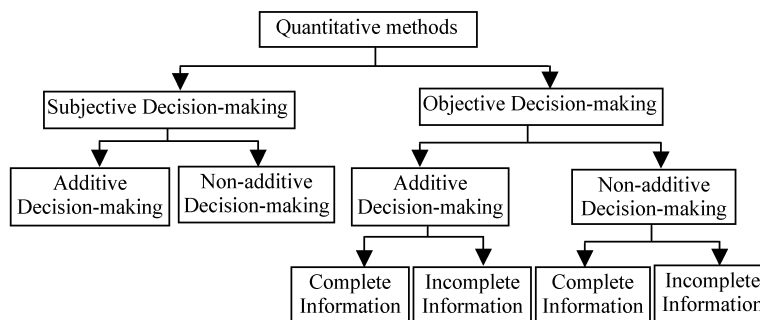
This special issue focuses on "Quantitative Approaches in Management" and eight articles reporting recent research results are preceded by a review of literature on the main topics of technology management. This review is intended as an introduction to the issue. According to the topics of interest, we list the eight articles in Table 1. The scope of these articles are management of technology for operations, forecasting, R&D funding decision, purchasing problem, performance measurement, and management decision-making. The methodologies of these articles are Forecasting, Analytical Hierarchical Process, Genetic Algorithm, Fuzzy Multi-Attribute Analysis, Case study, and Data Envelopment Analysis (DEA).

2   Classification of the methodology in this special issue

MCDM approaches at using a set of criteria for a management problem. Saaty (1980) proposed the Analytic Hierarchy Process (AHP) methodology to prioritise the selection criteria. However, the conceptual of AHP is only applicable to a hierarchy that assumes a unidirectional relation between decision levels. Therefore, the hierarchical structure may

need to be relaxed when modelling a more complicated decision problem that involves interdependencies between criteria of the same hierarchy or different hierarchy. Moreover, Saaty (1996) proposed Analytic Network Process (ANP) method that can evaluate multidirectional relationship among decision criteria. In order to solve unmeasurable information, many scholars apply fuzzy set and theory (Zadeh, 1965) to develop Fuzzy Multiple Attribute Decision-Making (FMADM) methods owing to the imprecision in assessing the relative importance of attributes and the performance ratings of alternatives with respect to attributes. Fuzzy set theory attempts to select, prioritise or rank a finite number of courses of action by evaluating a group of predetermined criteria.

Table 1   The methodology and scope among the eight articles

Articles	*Methodology*	*Scope*
Integrating the event study method and the Grey Markov forecasting model to evaluate the effect of announcements regarding the establishment of FHCs	Grey Markov Forecasting model	Determine whether the stock values of the target firms
THE R&D funding decision: the need for a systemic approach	Real options	Investigating resource allocation within a multi-project portfolio
Hierarchical alternatives in multi criteria decision making	Fuzzy Hierarchical alternatives in MCDM	Proposed approach, a hierarchical structure for alternatives
A genetic algorithm for solving a joint transportion-purchasing lot size problem	Genetic Algorithm	For simultaneous determination of purchasing quantities and transportation decision
An application of the analytical hierarchy process and fuzzy analytical process in the selection of collecting of centre location for the reverse logistics multi criteria decision-making supply chain model	Analytical Hierarchy Process and Fuzzy Analytical Hierarchy Process	Selecting the collecting centre location for the reverse logistics supply chain model
Application of fuzzy MCDM to establishing a new fee schedule for orthopedic procedures in a national health program	Fuzzy multiple criteria decision-making	Stablishing a new, rational fee schedule for orthopedic procedures in a national health insurance program
Analysis on the supply trend of Taiwan deck officers after the execution of STCW-95 convention	Markov forecasting	Predict the supply of deck officers
Using two-stage DEA to measure managerial efficiency change of non-life insurance companies in Taiwan	Two-stage data envelopment analysis	Measuring the comparative performance of the entire non-life insurance industry

Deng (1982) proposed grey theory that including Grey Relational Analysis (GRA), Grey Situation Decision Making (GSDM), and grey forecasting to solve engineering problem. Lin et al., (2005, 2006) apply GRA, GSDM and grey forecasting to approach in management. Moreover, some scholars combine such as AHP, ANP, entropy, TOPSIS, and Markov chain methods for decision making problems. Charnes et al. (1978) proposed DEA method to evaluate the efficiency of a number of producers. DEA is an extreme

point method and compares each producer with only the 'best' producers. In DEA literature, many scholars propose variety of DEA methods to evaluate organisation performance or provide decisions for decision makers. Holland (1975) proposed Genetic Algorithm (GA) that is a search technique used in computing to find approximate solutions to optimisation and search problems. Genetic algorithms are categorised as global search heuristics. Black and Scholes (1973) proposed the options pricing model and coined the term 'Black-Scholes' options pricing model. Many option pricing techniques are considered among the most mathematically complex of all applied areas of finance. Most of the models and techniques analysts are rooted in a model developed by Black and Scholes' model.

3   Summary

In this special issue, three articles combine AHP method to develop new decision process; two articles apply Markov forecasting and Grey Markov Forecasting for supply of deck officers and stock values; one article applies real options for investigating resource allocation; one article applies GA method for simultaneous determination of purchasing quantities and transportation decision; and the last article developing two-stage DEA for Measuring the comparative performance of the entire non-life insurance industry.

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References

Black, F. and Scholes, M. (1973) 'The pricing of options and corporate liabilities', *Journal of Political Economy*, Vol. 81, pp.637–654.

Chang, C.W. (2005) *Non-additive of Multiple Attribute Decision Making Process and Model Construction*, Ming Chuan University Press, PhD thesis.

Charnes, A., Cooper, W.W. and Rhodes, E.L. (1978) 'Measuring the efficiency of decision making units', *European Journal of Operational Research*, Vol. 2, No. 6, pp.429–444.

Deng, J.L. (1982) 'Control problems of grey systems', *Systems and Control Letters*, Vol. 5, pp.288–294.

Holland, J.H. (1975) *Adaptation in Natural and Artificial Systems*, University of Michigan Press, Ann Arbor.

Lin, C.T., Chang, C.W. and Chen, C.B. (2005) 'Relative control philosophy-balance and continual change for forecasting abnormal quality characteristics in a silicon wafer slicing process', *The International Journal of Advanced Manufacturing Technology*, Vol. 26, Nos. 9–10, pp.1109–1114.

Lin, C.T., Chang, C.W. and Chen, C.B. (2006) 'A simple approach to solving multi-response quality characteristic problems in CMOS ion implantation', *International Journal of Advanced Manufacturing Technology*, Vol. 28, Nos. 5–6, pp.592–595.

Saaty, T.L. (1980) *The Analytic Hierarchy Process*, McGraw Hill Publications.

Saaty, T.L. (1996) *Decision Making with Dependence and Feedback: The Analytic Network Process*, RWS Publications, Pittsburgh.

Zadeh, L.A. (1965) 'Fuzzy sets', *Information and Control*, Vol. 8, pp.338–353.