International Journal of Innovative
Computing, Information and Control
Volume **6**, Number **5**, May **2010**

 ISSN 1349-4198
pp. **2199–2209**

A FUZZY LOGIC APPROACH TO DEALING WITH OBJECTIVE DATA AND SUBJECTIVE RATING

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Received November 2008; revised June 2009

Abstract. *Dealing with subjective ratings is quite common in real life problems. Although a number of research approaches to solving decision-making problems have been proposed, most approaches focus on developing quantitative models for dealing with objective data or qualitative models for dealing with subjective ratings. Few researchers proposed approaches to dealing with both objective data and subjective ratings. Thus, this paper attempts to fill the gap in current literature by establishing a fuzzy logic approach to dealing with both objective data and subjective ratings. Finally, the utilization of the proposed fuzzy logic approach is demonstrated with a case study of location choice of container transshipment port.*
Keywords: Fuzzy logic, Multiple criteria decision-making, Transshipment port choice, Location selection, Containerization transportation

1. **Introduction.** In many real life problems, one has to deal with qualitative information. For example, the decision makers cannot provide a preference value precisely; instead, they express it in fuzzy terms such as "very good" and "very poor". However, in a logistics system, we use quantitative data to avoid inconsistency and uncertainty as well as to ensure precision and quality. There are situations where the instructions are given according to a conversation for convenience such as "if the performance of port is high then select the port as the best location for transshipment". In this case the quality characteristic (e.g. performance) is expressed in linguistic form (e.g. high). The location decision making approach to dealing with objective data and subjective ratings in such situation is not studied previously.

Location selection is one of the most important decision issues for decision makers. Many precision-based methods for location selection have been developed. Dahlberg and May [17] utilized the simplex method to determine the optimal location of energy facilities. Tompkins and White [43] introduced a method that used the preference theory to assign weights to subjective factors by making all possible pairwise comparisons between factors. Spohrer and Kmak [39] proposed a weight factor analysis method for integrating the quantitative data and qualitative ratings to choose a plant location from numerous alternatives. Stevenson [41] proposed a cost-volume analysis method to select the best plant location. Multiple criteria decision-making (MCDM) methods were provided to deal with the problem of ranking and selecting locations under multiple criteria [28,38]. All the methods stated above are based on the concept of accurate measure and crisp evaluation.

In general, the selection of a best location for the decision maker from two or more alternatives on the basis of two or more factors is a multiple criteria decision-making problem. Under many situations, the values for the qualitative criteria are often imprecisely defined