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Literature Review on Determination of Evaluators' Influence for Group Evaluation

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Abstract. Due to the difference between evaluators' ability and experience, the influence of each evaluator on the evaluation result should be different. Determining the weights of evaluators is an important step in group evaluation. In order to track the research progress and find the research tendency, a large number of documents are reviewed in this paper. According to the data source, the methods for determining the weights of evaluators are divided into three categories, named subjective weighting methods, objective weighting methods and combination weighting methods. Several characteristics of the methods are found by literature review. Firstly, the evaluators' dynamic influence is seldom considered. Secondly, it's difficult for many methods to solve complex evaluation problems. In order to provide reference for further research, some research prospects are proposed in the end.

Introduction

In the real life and economic management, in order to improve scientific and persuasion of the evaluation conclusion, we often need to focus many evaluators' opinion in evaluation problems. Due to the difference between evaluators' ability and experience, each evaluator's influence on the evaluation result should be different. Many scholars are attracted to the research of group evaluation methods for its widely application background. Determining the weights of evaluators is an important step in group evaluation. In order to track the research progress and find the research tendency, a large number of documents are reviewed in this paper.

Methods for Determining the Weights of Evaluators

According to the data source, the methods for determining the weights of evaluators are divided into three categories, named subjective weighting methods, objective weighting methods and combination weighting methods.

Subjective Weighting Methods. The weights of evaluators are determined by evaluators' fame, status, capacity. Bodily (1979) proposed a method for setting the weights of evaluators by peer assessment. It is shown that the Pareto optimal set at each step of delegation is a subset of the Pareto optimal set at the previous step [1]. Ramanathan et al. (1994) proposed a method for setting the weights of evaluators by social choice axioms. They proposed a simple and intuitively appealing eigenvector based method to intrinsically determine the weight for group members using their own subjective opinions [2].

Due to the subjective weighting methods need group members to be quite familiar with each other, and its subjectivity and uncertainty is very strong, so there are less research findings in this field.

Objective Weighting Methods. According to the quality of evaluators' opinions by certain rules, the weights of evaluators are determined on the basis of objective data. Liang et al. (2004) proposed a method of determining the weights of evaluators. They determined the personal consistency by the relationship between the direct and indirect information from the judgment matrix, and then confirmed the relative reliability of each evaluator [3]. Chen et al. (2007) proposed a factor score method (FAM) for determining the weights of experts, which can obtain a ranking of the assessment levels of experts in group-decision analysis. The proposed FAM can be used to obtain a ranking of the

assessment levels of experts from difference preference relations [4]. Ma et al. (2007) proposed a new method of determining the weights of the decision-makers based on the idea of maximizing deviations [5]. Chen et al. (2010) proposed a method of determining the weights of evaluators based on interval numbers group decision matrices, and realized by utilizing the adaptive iterative algorithm for the multi-attribute group decision-making problem [6]. Xu et al. (2010) developed two nonlinear optimization models, one minimizing the divergence between each individual opinion and the group one, and the other minimizing the divergence among the individual opinions, from which two exact formulae can be obtained to derive the weights of experts [7]. Yue et al. (2013) inspired by the idea of TOPSIS technique, combined an optimistic coefficient to determine the weights of experts. They first defined a positive ideal decision as the average of all individual decisions and three negative ideal decisions, which have the maximum separations from the positive ideal decision. This method is suitable for cautious (avoiding risk) decision, since each negative ideal decision can effectively avoid a risk [8]. Mao et al. (2013) proposed a method for determining the weight of evaluators based on stakeholders' perspective for the limitation of traditional method in determining the weight of evaluators in group evaluation. First, evaluation context was set and research hypothesis was proposed. In addition, related concepts and definitions of evaluators' dynamic influence were given, and then calculation methods of initial value of evaluators' dynamic influence, bargaining weight and value-added of evaluators' dynamic influence were proposed. What' s more, the parameter sensitivity was analyzed. Finally, a numerical example was given to illustrate the practicability and maneuverability of the proposed method [9]. Xu et al. (2016) proposed a new decision making method to solve the large group emergency decision making problem with the characteristic of multi-department and multi-index. They constructed the similarity formula of intuitionistic fuzzy numbers, which is taken as the clustering formula for expert preference clustering operation. Then, aiming at maximization of the distinction degree over index data for each department and the weights for each department are obtained [10].

Combination Weighting Methods. It combined with the characteristics of subjective weighting methods and objective weighting methods, used to determine the evaluators influence on evaluation results. Honert (2001) indicated that a quantitative knowledge of the players' decisional power was useful for better understanding of the group decision process, and could even be used in weighted voting within the group structure. They adapted the REMBRANDT suite of decision models (multiplicative AHP and SMART) to measure decisional power in groups, and they generalized this to cater for the case where power itself was deemed to be multidimensional in nature, and the case of uncertain subjective judgments of power amongst group members [11]. Song et al. (2001) divided the weights of decision-makers into two parts, named subjective weight and objective weight. Several methods of determining the objective weight of the decision-maker in multi-attribute group decision-making are given. In the end, the subjective weight and objective weight are combined into the final weight of the decision-makers [12]. Liu et al. (2007) indicated that the concept of weights of experts included static weights and dynamic weights. Experts' dynamic weights contained the information of consistency and similarity of judgment matrix [13]. Yan et al. (2014) proposed a method to determine the weights of decision-makers' based on the degree of group consensus and information distribution, the weights of decision-makers' can obtained by the maximum entropy thought and grey relation degree between every decision maker's comprehensive evaluations and average group evaluations [14]. For the limitations of the lack of considering evaluators' influence on existing bargaining evaluation, Mao et al. (2014) proposed a calculation method of evaluators' dynamic influence in bargaining evaluation [15]. Su et al. (2015) proposed a dynamic group evaluation method with considering time changing and subjects varying. They improved the reliability of results by measuring the vertical and horizontal conflicts of evaluation opinions [16]. Li et al. (2016) proposed a new method to determine the weights of evaluators based on network game. The paper considered evaluators as network nodes, and the evaluations as the links between the evaluators, which made up the edges of the network. Based on the evaluators' rating information，this

paper defined the “Cooperation” and “Confliction” matrix between the evaluators as the weight matrix of the network [17].

With the rapid development of information technology, the operated environment of government and the enterprise become more and more complicated. Above mentioned studies proposed some useful approaches to obtain the weights of evaluators in the group evaluation problem, and we can get each evaluator's influence on the evaluation result, but some problems still need to be discussed in depth. Firstly, the evaluators' dynamic influence is seldom considered. Secondly, it's difficult for many methods to solve complex evaluation problems.

Conclusion

The influence of each evaluator affects three stages of evaluation process, including group selection before the evaluation, information processing during the evaluation and supervision and review after the evaluation. So it is important to use scientific and reasonable methods to determine the weights of evaluators in group evaluation. In order to provide reference for further research, some research prospects are proposed as follow.

Firstly, propose calculation models of dynamic influence calculation models of evaluators with information completely. At first, analyze and measure the differences of evaluators’ behavior in different group by using social network theory and game theory. In addition, inspect the diversity and complexity of the evaluators’ interactive way. At last, consider group members complete and incomplete information.

Secondly, propose calculation models of dynamic influence calculation models of evaluators with information incompletely. On the basis of calculation models with information completely, consider the evaluators information incompletely or partially complete, compute the initial value of each evaluator’s influence by iterative method.

Thirdly, propose calculation models of dynamic influence calculation models of evaluators in large group evaluation. On the basis of calculation models with information completely or incompletely, analyze the rationality of the model parameter and the sensitivity of the parameter selection by numerical simulation.

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