Comparison among three analytical methods for knowledge communities group-decision analysis

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Abstract

Knowledge management can greatly facilitate an organization's learning via strategic insight. Assessing the achievements of knowledge communities (KC) includes both a theoretical basis and practical aspect; however, a cautionary word is in order, because using improper measurements will increase complexity and reduce applicability. Group decision-making, the essence of knowledge communities, lets one considers multi-dimensional problems for the decision-maker, sets priorities for each decision factor, and assesses rankings for all alternatives. The purpose of this study is to establish the objective and measurable patterns to obtain anticipated achievements of KC through conducting a group-decision comparison. The three multiple-criteria decision-making methods we used, simple average weight (SAW), "Technique for Order Preference by Similarity to an Ideal Solution" (TOPSIS) and "VlseKriterijumska Optimizacija I Kompromisno Resenje" (VIKOR), are based on an aggregating function representing "closeness to the ideal point". The TOPSIS and VIKOR methods were used to highlight our innovative idea, academic analysis, and practical appliance value. Simple average weight (SAW) is known to be a common method to get the preliminary outcome. Our study provides a comparison analysis of the above-three methods. An empirical case is illustrated to demonstrate the overall KC achievements, showing their similarities and differences to achieve group decisions. Our results showed that TOPSIS and simple average weight (SAW) had identical rankings overall, but TOPSIS had better distinguishing capability. TOPSIS and VIKOR had almost the same success setting priorities by weight. However, VIKOR produced different rankings than those from TOPSIS and SAW, and VIKOR also made it easy to choose appropriate strategies. Both the TOPSIS and VIKOR methods are suitable for assessing similar problems, provide excellent results close to reality, and grant superior analysis.
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1. Introduction

Appraisal of KC in achievements will influence an organization's strategic focus, knowledge transfer, resource allocation, and management performance. Meanwhile, proper measurement and decision-making processes are critical for knowledge management success. We try to analyze group decision of knowledge communities (KC) in achievements through three methods to meet organizational demands. Sixteen criteria and four options were built on the basis of four dimensions – *leadership locus*, *incentive mechanism*, *member interaction*, and *complementary assets* – so as to establish multi-level and multi-criteria frameworks. The results revealed that when KC takes different approaches, their implementation orientations and major impacts differ. In the context of strategic goals and transformation, using different KC will influence resource allocation and overall achievement of success.

Multiple attribute decision making (MADM) and group decision-making are widely used, and there are many such modes proposed in the literature. The chief advantage of

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MADM is that it can give managers many dimensions to consider related elements, and evaluate all possible options under variable degrees. Group decision-making is a process where experts make decisions and consolidate an optimal strategy. Our study constructed a comparison analysis based on AHP (Analytical Hierarchy Process), TOPSIS, and VIKOR. First, we used AHP to establish hierarchy architecture and then expressed individual opinions by comparing pairs. After collecting KC experts' opinions, TOPSIS and VIKOR were utilized to make non-linear calculations so as to obtain final appraisal values from which one can choose the best option. Our analysis was applied to the achievements of KC and we sought to prove the methods' reusability. From the KC illustrative example, this analysis can achieve effective group decision-making faster without requiring long meetings. Its non-linear nature provides better results than do mathematical averages, especially when extreme bias or widely differing viewpoints exist among the decision-makers.

The performance alternatives were ranked according to different group decision methods. There are many key success factors for KC one must consider, and to try to find the best option, our study analyzes and discusses the priority settings based on the constructed model which compares the ranking outcomes among TOPSIS, VIKOR, and SAW. The purpose of this study is to highlight both the innovation and application values. Our three major goals were as follows:

1. Use the fuzzy AHP, TOPSIS, and VIKOR methods to establish an objective appraisal of the KC.
2. Take the case of an R&D organization to illustrate the values and empirical analysis, and to compare with results from the traditional SAW method.
3. Verify the theory, literature review, and applications.

TOPSIS was chosen as an alternative that should have the shortest distance from the positive ideal solution (PIS) and the farthest from the negative-ideal solution (NIS) for solving a multiple-criteria decision-making problem. The basic concept of VIKOR lies in first defining the positive and negative ideal solutions. The positive ideal solution is the alternative with the highest value while the negative ideal solution is the one with the least test value. The goal of this study was to use the above two methods to assess the KC value. Our questionnaire was composed of a wide literature review, experts' opinions, and included the 16 criteria and four performance alternatives on the basis of four dimensions (Fig. 2). This study analyzed compromise solutions under well-defined conditions, quantitative goals, and objectively hierarchy system of KC achievement options. The characteristics of our construction (Fig. 2) are considering multiple and trade-off practical problems, adopting multi-criteria solution to discuss the subjective cognition. Before distributing the questionnaires, we conducted a pre-run of this study with experts and then modified the inadequate parts to ensure all the

questions could clearly express and measure the criteria. Four dimensions were utilized to construct the analysis: *leadership locus*, *incentive mechanism*, *member interaction*, and *complementary assets*. This let us establish a multi-level and multi-criteria framework. Proper ranking and priorities of KC performance were then assessed using the experts' questionnaires. The results could provide references for choosing the best KC solutions. After studying all related publications, this study applied a quantitative model to compensate for the deficiencies of existing KC analyses, such as subjective or qualitative viewpoints.

There are many dimensions to consider when assessing KC achievements with multiplicative hierarchy criteria (Kerzner, 1989). Many scholars have adopted AHP (Analytic Hierarchy Process) (Saaty, 1977, 1980) to obtain decision-making alternatives. Hwang and Yoon (1981) discuss the method and application of multi-attribute decision-making. It is easy for participants to complete questionnaires based on comparative importance, which parallels human logic, instead of using actual scores. In recent years, scholars have begun to apply Fuzzy AHP (Fuzzy Analytic Hierarchy Process) (Buckley, 1985) to resolve such fuzzy Linguistic Scale problems to facilitate expressions by study participants, such as Cheng and Mon (1994) in the selection of weapons systems.

An empirical case is illustrated to show the results of group decision-making. By adopting TOPSIS (Hwang & Yoon, 1981) and VIKOR (Opricovic, 1998) compared with SAW, this study explored both independent and interrelated criteria. We analyzed 57 questionnaires with software such EcPro (AHP) and Excel and the resulting analysis and explanations are as follows:

For TOPSIS and SAW, the results showed that the utility value of *increased core competency* was highest, followed in order by that of *enhanced work efficiency*, *induced innovative learning*, and *promoted responsiveness*.

For VIKOR, the results showed that the utility value of *increased core competency* was highest, followed by that of *enhanced work efficiency*, *promoted responsiveness*, and *induced innovative learning*.

From the above three methods, the ranking and priorities of TOPSIS and SAW were found to be the same, but TOPSIS and VIKOR had better distinguishing abilities.

The remainder of this paper is organized as follow. Basic concepts and comparisons of KCs are introduced in Section 2. In Section 3 methods of TOPSIS and VIKOR are reviewed. In Section 4 illustrates an empirical case for assessing the architectures of KC in achievements is illustrated to demonstrate the proposed methods. Discussion are presented in Section 5. Finally, we provide conclusions and remarks in last section.

2. Basic concepts and comparisons of KCs in achievement

Most Knowledge Management (KM) projects stress explicit knowledge. However, being able to exchange tacit knowledge is more important today than ever. Current