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Analysis on AHP-VIKOR-based Supplier Selection for Large Equipment Maintenance of Construction Enterprises

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Abstract

A good operating state of large equipment in construction projects is the key to ensuring the construction period, improving the project performance, and effectively reducing project costs. Hence, the problem of supplier selection for large equipment maintenance of construction enterprises has elicited extensive attention from scholars in the industry. The uncontrollable factors affecting large equipment maintenance in construction projects are numerous due to the complicated construction conditions of construction projects. Scientific selection of appropriate equipment maintenance suppliers can provide more reliable technical support and maintenance services for the operation safety and safety of large equipment during construction. In this study, the main factors influencing supplier selection for large equipment maintenance of construction enterprises were comprehensively combed. With the supplier selection of a top-10 Chinese construction enterprise for large equipment maintenance as a case, the factors influencing supplier selection were analyzed using analytic hierarchy process (AHP) and VlseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR). The group benefit value, individual regret value, and profit ratio were calculated, and schemes were compared and sorted. Results showed that the weights of the first-level indexes influencing supplier selection for large equipment maintenance of construction enterprises were sorted as enterprise competence (0.3321)>enterprise performance (0.2205)>service level (0.1748)>maintenance price (0.1381)>equipment quality (0.1345). Among the second-level indexes, the timely equipment maintainability, informatization level, and equipment maintenance price achieved the maximum weights. VIKOR-based calculation results revealed that supplier D ranked first, so it was selected by the construction enterprise as the supplier for large equipment maintenance of construction enterprises. On this basis, the practicability and operability of AHP and VIKOR in the scientific selection of suppliers were proved. The obtained conclusions are of important reference values for enriching the evaluation index system for construction enterprises to select large equipment suppliers, improving the quality of suppliers cooperating with construction enterprises, and enhancing the equipment management and maintenance efficiency of construction enterprises.

Keywords: Project construction, Large equipment maintenance, Supplier selection, AHP, VIKOR

1. Introduction

The construction industry is a pillar industry of socioeconomic development in China and exerts an important supporting effect on China's national economy and social development. As shown in Figure 1, China's construction industry is developing very fast and its total output value is growing rapidly, leading to the year-by-year growth in the total number of construction machinery and equipment self-owned by construction enterprises by the end of each year. However, construction equipment is still subject to extensive management and low accuracy, which can easily result in serious waste of construction resources. In particular, many construction enterprises have blindly pursued high construction speed, lacking fine management of large equipment at the construction site. These enterprises engage in such practices as blindly catching up with the construction schedule and seeking economic benefits while neglecting routine maintenance of large-scale machinery and equipment and effective periodic maintenance. Consequently, construction machinery and equipment operate in a poor state. Machinery and equipment may be uninterrupted long-term so that they operate under an overloaded state, accompanied by the shortened service life and frequent faults, thereby delaying the construction progress. During the repair and maintenance of construction machinery and equipment, actual faults can be effectively solved by implementing concrete repair and maintenance measures to improve the application quality of machinery and equipment and exert their positive role in concrete operations to improve construction quality.

The equipment management ability of construction enterprises directly decides whether a project can be smoothly implemented and has a direct bearing on the realization of project objectives like construction quality, construction progress, and construction costs. The most critical link in equipment management lies in selecting a high-quality equipment maintenance supplier, which facilitates construction enterprises to pay attention to quality management of construction projects. Hence, whether equipment maintenance suppliers are scientifically evaluated and selected decides the management level of the whole construction project. At present, construction enterprises should make active efforts into reforming and perfecting the corresponding management system with advanced management modes to improve management efficiency and

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strengthen their social influence. During project construction, supplier selection for equipment maintenance is of crucial importance to construction enterprises because the quality of suppliers will directly affect the quality, progress, and costs of project construction. Selecting an appropriate supplier for equipment maintenance can meet various index requirements of construction projects, seek greater products perfection, and further enhance customer satisfaction. This can also strengthen the logistics support for the construction and realize a multi-party reciprocal and win–win pattern. Hence, construction enterprises need to strengthen the research on supplier evaluation and selection for large equipment maintenance by combining their own needs and features. Construction enterprises should also select suppliers for large equipment maintenance more scientifically and reasonably by perfecting the evaluation method for suppliers. These changes will lay a foundation for smooth project progress and good economic benefits.

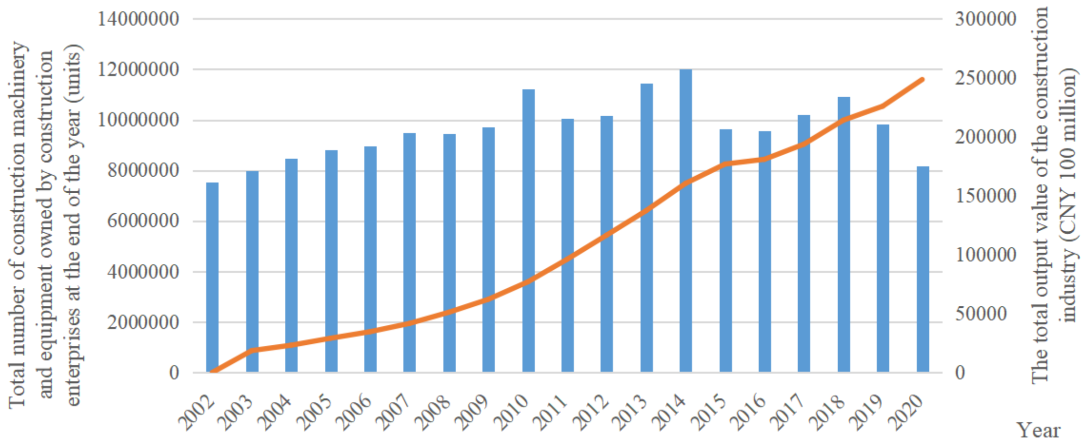

Fig. 1. Total number of construction machinery and equipment self-owned by Chinese construction enterprises by the end of each year and total output value of the construction industry during 2002–2020 (CNY 100 million)

2. State of the Art

The operating state of equipment in a construction project is closely related to enterprise efficiency. If large construction equipment fails to operate effectively, the continuity of project construction will be disrupted, even accompanied by shutdown, going against the healthy development of enterprises. Therefore, selecting appropriate suppliers is especially important. As one of the scholars investigating supplier selection very early, Dickson, G. W [1] paid field visits to nearly 300 personnel occupied in procurement work, distributed questionnaires among them, obtained 23 indexes influencing supplier evaluation through analysis, and sorted them according to their importance levels. Weber, C. A et al. [2] resorted 24 evaluation indexes through the statistical approach and concluded that three indexes—price, date of delivery, and quality—had the highest importance levels, and his method was extensively applied and promoted. Sanayei, A et al. [3] applied VlseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR) method to the multi-criterion decision-making (MCDM) problem with conflicts and incommensurability (different units) and proposed a hierarchical MCDM model based on fuzzy set theory and VIKOR to solve the supplier selection problem in supply chain systems. Based on the thought of supply chain management, Thiruchelvam, S et al. [4] stated that multiple criteria, including qualitative and quantitative ones, were involved in the decision-making process for supplier selection. Mokhlesian, S et al. [5] investigated how purchasers of Swedish contractors adopted green projects and how their opinions over suppliers' mastery of green knowledge influenced supplier selection. Results showed that the green knowledge of suppliers is an important factor influencing supplier selection. Schramm, F et al. [6] performed a structured evaluation of suppliers in the construction industry, proposed a multi-criterion decision-making model for supplier selection considering their quality and reputation—two obvious aspects—and applied it to a civil construction enterprise in Brazil. Results revealed that the model is effective. Thanks to his study, the method of the construction industry has developed. Arıoğlu, M. Ö et al. [7] put forward a pragmatic prediction and prediction technique for supplier selection, promoting the research on supplier selection. Asaad, A et al. [8] studied the critical criteria for selecting green suppliers in the construction industry of United Arab Emirates (UAE), confirmed 20 criteria through an extensive literature review, and included 39 professionals in the survey. Results evidently showed that technology and business bidding are listed as the most important categories with a weight of 0.338, followed by social economy, company characteristics, and environment with weights of 0.239, 0.225, and 0.199, respectively. Wang, T. K et al. [9] established with a supplier selection framework under the background of resilient construction supply chain, evaluated 17 resilient criteria of supplier performance using analytic hierarchy process and grey relational analysis and confirmed their priority level. Li, Z. Q et al. [10] conducted 12 semi-structured interviews with listed construction enterprises in Malaysia, and the empirical study revealed that the network-based supplier performance management system can simplify the supplier selection process and supplier performance monitoring. Govindan, K et al. [11] put forward a sustainability index-based optimal sustainable construction material evaluation model by combining a concrete survey in the UAE with the MCDM method. Results showed that the proposed method plays a critical role in environmental footprints of buildings by selecting sustainable materials. Hanák, T et al. [12] evaluated suppliers within the Czech construction industry and discussed problems related to supplier selection of construction projects, and results showed that supplier selection is influenced greatly by factors related to the actual implementation of construction projects. Ng, S. T et al. [13] concluded that selecting appropriate suppliers to provide all types of construction materials is one of the important aspects ensuring the success in bidding and projects. Erzaij, K. R et al. [14] developed an engineering equipment supplier evaluation and election management software system based on analytic hierarchy process (AHP). This model was verified in a case study in Baghdad. It can improve the current supplier selection process and help decision-makers make better decisions regarding engineering equipment suppliers. Dewo, O. O. C et al. [15] thought that due to the enormous number of raw material suppliers for construction projects, developers are prudent when selecting materials according to their own schedule. Then, he determined factors influencing the selection of raw material suppliers, provided support with substitutive decisions and integrated AHP and VIKOR using rough numbers. Results manifested that this method is conducive to selecting raw material suppliers and substitute goods. Chen, Y et al. [16] determined 33 sustainability criteria influencing project construction and surveyed experienced practitioners in America. The ranking analysis of survey results showed that in the selection of construction methods, social consciousness and environmental problems become increasingly important, and the final SPC list provides a new method of selecting construction methods for team members to boost the sustainable development of building environment. Shamsi, M et al. [17] pointed out that the main factors considered for equipment suppliers in the industrial system are equipment procurement price, production capacity reduction cost, system construction late charge, and system shutdown cost. Wu, C et al. [18] combined analytic network process and multi-objective programming to put forward a green partner selection and supply chain construction model, which was a new effective solution to green partner selection and supply chain construction. Rahimi, Y et al. [19] adopted the DEA/AHP/FDEMATEL (Data Envelopment Analysis/ Analytical Hierarchy Process/ Fuzzy Decision-making and Test Evaluation Laboratory) mixed method. Results showed that this method plays a significant role in the evaluation of construction enterprises for material suppliers. Wong, C. H et al. [20] thought that the perceived importance of project-specific criteria should be more considered in the customer selection of project construction in the United Kingdom. Zavadskas, E. K et al. [21] used a new simple grey relation weighted method and proved its applicability and effectiveness through a case study of contractors' competitiveness evaluation. Results showed that the method can serve as an effective supplementary means of selecting material and equipment suppliers for project construction. The existing studies indicate that the research on supplier selection methods has mainly experienced three stages: qualitative methods, quantitative methods, and qualitative–quantitative combined methods, which have been especially extensively applied in concrete industries. Domestic (Chinese) and foreign scholars have considered evaluation indexes more and more comprehensively when selecting suppliers of construction materials, equipment, and logistics support, accompanied by richer and richer selection methods adopted. The evaluation index systems established by most scholars are increasingly popularized, but the actual situation of concrete industries has been scarcely considered. Given the differences in the present management situation and industrial scale of all walks of life, the corresponding evaluation criteria should also be varied. In most of the existing studies regarding the selection of large equipment maintenance suppliers for project construction, index weights have been solved mostly using subjective methods, with selection methods to be further improved. In this study, various influencing factors of supplier selection were comprehensively explored. Then, the AHP-VIKOR combined model was established to carry out a case study of a top 10 Chinese construction enterprise in selecting large equipment maintenance suppliers, expecting to select high-quality suppliers in a more scientific, objective, and reasonable fashion.

3. Methodology

3.1 AHP－VIKOR method

The optimal selection of schemes based on the AHP–VIKOR method refers to finding the optimal scheme reaching the best compatibility of positive ideal solution and negative ideal solution among alternatives. AHP is a highly pragmatic method of transforming a qualitative problem into a quantitative problem, effectively solving the weight value of each evaluation index, as follows:

First, a decision matrix is constructed. Assumptions are as follows: there are m alternative large equipment maintenance suppliers for the construction enterprise in this project, n indexes are involved in the evaluation of schemes, and each evaluation index is denoted as a_{ij} representing the evaluation index j in the scheme i. Thus, an initial decision matrix can be obtained as seen in Formula (1):

$$A_{mn} = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1m} \\ a_{21} & \cdots & \cdots & a_{2m} \\ \vdots & \vdots & \vdots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nm} \end{bmatrix} \quad (1)$$

Then, the weight coefficient of each factor in each scheme is determined through AHP, and the concrete calculation refers to the method proposed by Saaty, T. L [22]. This process comprises three steps. First, a definite index system is constructed, and the hierarchical relations between factors are determined. Second, every two factors at each layer are compared according to the importance judgment matrix, and the judgment matrix of this layer is acquired to determine the importance level of each factor at each layer. Third, the weight vector is solved as seen in Formula (2), followed by consistency check.

$$W = (w_1, w_2, \cdots, w_j) \quad (2)$$

Where w_j in Formula (2) denotes the weight value of the index j. Then, the positive and negative ideal solutions are solved. To facilitate index comparisons in the decision matrix, the effects of different dimensions of different indexes on the evaluation are eliminated, and the index value of the decision matrix a_{ij} is standardized and normalized, as expressed by Formulas (3) and (4).

For benefit indexes, namely, the-greater-the-better indexes, Formula (3) is applicable.

$$b_{ij} = \frac{a_{ij} - \min\limits_j a_{ij}}{\max\limits_j a_{ij} - \min\limits_j a_{ij}}, i \in [1, m], j \in [1, n] \quad (3)$$

For cost indexes, namely, the-smaller-the-better indexes, Formula (4) can be adopted.

$$b_{ij} = \frac{\max_j a_{ij} - a_{ij}}{\max_j a_{ij} - \min_j a_{ij}}, i \in [1, m], j \in [1, n] \quad (4)$$

In Formulas (3) and (4), $\max_j a_{ij}$ denotes the maximum data in the column j of matrix b_{ij}; $\min_j a_{ij}$ stands for the minimum data in the column j of matrix b_{ij}.

According to Opricovic, S et al. [23], the positive ideal solution f_i^* and the negative ideal solution f_i^- are solved according to the normalized matrix, as seen in Formulas (5) and (6).

$$f_i^* = [(\max_j a_{ij} \big| i \in C), (\min_j a_{ij}) \big| i \in D], \forall i \quad (5)$$

$$f_i^- = [(\min_j a_{ij} \big| i \in C), (\max_j a_{ij}) \big| i \in D], \forall i \quad (6)$$

In Formulas (5) and (6), C is the set of benefit criteria and D represents the set of cost criteria. Next, the group benefit value S_j and individual regret value R_j are solved, where the former indicates the group benefit of alternative schemes: The smaller the S_j value, the higher the group benefit of alternative schemes, and the better the alternative schemes, as expressed by Formula (7):

$$S_j = \sum_{i=1}^{n} w_i \frac{(f_i^* - f_{ij})}{(f_i^* - f_i^-)}, \forall j \quad (7)$$

The individual regret value R_j denotes the rejection degree of alternative schemes. The smaller the R_j value, the smaller the individual regret of alternative schemes, and the better the alternative schemes, as denoted by Formula (8):

$$R_j = \max\left[w_i \frac{(f_i^* - f_{ij})}{(f_i^* - f_i^-)} \right], \forall j \quad (8)$$

Next, the benefit ratio Q of all alternative schemes, as seen in Formula (9).

$$Q_j = v(S_j - S^*)/(S^- - S^*) + (1-v)(R_j - R^*)/(R^- - R^*), \forall j \quad (9)$$

In Formula (9): $S^* = \min S_j$, $S^- = \max S_j$, $R^* = \min R_j$, $R^- = \max R_j$ in which v is the decision mechanism coefficient, taken as 0.5 in this study, namely, a mode of balanced compromise is adopted. In this case, the group benefit is maximized while its negative effect is minimized. Thus, a scheme with the best comprehensive benefit value is chosen.

3.2 Index system

In this study, the evaluation index system was screened out by distributing questionnaires. The more important evaluation indexes were selected through different respondents' understanding and cognition of evaluation indexes to construct an evaluation index system meeting their own actual situation, potentially helping construction enterprises select high-quality large equipment maintenance suppliers more reasonably. The respondents in the questionnaire survey included six large equipment maintenance engineers from construction enterprises and eight professors majoring in architecture in institutions of higher learning. To ensure the independence of such personnel in decision-making and the accuracy of their judgment results, the whole survey was carried out in an anonymous fashion. To establish a reasonable evaluation index system, an evaluation index system (Table 1) for large equipment maintenance suppliers of a construction enterprise was determined through the expert investigation method.

Table 1. Evaluation indexes for large equipment maintenance suppliers of a construction enterprise

First-level index	Second-level index
Equipment quality	Equipment performance Equipment durability Equipment acceptance rate Equipment green level
Maintenance price	Equipment warehousing cost Equipment transportation cost Equipment maintenance price
Service level	Service attitude Staff quality After-sales service
Enterprise competence	Warehousing level Financial situation Informatization level Timely equipment maintenance ability
Enterprise performance	Cooperation experience Historical rewards and punishment Market occupancy Contract performance rate

4. Results Analysis and Discussion

4.1 AHP calculation result

Located in Zhengzhou City, Henan Province, China, an ultra-large office building is built by a top 10 construction enterprise in China with a building area of 180,000 m^2. This company decides to select the optimal supplier among the construction equipment maintenance suppliers in the most recent five years to undertake the routine maintenance service of this office building.

First, the weight of each index reflects its importance level. By looking up domestic (Chinese) and foreign related information, AHP was utilized to construct a judgment matrix using the nine-scale method for each layer of the evaluation index system for large equipment maintenance suppliers of this construction enterprise. Then, the weights of indexes were calculated and their consistency was checked.

Table 2 shows that all the 5 designed judgment matrices passed the consistency check, and index weights were further calculated as seen in Table 3.

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Table 2. AHP Consistency Check Results

Measuring factor	Largest eigenvalue	CI value	RI value	CR value	Consistency check result
Equipment quality	4.244	0.081	0.89	0.091	Pass
Maintenance price	3.009	0.005	0.52	0.009	Pass
Service level	3.018	0.009	0.52	0.018	Pass

Enterprise competence	4.216	0.072	0.89	0.081	Pass
Enterprise performance	4.021	0.007	0.89	0.008	Pass
Total index	5.211	0.053	1.12	0.047	Pass

Table .3. Index weights

First-level index	Weight	Second-level index	Weight	Total weight
Equipment quality	0.1345	Equipment performance	0.1599	0.0215
		Equipment durability	0.2377	0.0320
		Equipment acceptance rate	0.3091	0.0416
		Equipment green level	0.2933	0.0394
Maintenance price	0.1381	Equipment warehousing cost	0.1638	0.0226
		Equipment transportation cost	0.2973	0.0411
		Equipment maintenance price	0.5390	0.0745
Service level	0.1748	Service attitude	0.1698	0.0297
		Staff quality	0.4429	0.0774
		After-sales service	0.3873	0.0677
Enterprise competence	0.3321	Warehousing level	0.1710	0.0568
		Financial situation	0.2207	0.0733
		Informatization level	0.2379	0.0790
		Timely equipment maintenance ability	0.3704	0.1230
Enterprise performance	0.2205	Cooperation experience	0.1485	0.0327
		Historical rewards and punishment	0.1632	0.0360
		Market occupancy	0.3263	0.0720
		Contract performance rate	0.3620	0.0798

The weights of all indexes were calculated using AHP. Three indexes-timely equipment maintenance ability, informatization level, and equipment maintenance price—had the maximum weights, being key factors influencing the supplier selection of the construction enterprise for large equipment maintenance. A possible main reason was that the timely equipment maintenance ability is the most critical factor measuring the supplier selection of the construction enterprise for large equipment maintenance because the construction enterprise needs to work overtime for construction in face of fierce market competition. Equipment maintenance enterprises conduct timely and rapid equipment maintenance within an agreed period to ensure the smooth subsequent construction work and further guarantee the completion of the whole project on schedule. The informatization level is also gradually deepened as construction enterprises utilize information technologies, and information system strategies have been highly valued by enterprises and become a key constituent part of enterprise strategies. Hence, suppliers' good information technologies exert an effective promoting effect on the development of construction enterprises. A favorable informatization level can facilitate construction enterprises to reach the goal of improving their large construction equipment management efficiency. The equipment maintenance price is the third most important factor influencing supplier selection and the key that must be considered in project construction, and it is very important for reducing the total cost and equipment maintenance cost of construction enterprises.

4.2 VIKOR calculation results

Then, six large equipment maintenance engineers from construction enterprises and eight professors majoring in architecture in institutions of higher learning were invited to score the performance of seven enterprises providing the construction enterprise with equipment maintenance services during 2017–2021. The construction enterprise submitted related materials provided by the seven enterprises to experts who gave subjective scores to the seven equipment maintenance suppliers, with the score ranging from 1 to 10.

Firstly, the positive and negative ideal solutions of each decision matrix were calculated as per Formulas (5) and (6), as seen in Table 4.

Table 4. Optimal and worst values

Second-level index	Optimal scheme (positive ideal solution) R	Worst scheme (negative ideal solution) R-
Equipment performance	0.465	0.321
Equipment durability	0.478	0.273
Equipment acceptance rate	0.495	0.291
Equipment green level	0.475	0.291
Service attitude	0.437	0.332
Staff quality	0.475	0.290
After-sales service	0.495	0.265
Warehousing level	0.484	0.321
Financial situation	0.441	0.299
Informatization level	0.461	0.284
Timely equipment maintenance ability	0.428	0.318
Cooperation experience	0.432	0.264
Historical rewards and punishment	0.445	0.265
Market occupancy	0.479	0.284
Contract performance rate	0.469	0.304
Equipment warehousing cost	0.276	0.474
Equipment transportation cost	0.268	0.438
Equipment maintenance price	0.285	0.511

Table 5. VIKOR analysis results

Supplier	Sum (S) of distance ratio of optimal schemes	Maximum value (R) of distance ratio of optimal schemes	Benefit ratio Q value	Scheme (Q value) ranking
A	0.5807	0.0556	0.9063	6
B	0.6214	0.0556	1.0000	7
C	0.5379	0.0556	0.8077	4
D	0.4386	0.0523	0.0794	1
E	0.5237	0.0535	0.4675	2
F	0.4041	0.0556	0.5000	3
G	0.5742	0.0556	0.8914	5

Table 5 shows that the benefit ratio Q value was calculated by the VIKOR method according to the distance of the evaluation object to positive and negative ideal solutions to evaluate the relative strength and weakness. Next, the benefit ratio Q value was used to express the proximity of the evaluation object to the reasonable scheme, and the smaller the Q value, the better the evaluation object, and the better its ranking.

Through the VIKOR-based calculation results (Table 5), supplier D ranked first, so the construction enterprise regarded supplier D as its large equipment maintenance supplier. The AHP–VIKOR comprehensive model, which was the synthesis and compromise of two models, considered the overall proximity between each alternative supplier and the ideal supplier as well as their differences in internal variation trends and enhanced the comprehensive evaluation from a theoretical level, thereby having strong reliability and scientificity. Therefore, supplier D was accepted as the optimal equipment maintenance supplier of the construction enterprise to carry out strategic cooperation. Suppliers E and F ranked second and third successively, which could be taken as alternative equipment maintenance suppliers of the construction enterprise.

4.3 Discussion

The literature review shows that the connotations about the evaluation index system for large equipment maintenance suppliers of construction enterprises have been gradually enriched in recent years. Price and quality are taken as important evaluation indexes, and enterprise service level, after-sales service, enterprise strategy, and cultural collaboration ability have also been included into the investigation. The indexes concerned vary with different industries. Therefore, comprehensive considerations should be taken during supplier selection. If established, a reasonable evaluation index system can improve the efficiency of supplier selection. In this study, the present research status in academic cirlce was analyzed. Five main factors influencing supplier selection were acquired, namely, equipment quality, maintenance price, service level, enterprise competence, and enterprise performance. On this basis, initial evaluation indexes were selected. A total of 18 second-level evaluation indexes were screened out through the questionnaire survey method, including equipment performance, equipment durability, equipment acceptance rate, and equipment green level. Then, a reasonable evaluation index system was constructed to provide a basis for the subsequent supplier selection, with certain applicability and comprehensiveness, thereby enhancing the efficiency of supplier selection. After all types of influencing factors were comprehensively considered, the advantages and disadvantages of each selection method were analyzed.

The AHP method simplifies complex problems into a series of simple comparison and sorting problems, followed by a comprehensive analysis of results, thereby realizing the optimal decision-making. Hence, index weights were calculated through the AHP method in this study. The VIKOR method introduces technique for order preference by similarity to an ideal solution to solve the ranking and selection problem in case of conflicts among multiple criteria and performs ranking according to the proximity of the evaluation value of each alternative scheme to the ideal scheme. Given this, VIKOR and AHP, if combined, can be used to calculate and rank the maximum group benefit value, minimum individual regret value, and benefit value of equipment maintenance suppliers for the construction enterprise to select the optimal scheme. The results proved that this combined method, which fully considered the relationship between the maximum group benefit and minimum individual regret, could select the optimal scheme feasibly and effectively. If combined to select the large equipment maintenance supplier for the construction enterprise, VIKOR and AHP can effectively reduce the impacts brought by uncertain factors, which is convenient for the enterprise to rapidly obtain important data required and rank alternative suppliers on this basis, thus providing construction enterprises with a more efficient and feasible supplier selection method.

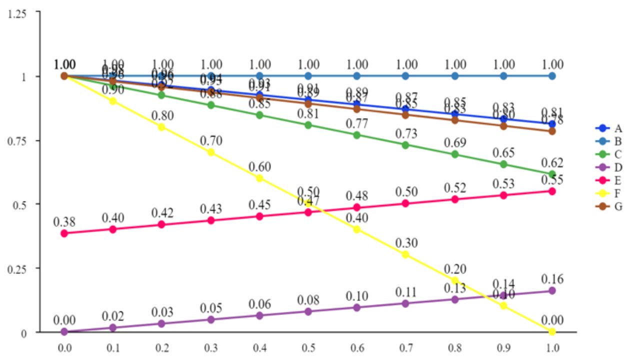

Fig. 2. Lambda value and profit ratio Q value

5. Conclusions

With the continuous scientific and technological progress and the advancement of management methods in the construction industry, equipment and facilities used in construction have gradually developed toward large-scale, continuous, complex, precise, and flexible directions. Therein, large equipment has been operating for a long term and subjected to performance deterioration (e.g., wear, corrosion) and sudden faults whenever possible. If such equipment is not promptly and efficiently repaired and maintained by high-quality large equipment maintenance suppliers, the proportion of maintenance costs in the total cost will increase substantially, thereby influencing the management performance of the whole construction project. In this study, the supplier selection of a top 10 construction enterprise in China for large equipment maintenance was taken as a case. Then, factors influencing supplier selection were analyzed by combining AHP and VIKOR, followed by comparisons and ranking of schemes. Results show that the key factors influencing supplier selection of a construction enterprise for large equipment maintenance are the timely equipment maintenance ability, informatization level, and equipment maintenance price. VIKOR calculation results manifest that the supplier D ranks first, so it is taken as the large equipment maintenance supplier for the construction enterprise. Hence, the practicability and operability of the AHP–VIKOR combined method in the scientific selection of suppliers have been proved. Suggestions are as follows. The characteristics of the construction industry and construction products can be continuously combined to further perfect the evaluation index system, and the concept of green construction can be integrated into the evaluation and selection of large equipment maintenance suppliers for construction enterprises. Moreover, more different industries can be chosen to verify the universality of the research results.

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