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MULTI-CRITERIA DECISION-MAKING APPROACHES FOR IT OUTSOURCING PROJECT PORTFOLIO MANAGEMENT

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The article provides an in-depth review of key multi-criteria decision-making (MCDM) approaches relevant to IT outsourcing project portfolio management. The discussion covers the classification of methods – from hierarchical and distance-based techniques to outranking, utility/efficiency, and hybrid approaches – with a focus on their strengths, limitations, mathematical requirements, and applicability in IT outsourcing environments. Comparative tables summarise advantages and disadvantages, typical application scenarios, and decision-support criteria. The paper also examines methodological aspects of selecting an MCDM method, considering data types, portfolio scale, uncertainty, resource constraints, and integration with collaborative decision-making tools. Additional frameworks for method selection are proposed, aiming to support IT outsourcing companies in aligning portfolio decisions with strategic goals.

Introduction

Over the last decade, the IT outsourcing industry has shown stable growth, accompanied by an intensification of competition. Companies aiming to maintain or strengthen their market positions can no longer rely solely on financial indicators when evaluating potential projects. Experience demonstrates that focusing exclusively on revenue or profitability leads to the gradual erosion of key competencies and increased portfolio vulnerability to market fluctuations. This challenge is particularly relevant in emerging IT service economies, where export revenue from the sector constitutes a significant portion of national GDP. In such contexts, competitive pressures demand that companies select projects based not only on short-term profit but also on strategic alignment, capability development, risk control, and optimal resource allocation.

Multi-Criteria Decision-Making (MCDM) methods provide a structured framework to address this challenge. Unlike intuitive judgment or single-criterion models, MCDM enables decision-makers to evaluate multiple heterogeneous factors simultaneously, reduce subjectivity, and ensure that choices remain aligned with long-term corporate strategy.

The selection of a specific method depends on various factors, including the nature of available data, the complexity of the portfolio, the number of stakeholders involved, and the resources available for model development. In the IT outsourcing context, methods must be flexible enough to handle both quantitative and qualitative criteria and support collaborative decision-making processes.

1. Classification of MCDM Methods

In project portfolio management research, MCDM methods are commonly grouped into categories that reflect their conceptual foundation and computational logic. This section expands on each method group, outlining its main principles, mathematical basis, and practical implications for IT outsourcing companies.

Table 1

Classification of MCDM methods

Method group	Examples	Core principle	Data type	Typical IT outsourcing tasks
Hierarchical	AHP, ANP	Pairwise comparison and criteria hierarchy	Quantitative, qualitative	Determining criteria weights
Distance-based	TOPSIS, VIKOR	Proximity to ideal solution	Quantitative	Project ranking
Outranking	ELECTRE, PROMETHEE	Establishing relative preferences	Quantitative, qualitative	Vendor/partner evaluation
Utility/ Efficiency-based	MAUT, DEA	Integrated utility or efficiency assessment	Quantitative	Resource efficiency evaluation
Hybrid	AHP–TOPSIS, ANP–VIKOR	Combination of methods	Mixed	Comprehensive project selection

1.1 Hierarchical methods (AHP, ANP) – decompose complex decision problems into levels: a goal at the top, criteria in the middle, and alternatives at the bottom [6]. Decision-makers perform pairwise comparisons of elements within the same level using a numerical scale (e.g., Saaty's 1–9 scale) to express relative importance. The comparison matrices are processed to derive priority vectors (weights), and a consistency ratio (CR) is calculated to verify logical coherence. In IT outsourcing, these methods are useful for criteria weight determination when selecting contracts or allocating resources.

1.2 Distance-based methods (TOPSIS, VIKOR) – rank alternatives by calculating their relative closeness to an ideal solution and their distance from an anti-ideal solution [4]. For example, in TOPSIS, each criterion is normalized, weighted, and then used to compute Euclidean distances to the ideal and anti-ideal points. The final score is the closeness coefficient.

1.3 Outranking methods (ELECTRE, PROMETHEE) – compare alternatives pairwise to determine whether one outranks another based on concordance and discordance indices [5, 7]. In IT outsourcing, these methods are valuable when qualitative assessments are as important as quantitative measures.

1.4 Utility/Efficiency-based methods (MAUT, DEA) – transform performance on each criterion into a utility score or measure the efficiency of each alternative as the ratio of weighted outputs to weighted inputs [8, 9].

1.5 Hybrid methods (AHP–TOPSIS, ANP–VIKOR, Fuzzy MCDM) – combine complementary strengths of different approaches [3]. For IT outsourcing, hybrid methods are attractive when both strategic alignment and numeric performance indicators must be considered in one framework.

2. Comparative Analysis for IT Outsourcing

The diversity of multi-criteria decision-making methods available to managers in the IT outsourcing sector reflects the broad spectrum of decision contexts encountered in practice. While all MCDM approaches share the common goal of integrating multiple evaluation criteria into a single, coherent assessment, they differ significantly in their mathematical foundations, data requirements, interpretability, and suitability for specific operational environments. Understanding these differences is critical for ensuring that the selected method not only yields a robust ranking of alternatives but also fits the strategic and operational realities of a given company.

In the context of IT outsourcing project portfolio management, hierarchical methods such as the Analytic Hierarchy Process (AHP) and the Analytic Network Process (ANP) are often appreciated for their conceptual clarity and ability to capture subjective judgments in a structured way [6]. They enable decision-makers to decompose complex problems into manageable components, assigning weights to criteria through systematic pairwise comparisons. This transparency makes them particularly effective for strategic discussions in which consensus among stakeholders is important. However, their reliance on human judgment can become a limitation when the number of criteria and alternatives grows. In large-scale portfolios, the cognitive burden of numerous pairwise comparisons can lead to inconsistencies, and the subjective nature of the inputs may introduce bias if not managed carefully [1].

Distance-based approaches, including the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) and the VIKOR method, are grounded in the geometric evaluation of alternatives relative to ideal and anti-ideal solutions [4]. They tend to perform well in environments where quantitative data are readily available and comparable across alternatives. For IT outsourcing companies that track detailed financial indicators, risk scores, and resource usage metrics, these

methods offer an efficient and reproducible way to produce rankings. Their outputs are straightforward to interpret: alternatives closer to the ideal point and further from the anti-ideal point are preferred. Nonetheless, these approaches require careful normalization of data, and their results can be sensitive to the weighting scheme and the presence of outliers [10].

Outranking methods such as ELECTRE and PROMETHEE adopt a different logic, focusing on the degree to which one alternative can be said to outrank another based on concordance and discordance measures [5, 7]. This family of methods is especially well suited to decision problems where both quantitative and qualitative criteria play decisive roles and where the objective is not merely to produce a strict ranking but to explore dominance relationships between alternatives. In IT outsourcing, such methods can be valuable when evaluating strategic partnerships or innovation-driven projects, where qualitative assessments – such as brand fit or potential for technology transfer – are as significant as measurable financial returns. However, their mathematical complexity and the need to calibrate thresholds or preference functions may pose challenges for organizations without specialized decision-analysis expertise.

Utility and efficiency-based methods, including Multi-Attribute Utility Theory (MAUT) and Data Envelopment Analysis (DEA), provide yet another perspective. MAUT aggregates multiple criteria into a single utility score, allowing explicit modelling of the decision-maker's risk preferences and trade-offs between attributes [8]. DEA, on the other hand, measures the relative efficiency of alternatives by comparing weighted outputs to weighted inputs [9]. These methods are particularly attractive to larger IT outsourcing firms with the capacity to collect and maintain high-quality datasets on project performance and resource utilization. In such cases, DEA can uncover underperforming projects or teams, while MAUT can integrate diverse performance dimensions into a unified decision framework. Their main limitation lies in the need for extensive, accurate, and comparable data, as well as in the technical expertise required to construct valid utility functions or linear programming models.

Hybrid methods, most notably AHP–TOPSIS, seek to combine the advantages of qualitative and quantitative approaches [3]. By using AHP to derive weights and TOPSIS to conduct the final ranking, these methods allow strategic priorities to be incorporated while ensuring that the evaluation reflects quantitative performance metrics. For IT outsourcing portfolios that include both strategic capability-building projects and high-revenue contracts, such hybrid models can offer a balanced view. They also facilitate structured participation from multiple

stakeholders, as the AHP stage can incorporate the perspectives of executives, project managers, and technical leads. The trade-off is that hybrid methods are more demanding in terms of modelling time and often require custom software or advanced spreadsheet models to implement effectively.

When comparing these approaches holistically, it becomes evident that no single method dominates across all decision contexts. Hierarchical methods excel in clarity and stakeholder engagement but may falter under the weight of large datasets. Distance-based methods are efficient for quantitative, well-structured data but require careful preprocessing and may oversimplify nuanced strategic considerations. Outranking methods handle complexity and mixed data types gracefully yet demand more advanced methodological skills. Utility and efficiency approaches provide a strong analytical foundation but depend heavily on data quality. Hybrid models offer the promise of integration but come with higher implementation costs.

Ultimately, the choice of method in IT outsourcing portfolio management must balance analytical rigour with practical constraints, aligning the method's strengths with the company's decision-making culture, data environment, and strategic objectives. The tables below synthesize these comparative insights, summarizing the advantages, limitations, and typical applications of each method within the IT outsourcing context

Table 2

Advantages, limitations, and IT outsourcing applications of MCDM methods

Method	Advantages	Limitations	IT outsourcing applications
AHP / ANP	Transparent; consistency check; intuitive for experts	Subjectivity; limited number of criteria	Determining weights for contract selection
TOPSIS / VIKOR	Quantitative accuracy; accounts for both benefits/costs	Sensitive to data normalization; full datasets needed	Ranking projects
ELECTRE / PROMETHEE	Works with incomplete/qualitative data	Complex interpretation; computationally demanding	Supplier or partner evaluation
MAUT / DEA	Integrated efficiency assessment	Requires large, accurate datasets	Evaluating resource efficiency
AHP–TOPSIS	Combines expert and quantitative evaluation	Requires specialized software	Comprehensive contract selection

Table 3

Computational characteristics of MCDM methods

Method	Complexity growth with alternatives	Sensitivity to weight changes	Need for normalization	Software availability
AHP / ANP	Quadratic (pairwise comparisons)	High	No	Expert Choice, Super Decisions
TOPSIS / VIKOR	Linear	Moderate	Yes	Excel, MATLAB, Python libs
ELECTRE / PROMETHEE	Quadratic	Low–Moderate	No	Decision Lab, Visual PROMETHEE
MAUT / DEA	Varies (linear; LP complexity)	Low	Sometimes	DEA Solver, R, Python
AHP–TOPSIS	Combination of above	Moderate–High	Yes	Custom integrations

3. Methodological Aspects of Selecting an MCDM Method

Selecting an appropriate multi-criteria decision-making method for IT outsourcing project portfolio management is not a purely technical exercise; it is a process shaped by the interplay of data availability, decision complexity, organizational priorities, and the cultural environment in which decisions are made. The methodological choice is ultimately a question of fit – between the capabilities of a given approach and the operational realities of the company.

One of the most decisive factors in this process is the nature and quality of the available data. When the evaluation must be based on qualitative judgments, incomplete information, or linguistic descriptors, hierarchical approaches such as the Analytic Hierarchy Process (AHP) or the Analytic Network Process (ANP) provide a structured way to translate expert opinions into numerical priorities [6]. By contrast, when companies can rely on complete and consistent quantitative indicators – such as net present value, risk exposure metrics, or resource allocation figures – distance-based techniques like TOPSIS and VIKOR can produce rankings that are both efficient to compute and easy to interpret [4]. In environments where data are mixed or inherently uncertain, fuzzy extensions of these methods offer an effective compromise, allowing qualitative assessments to be incorporated into quantitative models [3].

The size of the portfolio and the number of evaluation criteria also exert significant influence on method selection. Large portfolios containing dozens of alternatives can quickly render hierarchical methods impractical due to the exponential growth in pairwise comparisons. In such cases, approaches with linear computational complexity, including TOPSIS, VIKOR, or Data Envelopment Analysis (DEA), are generally more scalable [9]. Smaller portfolios with well-

defined strategic objectives, on the other hand, can benefit from the transparency and participatory nature of AHP, especially when stakeholder engagement is a priority.

Decision environments in IT outsourcing are often shaped by varying degrees of risk and uncertainty, particularly when projects involve new technologies, emerging markets, or untested business models. Under such conditions, outranking approaches like ELECTRE and PROMETHEE [5, 7] provide valuable flexibility by accommodating partial dominance and by allowing the decision-maker to set veto thresholds for certain criteria. Hybrid models that incorporate fuzzy logic can further enhance resilience to uncertainty by tolerating imprecision in both criteria weights and performance scores [3].

Practical considerations such as time constraints and resource availability frequently determine whether a method is viable in a given situation. When deadlines are tight and analytical resources are limited, simpler models such as TOPSIS or basic versions of the Multi-Attribute Utility Theory (MAUT) [8] can be implemented using standard spreadsheet tools, providing timely results without sacrificing basic methodological soundness. By contrast, strategic planning exercises that unfold over longer time horizons can justify the greater investment required to implement hybrid frameworks like AHP–TOPSIS, which combine the depth of qualitative weighting with the precision of quantitative ranking [3].

Finally, the growing availability of collaborative decision-support systems is changing the way MCDM methods are selected and applied in IT outsourcing contexts. Platforms such as *decideXpert* [3] integrate multiple decision-making algorithms into a single environment, enabling geographically distributed teams to participate in evaluations and receive real-time feedback on consistency and sensitivity. The integration of such tools not only streamlines the computational process but also improves transparency and stakeholder buy-in, reducing the likelihood of disputes over final rankings.

In practice, method selection is rarely about finding the perfect algorithm; rather, it is about aligning analytical capabilities with the strategic imperatives of the firm. Smaller organizations with limited data may value transparency and ease of use over methodological sophistication, whereas larger enterprises with mature analytics infrastructures can afford to deploy more complex, data-intensive models. The most effective choices are those that balance methodological rigour with usability, ensuring that portfolio decisions are not only technically defensible but also strategically coherent.

The key considerations outlined above can be synthesised into a condensed framework, presented in the table below, which maps different decision contexts to the most suitable MCDM methods for IT outsourcing portfolio management.

Conclusions

This extended review confirms that no single MCDM method universally fits all IT outsourcing portfolio management contexts. Hierarchical methods provide transparency and stakeholder engagement, distance-based methods offer computational efficiency, outranking methods handle uncertainty well, utility and efficiency methods excel with reliable data, and hybrid approaches balance strengths at the cost of complexity.

For practitioners, adopting a method selection framework such as Table 4 can align decision contexts with the most appropriate tools. For researchers, future work should explore integrating MCDM with AI-driven predictive analytics and digital twin simulations, enabling dynamic re-ranking as conditions evolve.

Table 4

Method Selection Map for IT Outsourcing Portfolios

Decision context	Data type	Portfolio size	Decision urgency	Recommended methods
Strategic, qualitative-heavy evaluation	Qualitative/mixed	Small	Low	AHP, ANP, Fuzzy AHP
Large portfolio, full metrics available	Quantitative	Large	Medium	TOPSIS, VIKOR, DEA
High uncertainty/risk	Mixed	Medium/Large	Medium	ELECTRE, PROMETHEE, Fuzzy MCDM
Rapid decision needed	Quantitative	Any	High	TOPSIS, MAUT
Balanced qualitative & quantitative	Mixed	Small/Medium	Low/Medium	Hybrid AHP–TOPSIS

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