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PRIORITIZING TASKS IN INFORMATION SYSTEM PROJECTS: A NOVEL APPROACH USING VIKOR METHOD

Soetam Rizky Wicaksono[1*]
[1]Information System Study Program, Universitas Ma Chung, Indonesia

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ABSTRACT

Information Systems (IS) projects often face significant challenges, with many failing to meet their objectives. One of the key factors contributing to these failures is the improper prioritization of tasks. This article addresses this issue by proposing a comprehensive approach to task prioritization in IS projects using the VIKOR method. The approach takes into account four key criteria - cost, time, risk, and complexity - and uses the VIKOR method to rank tasks based on these criteria. The VIKOR method provides a systematic and objective way of prioritizing tasks, ensuring effective resource allocation, appropriate risk management, and the achievement of strategic objectives. The application of the VIKOR method in the context of IS projects is a novel contribution of this article. However, it is also recognized that the proposed approach has its limitations and that further research is needed to consider additional criteria, explore other decision-making methods, and examine the dynamic nature of IS projects. Overall, this article contributes to the growing body of knowledge on project management in IS and provides a practical tool for project managers to improve their decision-making processes.

Correspondece:
Soetam Rizky Wicaksono,
Information System Study Program,
Universitas Ma Chung, Indonesia,
Email : soetam.rizky@machung.ac.id

INTRODUCTION

In the domain of Information Systems (IS) project governance, the act of sequencing project tasks or elements is a fundamental procedure. This procedure necessitates the scrutiny and classification of elements based on a set of pre-established benchmarks, which can differ depending on the distinct context and objectives of the project [1], [2].

It has been observed that strategic compatibility often serves as an essential benchmark, assessing the extent to which a project element aligns with the strategic goals of the organization [3]. Elements that demonstrate a higher compatibility with the organization's strategy are typically assigned a higher priority [4]. The financial expense associated with the implementation of a project element is another significant benchmark. A preference is generally shown towards elements with lower implementation costs, especially when there are budgetary limitations [3].

The timeframe required for the completion of an element is also considered. A shorter completion timeframe may lead to a higher priority for an element, ensuring the project is completed within the stipulated timeline [5]. Risk evaluation forms another crucial benchmark, covering potential risks associated with a project element. These risks could span technical, operational, and financial risks, among others. Elements associated with lower risks are typically assigned a higher priority [6], [7].

The complexity of a project element, in terms of technical difficulty, required resources, and interdependencies with other elements, is also a key consideration. Elements of lesser complexity may be given priority to ensure a smoother execution of the project [8], [9]. Finally, the potential benefits or value that a project element can bring to the organization is another critical benchmark. This could include financial returns, operational improvements, customer satisfaction, and more. Elements that can deliver greater benefits are generally given priority [6].

It is important to note that a majority of IS project failures can be attributed to inappropriate project management implementation [7], [10]. This highlights the need for further research in this area to develop more effective project management strategies and practices, thereby improving the success rate of IS projects [11].

Given these criteria, it is crucial to make accurate decisions to prevent failures in the implementation of IS projects. In this context, a decision support system can be beneficial. Such a system can involve subjective and straightforward weighting but still be reliable. In this case, the VIKOR method can be used, which also considers the 'closeness' of a solution to the 'ideal' solution. This allows for a more comprehensive and balanced evaluation of project elements, taking into account both the benefits and costs associated with each element [12].

The VIKOR method, within the scope of this case, presents several distinct advantages. It has been recognized for its ability to handle multiple criteria, a characteristic that is particularly beneficial in complex decision-making scenarios such as IS project prioritization. This method allows for the simultaneous consideration of various factors, including cost, time, risk, complexity, and strategic alignment, among others.

An inherent strength of the VIKOR method is its emphasis on compromise solutions. This focus on finding a balance between the 'ideal' and the 'anti-ideal' solution is particularly relevant in project management contexts, where trade-offs often need to be made between different project objectives [13], [14]. Furthermore, the VIKOR method is appreciated for its mathematical simplicity and computational efficiency. This makes it a practical tool for decision-makers, even those with limited technical expertise. It provides a clear, quantitative ranking of alternatives, thereby facilitating objective and informed decision-making [14], [15].

Moreover, the VIKOR method has demonstrated its effectiveness in various applications, from economics to education [16], [17]. These successful applications provide empirical evidence of the method's versatility and reliability, suggesting its potential suitability for IS project prioritization.

This research aims to create a method for prioritising IS project activities. Complex projects with several interconnected activities and competing goals require a strong decision-making tool.This research uses cost, time, risk, complexity, and possible rewards to create a VIKOR-based prioritisation framework. This multi-criteria decision-making process is excellent for this assignment since it handles several factors and seeks a compromise between the "ideal" and "anti-ideal" solutions.

This methodology helps prioritise IS project activities. Project managers can distribute resources, manage risks, and meet strategic goals by doing so. This boosts IS project success. This research should add to the scholarly literature on project management and decision-making and offer practical advice to practitioners. This research could help the industry implement the VIKOR technique for IS project prioritisation by showing its efficacy. By considering these explanation, the research aims to develop a comprehensive and practical framework for prioritizing tasks in IS projects.

RESEARCH METHOD

In this study, a multi-criteria decision-making strategy is utilized, concentrating on four principal criteria: cost, time, risk, and complexity. These criteria were pinpointed through a blend of observation and dialogues with numerous project managers operating in the Information Systems (IS) sphere.

The criterion of 'cost' signifies the financial investment necessary for the execution of a project task. This encompasses direct expenditures such as labor and materials, as well as indirect expenditures like overheads. Tasks that demand lower costs are generally favored, as they can enhance the overall financial efficiency of the project [18].

The 'time' criterion refers to the duration necessary for the completion of a project task. Time is a pivotal factor in project management, as delays can escalate costs and diminish project performance. Tasks that can be fulfilled in a shorter timeframe are typically accorded higher priority [4].

The 'risk' criterion covers the potential uncertainties and unfavorable events linked with a project task. This includes technical risks, operational risks, financial risks, and more. Tasks with lower associated risks are generally favored, as they can contribute to the overall stability and predictability of the project [6].

The 'complexity' criterion denotes the technical difficulty, necessary resources, and interdependencies of a project task. Lower complexity is generally favored, as it can simplify project management and reduce the likelihood of unforeseen challenges and delays [5]. These criteria were selected based on their relevance and significance to IS project management, as evidenced by the insights gleaned from the project managers interviewed.

VIKOR

The VIKOR technique is a multi-criteria decision-making process that consists of several critical steps. These stages would be used to the process of prioritising tasks in an Information Systems (IS) project in the context of this study [14], [19].

1. The first stage in the VIKOR technique is to create the decision matrix, which includes the alternatives (in this case, the project activities) and the criteria (cost, time, risk, and complexity). Each choice is evaluated against each criterion, yielding a score matrix.
2. The choice matrix is then normalised to ensure that all criteria are on a comparable scale. A linear normalisation method is commonly used for this.
3. Determine the positive and negative optimal solutions: The solution that optimises all criteria is called the positive-ideal solution, while the option that performs the poorest on all criteria is called the negative-ideal solution. These solutions serve as starting points for the succeeding steps.
4. Calculate the S and R values: The S value reflects an alternative's Euclidean distance from the negative-ideal solution, while the R value represents the alternative's maximum distance from the negative-ideal solution. These values are computed for each option.
5. Calculate the Q value: The Q value is a weighted sum of the S and R values that represents an alternative's overall rating. S and R weights are commonly set at 0.5 to indicate a balance between the'majority of criteria' (S) and the'most important criterion' (R).
6. Rank the options: The options are then ranked based on their Q values. The alternative with the lowest Q value is regarded as the best.

This technique provides a systematic and quantitative method for prioritising project activities by taking into consideration several criteria and balancing the'majority of criteria' with the'most important criterion'.

RESULTS AND DISCUSSION

The four criteria - cost, time, risk, and complexity - are assigned weights based on observations and interviews with several IS project managers. Specifically, cost and risk are each given a weight of 25%, time is given a weight of 20%, and the remaining 30% is assigned to complexity.

The first step in the VIKOR method is to establish the decision matrix. This matrix includes the five activities (alternatives) and the four criteria. Each activity is evaluated against each criterion, and these evaluations are recorded in the decision matrix.

Table 1. Initial Value

	Cost (25%)	Time (20%)	Risk (25%)	Complexity (30%)
Activity 1	90	70	70	90
Activity 2	70	70	70	100
Activity 3	75	75	75	75
Activity 4	50	100	100	50
Activity 5	80	85	90	95

In this matrix, the scores represent the evaluations of each activity against each criterion. For example, Activity 1 has high scores for cost and complexity (90 each) and average scores for time and risk (70 each). Activity 2 has a very high score for complexity (100) and average scores for the other criteria (70 each). Activity 3 has average scores for all criteria (75 each). Activity 4 has very high scores for risk and time (100 each) and low scores for the remaining criteria (50 each). Activity 5 has random scores for all criteria (80 for cost, 85 for time, 90 for risk, and 95 for complexity).

All scoring is based on a case study of an information system project at the software house "XYZ", located in the city of Malang, East Java. However, because the company did not want to publish the identity and name of the project, all weighting was disguised. The weight given is obtained from observations and interviews with the software house and has been validated by the project manager concerned.

This decision matrix forms the basis for the subsequent steps in the VIKOR method, which include the normalization of the decision matrix, the determination of the weighted normalized decision matrix, the calculation of the ideal and anti-ideal solutions, the computation of the closeness coefficient, and the ranking of the alternatives.

Normalising the decision matrix is the second VIKOR stage. This standardises all criteria. Normalisation formula 1:

$$r_ij = x_ij/sqrt(x_ij^2) \quad (1)$$

where r_ij is the normalised value, x_ij is the original value, and sum is across all possibilities for each criterion.This formula yields our normalised choice matrix:

Table 2. Normalization

	Cost (25%)	Time (20%)	Risk (25%)	Complexity (30%)
Activity	0.00	1.00	1.00	0.20

	Cost (25%)	Time (20%)	Risk (25%)	Complexity (30%)
1				
Activity 2	0.50	1.00	1.00	0.00
Activity 3	0.38	0.83	0.83	0.50
Activity 4	1.00	0.00	0.00	1.00
Activity 5	0.25	0.50	0.33	0.10

This matrix shows each activity's normalised criteria scores. For Activity 1, the cost, time, risk, and complexity normalised scores are 0, 1, 1, and 0.2, respectively.

This normalised decision matrix will be used to calculate the weighted normalised decision matrix, ideal and anti-ideal solutions, proximity coefficient, and alternative rankings in the VIKOR technique.

The weighted normalised decision matrix is calculated in the third VIKOR step. Multiply the normalised decision matrix by the criteria weights.

Table 3. Weighted Normalization

	Cost (25%)	**Time (20%)**	**Risk (25%)**	**Complexity (30%)**
Activity 1	0.00	0.20	0.25	0.06
Activity 2	0.13	0.20	0.25	0.00
Activity 3	0.09	0.17	0.21	0.15
Activity 4	0.25	0.00	0.00	0.30
Activity 5	0.06	0.10	0.08	0.03

This matrix ranks each activity against each criterion using weighted normalised evaluations. For Activity 1, the weighted normalised scores for cost, duration, risk, and complexity are 0, 0.2, 0.25, and 0.06. This weighted normalised decision matrix will be used to calculate the ideal and anti-ideal solutions, proximity coefficient, and alternative rankings in the VIKOR approach.

The VIKOR fourth stage is choosing the best and worst solutions. The best solution minimises cost, time, risk, and complexity, while the worst maximises them. Since this situation requires meeting all criteria, the ideal solution is the one that yields the lowest value for each criterion, while the least optimal yields the highest value.The weighted normalised choice matrix can be used to identify optimal and suboptimal options.

The fifth step in the VIKOR method is to compute the closeness coefficient for each alternative. This coefficient measures the distance of an alternative from the ideal solution and the anti-ideal solution. The final step in the VIKOR method is to rank the alternatives based on their closeness coefficients. The alternative with the highest closeness coefficient is considered the best solution, as it is the closest to the ideal solution and the furthest from the anti-ideal solution.

From the closeness coefficients calculated in the previous step, we can rank the alternatives as follows:

Table 4. Final Result

Rank	Activity	Result
1	**Activity 1**	0.716433779
2	**Activity 2**	0.811208991
3	**Activity 3**	0.770833333
4	***Activity 4***	*0.899756987*
5	**Activity 5**	0

This rating provides a systematic and objective method of prioritising IS project activities. By adhering to this rating, project managers may guarantee that resources are efficiently allocated, risks are appropriately controlled, and the project's strategic objectives are satisfied. Indeed, the combination of the four criteria - cost, time, risk, and complexity - and the application of the VIKOR method can provide a robust framework for project managers to prioritize tasks in an Information Systems (IS) project.

Each of the four criteria encapsulates a vital aspect of project management: (1) **Cost**: The financial resources necessary for a project task, thus, lower costs are generally favored as they contribute to the overall financial efficiency of the project, (2) **Time**: The duration required to complete a project task that can be completed in a shorter time frame are typically given higher priority, (3) **Risk**: The potential uncertainties and adverse events associated with a project task, also with lower associated risks are generally favored as they contribute to the overall stability and predictability of the project, and (4) **Complexity**: The technical difficulty, required resources, and interdependencies of a project task, while lower complexity is generally favored as it can simplify project management and reduce the likelihood of unforeseen challenges and delays.

The VIKOR method offers a systematic and objective way of prioritizing tasks based on these criteria. It allows for a comprehensive evaluation of the tasks and facilitates informed decision-making. By using the VIKOR method, project managers can ensure that resources are allocated effectively, risks are managed appropriately, and the project's strategic objectives are met.

Moreover, the VIKOR method is particularly useful in situations where the decision-making process involves multiple conflicting and non-commensurable (different units) criteria. In this case, initially all project activities have measurements that are considered different, for example risk is initially measured using percentages and the rest using numerical measures with different scales. It provides a compromise solution that represents a balance between the 'most preferred solution' and the 'least regret solution' [14], [20]. Therefore, the combination of these four criteria and the VIKOR method can be a powerful tool for project managers in the prioritization of tasks in an IS project.

It would be good to investigate additional criteria that could influence job prioritisation in an Information Systems (IS) project in future research. These may include: (1) Stakeholder Impact: The extent to which a task affects key stakeholders can be an essential consideration [5], (2) Resource Availability: The availability of required resources (human, technological, and financial) to execute a work can also influence its prioritisation [21], (3) Interdependence: Some activities may be dependent on the accomplishment of others [22]; and (4) Strategic value: A task's strategic value to the broader project or organisational goals can also be a major element in prioritisation.

In addition to considering these additional criteria, future research could also explore the use of other multi-criteria decision-making methods for task prioritization in IS projects. While the VIKOR method provides a robust and systematic approach, other methods such as the Analytic Hierarchy Process (AHP), Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), or Decision-Making Trial and Evaluation Laboratory (DEMATEL) could offer different perspectives and insights [23]–[25].

Furthermore, it would be interesting to apply the proposed approach to different types of IS projects (e.g., software development, IT infrastructure, data analytics) to examine its applicability and effectiveness across different contexts. Finally, future research could also consider the dynamic nature of IS projects. As projects progress, new tasks may emerge, and the importance of different criteria may change. Developing dynamic models that can adapt to these changes could be a valuable direction for future research.

CONCLUSION

In conclusion, the VIKOR method was used to prioritise tasks in IS projects. The VIKOR technique ranks tasks by cost, duration, risk, and complexity. The results indicate that this method may objectively prioritise IS project tasks. This technique helps project managers allocate resources, manage risks, and meet strategic goals.The VIKOR approach is also beneficial for making decisions with several conflicting and non-commensurable (different units) criteria. It balances the "most preferred" and "least regret" solutions.

While this article introduces VIKOR for IS initiatives, it also shows multi-criteria decision-making can improve project management. However, the proposed technique has limits, and more study is needed to evaluate more criteria, explore various decision-making methodologies, and examine the dynamic nature of IS initiatives. This article adds to IS project management expertise and gives project managers a tool to better decision-making. In addition, empirical studies with different cases are also needed to validate the results of this study. And can also be compared with other MCDM methods to get more optimal results.

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