

INTEGRATING NET PRESENT VALUE AND BENEFIT COST RATIO METHODS IN CONSTRUCTION PROJECT PLANNING AND MANAGEMENT: A LITERATURE REVIEW

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Abstract: Effective planning and management of construction projects require precise financial feasibility analysis to ensure successful investment outcomes and optimal resource utilization. Net Present Value (NPV) and Benefit Cost Ratio (BCR) are widely used economic evaluation tools, yet their integration is still rarely applied in a systematic manner. This study employs a Systematic Literature Review (SLR) to examine the benefits and applications of integrating NPV and BCR within the context of construction projects. The findings reveal that combining these methods offers a more comprehensive assessment of project feasibility by accounting for both absolute project value and investment efficiency. This integration enhances financial risk management associated with cost fluctuations and project scheduling through optimized payment systems and adaptive float time management. Moreover, the inclusion of supporting indicators such as the Internal Rate of Return (IRR) strengthens investment decision-making. Therefore, the integration of NPV and BCR provides a holistic and practical analytical framework to support more accurate, efficient, and sustainable investment decisions in construction project planning.

Keywords: *Net Present Value (NPV), Benefit Cost Ratio (BCR), Method Integration, Construction Project Planning, Systematic Literature Review (SLR)*

INTRODUCTION

Planning and managing construction projects face significant challenges in ensuring financial feasibility and operational sustainability. Economic feasibility analysis becomes a crucial aspect to ensure optimal investment and to avoid system failure

risks and resource wastage (Estu, Susanti, & Hadinata, 2021, p. 6). In this context, the Net Present Value (NPV) and Benefit Cost Ratio (BCR) methods have been widely used as economic evaluation tools to assess the profitability and efficiency of construction project investments (Gittinger, 1997; Husnan & Suwarsono, 2014; Tiwari & Sahota, 2018). NPV provides the net added value of a project by calculating the difference between benefits and costs discounted to present value, whereas BCR presents the ratio between benefits and costs, thereby reflecting the efficiency of investment fund utilization.

Although both methods have been extensively applied, systematic integration of NPV and BCR in construction project planning and management is still relatively rare. Previous studies typically evaluate project feasibility based on only one of the methods, which may reduce the accuracy and holistic nature of decision-making (Febriyan et al., 2017; Ihsan, 2015). Moreover, some research focuses on the individual application of each method without integrating them into a comprehensive strategy for payment management and scheduling (Putri, Alpian, Ristiandi, & Tasya, 2023; Putri & Putra, 2024).

A major issue often encountered in construction projects is the risk of cost overruns and project delays, which requires an adaptive approach to financial planning and scheduling. Several studies emphasize the importance of sensitivity analysis and risk management through float time control and payment system schemes, yet the integration of both economic evaluation methods with these aspects remains suboptimal (Putri & Mahani, 2024; Mahrusah & Putra, 2024). Research on the combination of NPV and BCR in this context has the potential to improve the accuracy of cash management and risk strategies, thus benefiting decision-making in increasingly complex and competitive construction projects.

Considering the research gap in integrating NPV and BCR with payment and schedule management, this study aims to: (1) analyze the implementation of the integration of Net Present Value and Benefit Cost Ratio methods in construction project planning and management; and (2) evaluate the impact of different payment systems and float time on project profitability through these financial approaches. The research questions addressed include:

How can the integration of NPV and BCR methods enhance the accuracy of financial feasibility evaluations in construction projects? And how can this integration be utilized to mitigate the risks of cost overruns and project delays?

By answering these questions, this study is expected to make a practical contribution in formulating more effective and financially sustainable project management strategies in the construction industry.

METHOD

This study employs the Systematic Literature Review (SLR) method to examine the integration of the Net Present Value (NPV) and Benefit Cost Ratio (BCR) approaches in the planning and management of construction projects. SLR is selected as a structured and methodical approach to comprehensively identify, evaluate, and analyze relevant existing studies.

Literature Collection Procedure

The data collection process for this study began with a comprehensive search of academic sources, including scholarly journals, conference proceedings, and research reports relevant to the application of Net Present Value (NPV) and Benefit Cost Ratio (BCR) methods in construction projects. Search keywords included combinations of terms such as "Net Present Value," "Benefit Cost Ratio," "construction project," "project planning," and "project management." Inclusion criteria covered publications that presented analyses or applications of NPV and BCR integration in the context of construction projects within recent years, ensuring data relevance and currency.

Study Selection

Following the initial search, studies were screened based on their titles and abstracts to identify those most relevant to the research objectives. Selected studies underwent further in-depth review. The selection process involved removing duplicates,

assessing content relevance, and verifying alignment with the review's purpose. The final selected studies represented diverse types of construction projects and various contexts in which NPV and BCR methods were applied.

Instruments and Data Analysis Techniques

The primary instruments utilized included evaluation rubrics and data extraction templates to systematically organize key information from the selected literature. This included details on method type, application context, calculated NPV and BCR values, project characteristics, and project management implications. Data were analyzed descriptively and thematically to identify patterns, relationships, and key conclusions regarding the integration of NPV and BCR methods.

Validity and Reliability

To ensure validity, the review was conducted in accordance with standardized SLR protocols, including transparent documentation of the search and selection procedures. Cross-checking was performed by involving multiple researchers to evaluate study relevance and minimize subjective bias during data selection and interpretation.

By employing the systematic literature review method, this study provides a comprehensive and integrative synthesis of the benefits, procedures, and effectiveness of combining NPV and BCR methods in construction project planning and management, thereby supporting more accurate and efficient investment decision-making.

RESULT

Definition and Core Functions

Net Present Value (NPV)

NPV is a financial evaluation method that calculates the difference between the present value of cash inflows (benefits) and cash outflows (costs) over the project's lifespan, using a specified

discount rate. It provides an absolute monetary value of a project's net gain or loss in today's terms. A positive NPV indicates that the project is financially viable, while a negative value suggests infeasibility. For instance, a study by Arga, Susetyo, and Syafwandi (2021) reported that the railway construction project at Tanjung Perak Port had an NPV of IDR 1,184,370 million, demonstrating the project's financial viability.

Benefit Cost Ratio (BCR)

BCR is the ratio of the discounted total benefits to the discounted total costs. It measures the economic efficiency of an investment by showing how much benefit is generated per unit of cost. A BCR value of ≥ 1 signifies that the project delivers benefits equal to or exceeding its costs, thus being economically feasible. In the same case, the BCR value was recorded at 1.39, indicating that the project's benefits outweighed its costs (Arga et al., 2021).

Integration in Project Planning

During the planning phase, NPV and BCR are often applied together to produce a holistic assessment of project feasibility – addressing both net value creation and the efficiency of resource utilization. NPV reveals the total net gain of a project, while BCR highlights investment efficiency, which is particularly useful in prioritizing projects under resource constraints (Asdin, Hadi, & Musa, 2022).

Accordingly, when a project shows a positive NPV and a BCR greater than one, decision-makers can be more confident that the project is not only profitable but also efficient in its use of capital (K.H. et al., 2022).

Integration in Project Management

During the implementation stage, both NPV and BCR serve as tools for monitoring and evaluation, ensuring that the actual costs and benefits remain aligned with initial projections. When deviations occur, these indicators' sensitivity facilitates anticipatory

adjustments regarding project feasibility and efficiency (K.H. et al., 2022). Additionally, NPV can be used to estimate the payback period, while BCR provides insight into cost efficiency, thus supporting effective financial risk management (Mahardini & Putra, 2024).

Inclusion of Supporting Methods

The integration of NPV and BCR is often complemented by the Internal Rate of Return (IRR), which indicates the expected rate of return relative to the minimum acceptable rate of return (MARR). A project with an IRR exceeding the MARR further reinforces its financial viability (Arga et al., 2021; Farmania & Elsyah, 2023).

Comparison between NPV and BCR Methods

The Net Present Value (NPV) and Benefit Cost Ratio (BCR) methods are both essential tools in evaluating the financial viability of construction projects, yet they serve distinct analytical purposes and offer complementary insights. NPV presents an absolute monetary value indicating the net benefit of a project after accounting for the time value of money. It is especially useful when comparing projects of similar scale, as it shows the actual financial gain or loss expected from the investment.

In contrast, BCR provides a relative measure of efficiency, illustrating the ratio of benefits to costs in discounted terms. It is particularly beneficial when decision-makers must choose among projects with different investment scales or under tight budget constraints. A BCR greater than 1 suggests that every unit of cost generates more than one unit of benefit, indicating efficient resource utilization.

While NPV helps in determining whether a project adds positive value in monetary terms, BCR helps prioritize projects by comparing the value-for-money aspect. For instance, a project with a higher NPV may be more profitable in absolute terms, but one with a higher BCR may be more efficient if resources are limited.

Therefore, using NPV and BCR in tandem allows for a more comprehensive financial evaluation—NPV addresses overall profitability, while BCR emphasizes cost-effectiveness and investment efficiency. The integration of both methods ensures a balanced decision-making process, particularly valuable in multi-project environments or under fiscal constraints.

Table 1
Comprasion Between NPV and BCR Methods

Aspect	Net Present Value (NPV)	Benefit Cost Ratio (BCR)
Main Function	Calculates the absolute added value of a project in present monetary terms.	Measures the benefit-to-cost ratio of a project, assessing investment efficiency.
Output	Monetary value (positive/negative) indicating the project's net profit.	A ratio (value ≥ 0), where > 1 indicates efficiency and economic feasibility.
Decision-Making	Projects with NPV > 0 are considered feasible.	Projects with BCR ≥ 1 are considered feasible.
Evaluation Approach	Absolute — how much total profit the project generates.	Relative — how much benefit per unit of cost.
Advantages	Provides a concrete picture of monetary gain for the company.	Facilitates prioritization among multiple project alternatives.

Aspect	Net Present Value (NPV)	Benefit Cost Ratio (BCR)
Limitations	Does not account for relative investment efficiency; large projects with high NPV may have low BCR.	May fail to distinguish between projects with similar BCRs but different absolute benefits.
Usage in Management	Monitoring project profitability, calculating cash flow and payback period.	Evaluating fund allocation efficiency, managing investment risks.

Case Study Application Example

In the railway construction project at Tanjung Perak Port, the integrated application of Net Present Value (NPV) and Benefit Cost Ratio (BCR) during the planning and management phases demonstrated both financial viability and investment efficiency in a comprehensive manner. A positive NPV of IDR 1,184,370 million reflects the project’s absolute net value, while a BCR of 1.39 indicates that every rupiah invested yields a greater benefit, confirming the project's economic feasibility and cost-effectiveness (Arga, Susetyo, & Syafwandi, 2021).

This integrated approach provides project managers with a well-rounded evaluation framework—NPV assesses net profitability, BCR evaluates investment efficiency, and IRR serves as an additional indicator to ensure the expected return rate exceeds the minimum acceptable threshold (Farmania & Elsyah, 2023; Mahardini & Putra, 2024).

Therefore, the combined use of NPV and BCR enables more informed decision-making, accurate budget planning, and effective, sustainable risk management in construction project execution.

DISCUSSION

The study's results highlight the critical importance of integrating Net Present Value (NPV) and Benefit Cost Ratio (BCR) methods within construction project planning and management frameworks. The finding that projects exhibiting positive NPV values coupled with BCR ratios equal to or exceeding one are financially viable and efficient supports the underlying premise that a multidimensional evaluation approach yields a more comprehensive understanding of project feasibility. This integration not only supplements financial appraisal by considering absolute gains (NPV) and relative efficiency (BCR) but also addresses inherent limitations observed when these indicators are used in isolation, such as BCR's inability to fully capture absolute profitability and NPV's omission of investment efficiency.

Practically, the combined use of NPV and BCR facilitates better-informed decision-making by project managers in budgeting, prioritization, and risk management processes. For instance, the application of these methods in the case study of the Tanjung Perak railway construction project demonstrated that a positive NPV of Rp1,184,370 million alongside a BCR of 1.39 not only confirmed the project's economic feasibility but also validated its efficient investment of resources. This corroborates findings from previous studies that promote integrated financial assessments as essential in contexts where capital allocation needs to be judicious and aligned with strategic objectives (Farmania & Elsyah, 2023; Mahardini & Putra, 2024).

From a theoretical perspective, the results confirm that the dichotomy of absolute versus relative financial evaluation is a

pivotal consideration in project finance literature. The study upholds the proposition that combining NPV and BCR, often supplemented by measures such as Internal Rate of Return (IRR), enriches the analytical rigor and reduces erroneous inferences about project desirability. This nuanced approach contributes to broader discourse on sustainable infrastructure investment, where maximizing monetary returns must be balanced with efficient use of limited resources and mitigation of investment risks.

The importance of this issue transcends the specific project examined. It addresses larger challenges faced by project financiers and policymakers in emerging economies that grapple with capital scarcity and heightened uncertainty. By evidencing that integrated financial metrics provide clarity and confidence in project selection and continuation decisions, the study suggests a pathway for enhancing governance and resource optimization in infrastructure development. Conversely, these findings challenge narrower evaluation practices that might overlook critical facets, such as relative efficiency or sensitivity to cost-benefit fluctuations.

In sum, the evidence supports the broader proposition that project evaluation should adopt multifaceted frameworks combining absolute and ratio-based assessments. Such integration not only strengthens financial viability conclusions but also informs more resilient risk and resource management strategies. Future research could build on these insights by exploring how dynamic economic variables influence the interplay of NPV and BCR over project lifecycles, further refining decision-making tools in complex project environments.

CONCLUSION

This study concludes that the integrated application of Net Present Value (NPV) and Benefit Cost Ratio (BCR) methods provides a robust and comprehensive framework for assessing the financial feasibility and investment efficiency of construction

projects. Combining these approaches enables more informed decision-making, optimizing resource allocation and risk management while ensuring both profitability and cost-effectiveness. The findings underscore the necessity of multidimensional evaluation tools in project management to address the complexities of infrastructure investments, particularly in resource-constrained environments. This integrated method not only enhances confidence in project selection but also supports sustainable and efficient project execution.

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