A Review on Evaluation of Economic Sustainability of Construction Materials Through Cost-Benefit Analysis

[1]Jessy Felix, [2]Sahimol Eldhose

[1]PG student, Civil Department, Toc H Institute of Science & Technology, Kerala.

[2]Assistant Professor, Civil Department, Toc H Institute of Science & Technology, Kerala.

[1]happyjeff122@gmail.com, [2]sahimol27@gmail.com

ABSTRACT - Sustainability is one of the major concerns in the present scenario. To bring out the economic benefits in sustainable construction the method of cost-benefit analysis can be used. Cost-benefit analysis (CBA) is a framework that is used to bring out the benefits of a project over its costs. This method can be used before the start of a project and also for comparing various business models. In order to calculate the benefits of a particular project, it needs to be converted to its monetary terms. CBA method helps to bring out the benefits in terms of costs. The various key indicators for Cost-benefit analysis are net present value (NPV), benefit cost ratio, incremental benefit cost ratio, internal rate of return (IRR) and payback period (PBP).

Keywords: Sustainability, Cost-benefit analysis, IRR, NPV

I. INTRODUCTION

Cost-benefit analysis technique is used for projects in the planning stage as well as for the comparison of various business models. This technique helps to understand whether the adopted alternatives for the projects are feasible or not. The costs and benefits need to be expressed in terms of equivalent monetary terms in that particular time for the analysis. It helps to decide the economic sustainability of the project. The various indicators like NPV, IRR, benefit cost ratio, payback period are used for CBA. Sensitivity analysis is done to check the uncertainties if any while conducting the cost-benefit analysis.

II. REVIEW ON CBA METHOD

Araujo C, Almeida M (2016) investigated and found that the cost benefit analysis methods are an upgraded version of cost optimal method. The difference between cost optimal and cost-benefit analysis method is that in CBA the stakeholders point of view is considered while selecting the alternatives for projects whereas in cost optimal method it is not. Capital costs, operational costs and maintenance costs are the main factors that affect the economic performance of a projects. In this study CBA is performed to compare building solutions with regard to costs and energy. Then, a sensitivity analysis is performed to assess the robustness of the method in terms of energy prices and discount rate.

Rochas C, Zogla G (2015) in their study compared different business models in residential sector in Latvia based on their energy efficiency with the cost-benefit analysis method. Energy performance contracts (EPC) are rarely used in residential sectors. This study was done to show that the use of EPCs reduces the annual costs for residents ensuring safe, comfortable and sustainable house. CBA was carried out considering three different project investments, costs and benefits which are in terms of saved energy costs. The indicator of NPV was used for comparison.

Liu Y, Guo X (2014) conducted a CBA of energy efficiency technology application (EETA) on green buildings in China. A new theoretical framework had to be created for the analysis. The key indicator used here was the incremental cost benefit ratio. According to EETA, a green building energy efficiency scheme (GBEES) will be first set up then the incremental costs and benefits are calculated followed by CBA. The unit area incremental costs, power price and lifetime are the factors affecting CBA of GBEES. Finally, to test the robustness of the methods sensitivity analysis is conducted.

Hanley N, Olsen S B (2018) investigated and found that CBA method can take a bottom approach towards the analysis pattern followed rather than the top down approach where a decision-making body comes first and makes decisions, applies a set of criteria's and valuing relevant benefits and costs. Instead of starting with the policy, the environmental problems are considered and then costs and benefits of their alternatives are assessed. This method embeds in the stakeholder active participation within environmental policies.

Perini K, Rosasco P (2013) conducted CBA method on various vertical greening systems (VGS) including green

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facades and living wall systems in order to bring out the economic sustainability in them. Installation, maintenance and disposal costs are compared with related private and social benefits including savings for heating and air conditioning, air quality improvement etc. determining the indicators like NPV, IRR and PBP.

Ade R, Rehm M (2019) studied a cost comparative analysis to determine the ability of residential buildings to attain the claims related to Homestar (version 4) made by the New Zealand Green Building Council (NZGBC). The modifications made only affected the elements that has impact on the operational savings which includes building thermal envelope and water fixtures and fittings.

Liu Y, Liu T (2017) presented a methodological framework to conduct an economic CBA for energy efficient retrofit (EER) of buildings over their life cycle. Project financial evaluation methods are used to carry out CBA. Key indicators are static investment payback period, IRR. Benefits include direct and indirect benefits. Costs and benefits are estimated and CBA analysis is carried out. Sensitivity analysis is conducted to test the robustness.

Rosen L, Brinkhoff P (2015) in their study used CBA as a part of Excel based multicriteria analysis (MCA) tool Sustainable choice of Remediation (SCORE) to assess the economic sustainability of the alternatives that are used in the project. The key indicator used here is the net present value.

Rosasco P, Perini K (2018) in their study evaluated the economic sustainability of vertical greening systems of a pilot project in the Mediterranean Sea through CBA. The economic benefits considered are related to the economic effects of energy savings (for air conditioning), with values deriving from field studies and monitoring activities, biomass production etc. VGS can be economically sustainable if tax reduction is considered while installation. The key indicators are IRR, NPV and PBP. Finally, a sensitivity analysis is conducted.

III. CONCLUSION

Cost-benefit analysis is necessary for evaluating expected outcomes and choosing between alternatives strategies. Performing a cost benefit analysis model is critical for the continuation of a development project. It is important that both costs and benefits be thoroughly defined and scrutinized. CBA method helps in comparing various business models and helps to bring out the benefits of proposed models over its costs. It is a decision-making process that compares all the positive and negative impacts of the decision on an objective basis and also helps in attaining economic sustainability.

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