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Life cycle cost analysis of green construction: a comparison with conventional construction

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ABSTRACT

Green buildings are perceived to be an additional burden in terms of cost and duration to the stakeholders due to the inherent level of standardization and control imposed at various stages of construction. This study focuses on the benefits for construction firm/ contractor and construction workers when green features are incorporated in a project. A detailed field study has been carried out and databases of the costs are charted out and compartmentalized. A complete Life cycle cost analysis (LCC) was carried out on a a high rise building in which green construction techniques were adopted and a similar LCC analysis was carried out on a conventional construction of the same magnitude and a comparison has been made. The sensitivity analysis is done for considering the uncertainties in the input data and taking discount factor as the sensitive parameter which shows also shows a positive trend. This study overwhelmingly shows that right from the planning stages of a project adopting green construction techniques are hugely beneficial compared to conventional construction.

KEY WORDS: Life cycle, Comparison, Construction.

1. INTRODUCTION

India is witnessing tremendous growth in infrastructure and construction development. Construction industry in India is considered to be one of the largest economic activity that grows at an average rate of 9.5% as compared to the global average of 5% and contributes 10% of GDP (JLL research). As the sector is growing rapidly, preserving the environment poses many challenges. The construction sector therefore needs to contribute towards environmental responsibility. Green Building movement in India is a step in this direction – to minimize the negative impact of construction activity on the environment. 'Traditional' LCC refers to the building and construction assets standard as per ISO 15686.

Present scenario: It is perceived to be an additional burden in terms of cost and duration to the stakeholders due to its inherent level of standardization and control imposed at various stages of construction. Building sector in India is the third largest consumer of energy and energy consumption is expected to grow at a rate of 4.3%.IGBC has assured that by 2100,there will be about 1800 crore worth of green buildings(IGBC). Green buildings offer a range of economic and environmental benefits such as

- 30-40% reduction in operation cost
- Enhancing comfort issues to the occupants.
- Improved productivity
- Incorporates latest techniques and technologies

Need for the study: Lack of time and knowledge on part of the contractors, to understand green construction in depth is one of the reasons for low acceptance of the concept. It is commonly believed that 'Green buildings cost more' and no efforts are made to study its depth from the contractor point of view. In green construction, analysis of energy savings and improvement in productivity over a period of time help to justify most green construction features are beneficial for the contractors and construction personnel as well.

Target group of study: Construction Company or Contractor, Construction personnel

Objective: The study needed to be conducted to measure the benefits for construction firm or contractor and construction workers when green features are incorporated in the project. The study involves comparison of life cycle costs of green construction with conventional construction of the same magnitude.

Scope of study: The scope of work is to make a comparative study on Life cycle cost for construction site of Green building and conventional building. The study is limited to the construction project and does not take into account the life span of the building. The study need to be carried out to ascertain the cost associated with various factors that contribute for green rating viz.

- Sustainable site planning
- Efficient water utilization
- Energy consumption
- Utilization of material and resources
- Air quality

Life cycle costing methodology: The Applications for which Life Cycle Costing is divided in two parts:
Following parameters are comes under absolute analysis:

- Plans

- Budgeting
- Contracting
- Undertaking financial issues

Cost details: The cost details of the green construction project and conventional project are shown in Figure1. From the figure it can be seen that green construction offers a savings (resale value) of 20% of the total investment compared to 8% savings in conventional construction.

The savings is due to the following aspects

- Savings due to reduction of dust and smoke control measure at site
- Savings due to reduction of site disturbance
- Savings due to reduction in artificial site lighting
- Savings due to reduction in energy consumption
- Savings due to reduction in construction waste
- Savings due to onsite utilization of construction waste
- Savings due to material and manpower transport
- Savings due to reduction in scheduled duration due to increased labour productivity

Criteria of economic analysis of LCC are given in Table 1.After identifying all costs and discounting them to the present values, they are summed up to arrive at the life cycle costs. Present value life cycle costs of green construction are found to be lesser than the present value life cycle costs of corresponding conventional construction. Comparison of life cycle costs of green and conventional construction is shown in Figure 2. It clearly indicates that LCC of green construction is lesser than conventional construction.

Calculation of supplementary measures:

Net Savings: It is a variation of the Net Benefits measure of economic performance of a project.

NS = LCC (conventional)-LCC (green)

If NS >0 , then the project is cost effective.

It is seen that the NS is greater than zero right from the base year and the savings shows an increasing trend.

Savings to Investment Ratio (SIR): Savings to investment Ratio > 1, the project is economically justified. It can be seen that right from the planning phase the ratio is greater than 1 which implies that green construction is cost effective at all stages of a project.

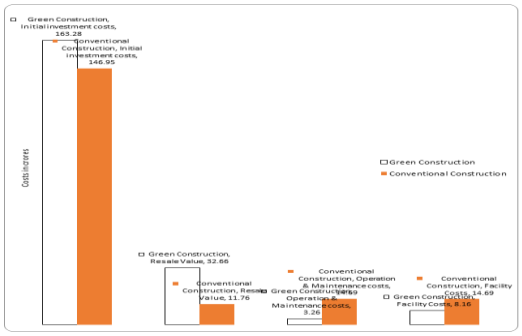

Figure.1.Comparison of Costs of Green and conventional Construction

Table.1.Criteria of economic analysis of LCC

Criteria of economic analysis	Methodology
Evaluation method	Life cycle cost analysis
Discounting approach	Present value (PV)of the Base date
Evaluation criteria	Lowest life cycle cost
	Highest net savings
	SIR>1
	AIRR>discount rate
Uncertainty assessment	Sensitivity Analysis
	Data & parameters
Base date(Beginning of Study period)	2006
Study period	Planning, Construction & Maintenance Period(6 yrs)

Table.2.Net Savings due to Green Construction

Net Savings in LCC (Rs in crores)	Number of years from the base year						
	0	1	2	3	4	5	6
	22.53	15.18	25.12	34.67	43.67	52.21	60.19

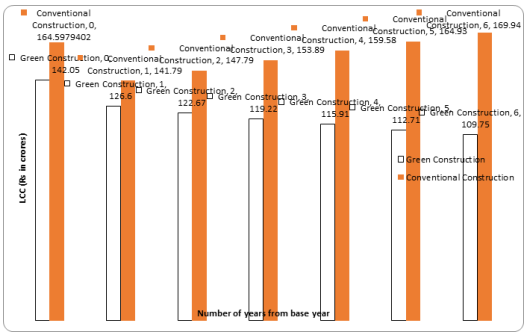

Figure.2.Comparison of LCC of Green and Conventional Construction

2. CONCLUSION

This study helps in understanding the green construction from the contractor's point of view till the maintenance period of a project. The study period for this project has been for six years which includes planning, construction and maintenance by the contractor. In the first scenario green construction planning investment comparatively more than the typical conventional method and there is a reduction in operating cost of around 5%However, a study of only the initial investment cost comparison will convince the contractors to opt for conventional buildings only. But this LCC analysis taking into account the savings in operation and maintenance costs clearly indicates that the savings due to green construction are more as the number of years of building service life increases. The sensitivity analysis is done for considering the uncertainties in the input data and taking discount factor as the sensitive parameter which shows also shows a positive trend.This study overwhelmingly shows that right from the planning stages of a project adopting green construction techniques are hugely beneficial compared to conventional construction.

REFERENCES

Anbazhagan, R, Satheesh, B, Gopalakrishnan, K, Mathematical modeling and simulation of modern cars in the role of stability analysis, Indian Journal of Science and Technology, 6 (5), 2013, 4633-4641.

Brindha G, Krishnakumar T, Vijayalatha S, Emerging trends in tele-medicine in rural healthcare, International Journal of Pharmacy and Technology, 7 (2), 2015, 8986-8991.

Brintha Rajakumari, S, Nalini, C, An efficient cost model for data storage with horizontal layout in the cloud, Indian Journal of Science and Technology, 7, 2014, 45-46.

Gopalakrishnan K, Prem Jeya Kumar M, Sundeep Aanand J, Udayakumar R, Analysis of static and dynamic load on hydrostatic bearing with variable viscosity and pressure, Indian Journal of Science and Technology, 6 (6), 2013, 4783-4788.

Gottfried D, The Economics of Green Buildings, Sustainable Building Technical Manual, Green Building Design, Construction, and Operation". Annapolis, MD, McGraw Hill, 1996.

Gregory H Kats, Green building costs and financial benefits, Published in USA for Massachusetts Technology Collaborative, 2009, 1-10.

Jeyanthi Rebecca, L, Susithra, G, Sharmila, S, Das, M.P, Isolation and screening of chitinase producing Serratia marcescens from soil, Journal of Chemical and Pharmaceutical Research, 5 (2), 2013, 192-195.

Kerana Hanirex D, Kaliyamurthie K.P, An adaptive transaction reduction approach for mining frequent itemsets, A comparative study on dengue virus type1, International Journal of Pharma and Bio Sciences, 6 (2), 2015, B336-B340.

Khanaa V, Mohanta K, Saravanan T, Comparative study of uwb communications over fiber using direct and external modulations, Indian Journal of Science and Technology, 6 (6), 2013, 4845-4847.

Khanaa V, Thooyamani KP, Udayakumar R, Cognitive radio based network for ISM band real time embedded system, Middle - East Journal of Scientific Research, 16 (12), 2013, 1798-1800.

King County LCCA Guide, Paldino and Company, Canada, 2006

Kirk S.J & Dell Isola A.J, Life Cycle Costing for the Design Professional, New York -McGraw Hil, 1995.

Kumarave A, Rangarajan K, Algorithm for automaton specification for exploring dynamic labyrinths, Indian Journal of Science and Technology, 6 (5), 2013, 4554-4559.

Kumaravel A, Pradeepa R, Efficient molecule reduction for drug design by intelligent search methods, International Journal of Pharma and Bio Sciences, 4 (2), 2013, 1023-1029.

Life Cycle Cost Analysis Handbook, State of Alaska-Department of Education and Early Department,1st edition, Education Support Services/Facilities Publication,1999.

Miller G, Green Buildings and Productivity, The Journal of Sustainable Real Estate, 1, 2009, 1-3.

Ruegg R.T & Marshall H.E, Building Economics, Theory and Practice New York- Van Nostrand Reinhold, 1990, 21.

Sachithanantham P, Sa Nkaran S, Elavenil S, Experimental study on the effect of rise on shallow funicular concrete shells over square ground plan, International Journal of Applied Engineering Research, 10 (20), 2015, 41340-41345.

Sharmila S, Jeyanthi Rebecca L, Das MP, Production of Biodiesel from Chaetomorpha antennina and Gracilaria corticata, Journal of Chemical and Pharmaceutical Research, 4 (11), 2012, 4870-4874.

Sharmila, S, Jeyanthi Rebecca L, Naveen Chandran P, Kowsalya E, Dutta, H, Ray S, Kripanand N.R, Extraction of biofuel from seaweed and analyse its engine performance, International Journal of Pharmacy and Technology, 7 (2), 2015, 8870-8875.

Udayakumar R, Khanaa V, Saravanan T, Saritha G, Cross layer optimization for wireless network (WIMAX), Middle - East Journal of Scientific Research, 16 (12), 2013, 1786-1789.

Vanangamudi S, Prabhakar S, Thamotharan C, Anbazhagan R, Dual fuel hybrid bike, Middle - East Journal of Scientific Research, 20 (12), 2014, 1819-1822.