Cost-Benefit Analysis of Construction Material Wastage, Its Causes, Adaptation and Financial Influences on high-rise Structure

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Abstract- ***Construction costs form part of the overall costs incurred during the development of a built asset such as a building. Construction cost is one of the peak criteria of success of a project throughout its lifecycle and is of high concern to those who are involved in the construction industry. Shaping the methodological basis of professional cost management it is possible to speak about a new direction in the development of the construction pricing. Effective management of solid waste has become environmentally and economically mandatory due to the increase of environmental problems. The evaluation of economic aspects is imperative since the implementation of a solid waste management system is connected with considerable investment and operating costs. The Economic Evaluation was performed based on a cost structure, which we have to analyze the waste management scenarios from a cost perspective.***

Indexed Terms— Construction costs, Real Estate Regulatory Authority (RERA), Waste management techniques, RERA & GST Effect, Benefits, Economic Feasibility, impacts, Compositing cost, Construction and Demolition Waste.

I. INTRODUCTION

1.1.1 Construction industry scenario in India

The infrastructure sector is a crucial driver for the Indian economy. The industry is highly responsible for propelling India’s overall development and enjoys intense focus from the Government for initiating policies that would ensure the country’s time-bound creation of world-class infrastructure. The infrastructure sector includes power, bridges, dams, roads, and urban infrastructure development. In India Construction has accounted for around 40 per cent of the development investment during the past 50 years. Around 16 per cent of the nation's working population depends on construction for its livelihood.

The Indian construction industry employs over 30 million people and creates assets worth over ₹ 200 billion. It contributes more than 5 per cent to the nation's GDP and 78 per cent to the gross capital formation. Total capital expenditure of state and central govt. will be touching ₹ 8,021 billion in 2011-12 from ₹ 1,436 billion (1999-2000). The share of the Indian construction sector in total gross capital formation (GCF) came down from 60 per cent in 1970–71 to 34 per cent in 1990–91. Thereafter, it increased to 48 per cent in 1993-94 and stood at 44 per cent in 1999–2000. In the 21 st century, there has been an increase in the share of the construction sector in GDP and capital formation. GDP from Construction at factor cost (at current prices) increased to ₹ 1.745 billion (12.02% of the total GDP) in 2004-05 from ₹ 1,162.38 billion (10.39% of the total GDP) in 2000–01. The main reason for this is the increasing emphasis on involving the private sector infrastructure development through public-private partnerships and mechanisms like build-operate-transfer (BOT), private sector investment has not reached the expected levels.

Third-largest construction market by 2022. According to the Department for Promotion of Industry and Internal Trade (DPIIT), FDIs in the construction development sector (townships, housing, built-up infrastructure, and construction development projects) and construction (infrastructure) activities stood at

US$ 25.93 billion and US$ 23.99 billion, respectively, between April 2000 and December 2020.

II. LITERATURE REVIEW

1. Raviraj S. Gaikwad1, Dhananjay S. Patil, the economics of landfill mining, IJRETS: International Journal of Research in Engineering, Technology and Science, Volume XIII, Issue VIII, September, 2020

Landfill mining of municipal solid waste is a technology that combines the concepts of material recycling and sustainable waste management. In this research work, an economic feasibility was assessed for landfill mining scenario. Initially the cost-benefit framework was prepared which has included seven indicators of costs and seven indicators of benefits of landfill mining scenario.

The cost-benefit framework was applied to a selected case study and the cost-benefit analysis

To performed for assessing an economic feasibility of landfill mining scenario for the same

2. International Conference on Sustainable Engineering Techniques (ICSET 2019), IOP Conf. Series: Materials Science and Engineering 518 (2019), Impact of the Feasibility Study on the Construction Projects, Sawsan Rasheed Mohammed, Hafeth I. Naji, Rouwaida Hussein Ali

A Feasibility studies include recognizing and analyzing the power and the flaws of the project, in conjunction, also defining the chance and intimidations external the company within the construction industry. There are a number of problems of the feasibility study as it regards overlooked part in Iraqi construction industry and the problems of feasibility studies abuses. Misinterpretation of study stages and also having incorrect idea of the goal of the feasibility studies, other factors that affect directly and negatively in the Iraqi industry such as delay, cost, and other issues that affect quality of the construction projects The aim of this paper Assess the awareness level of the feasibility study in construction projects and to determine the effects of feasibility study in construction industry

To identify the causes of abuses of feasibility study in construction industry. The methodology of the paper includes survey and formulation of the questionnaire
To identify the factor the cause the feasibility study to fail and then use system dynamic to analysis the impact of these factors.

3. J Prakash Arul Jose, P Rajesh Prasanna, Fleming Prakash, “Lean Design Strategy of Waste Minimization in Construction Industries” International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 6 (2018) pp. 4593-4598 Research India Publications, 4593

Construction waste minimization is practiced, for the system to be economical and feasible, irrespective of the construction methodology. This paper would be the answer for wastage problems that are common in construction sectors. On reviewing the reliability and accuracy over both the construction and demolition waste, a management scheme is proposed in accordance with lean construction concept. In lean design, last planner system is implemented

To identify the confronting problems, where resource management and scheduling are the key concepts that are focused on.

4. Management of Construction Waste Materials: A Review Thangjam Somchand Singh, International Journal of Geology, Agriculture and Environmental Sciences Volume – 3 Issue – Website: www.woarjournals.org/IJGAES ISSN: 2348-0254 WOAR Journals, 4 August 2017

The cost of construction materials may be up to 65% or more of the total cost. Utilization of appropriate construction materials coupled with effective management of these construction materials largely help successful completion of the structure. Due to mushrooming of big construction industries/companies, disposal of construction wastes has become an environmental issue these days, especially in big cities. A large quantity of various types of construction wastes with different characteristics is generated every day. However, this environmental problem may be minimized by introducing a systematic management of construction

wastes. Such a system coupled with appropriate construction techniques minimizes generation of waste construction materials and consequently helps in achieving economic and environmental benefits.

- In this study, a review on systematic investigation on the management of construction materials and construction wastes is presented.

5. Feasibility and cost-benefit analysis of automated underground waste collection in Tallinn Old Town, January 2017 Vreimann Karl Kupits Kadri Mäsak, Tuuli

The size of the building that accommodates the collection terminal depends on the number of collected waste types. The building features a control centre, airtight waste containers and separate rooms for pumps. The minimum area of the building is 500 m2 . Further, the building size depends on installed equipment and requirements to structural design. The building needs an 800A power supply with energy consumption typically ranging between 30 and 50 kWh per ton of waste. The collection terminal consists of four core components:Waste and air separator consisting of a cyclone and rotating screen. Air conveying waste is channelled through a filter that removes dust and smell;

6. Construction waste management in India Job Thomas, Wilson P. M. American Journal of Engineering Research (AJER) e-ISSN: 2320-0847 P-ISSN: 2320-0936 Volume-2 pp-06-09 www.ajer.org,

The management of construction waste is important today. The scarcity in the availability of aggregate for the production of concrete is one of the important problems facing by the construction industry. Appropriate use of the construction waste is a solution to the fast degradation of virgin raw materials in the construction industry.

The exploitation of potential resources from construction and demolition (C&D) wastes is yet another opportunity and future profession in the construction industry in India. Waste minimization and waste management programs are in its infancy in India. It is possible to minimize the volume of C&D waste generated by identifying the potential waste early in the design. But even with proper resource-efficient design and by adopting proper construction and deconstruction procedure, some waste may essentially be generated in every project.

7. Economic Feasibility of Waste-to-Energy Project in the Philippines Using Real Option Approach, Resy Villanueva, Riza Villanueva, Paul, Johannes G., Joan Arce-Jaque, Neil Ravena, and Salome P. Villamor. "Integration of the informal sector into municipal solid waste management in the Philippines–What does it need?" Waste Management 32, 2017

Waste to energy refers to the recovery of the energy from waste materials into usable heat, electricity, or fuel. 18 Different WtE approaches can be categorized into landfill, thermal treatment, and biological treatment. Landfill gas recovery system (LFGRS) can be considered as a WtE technology when it generates biogas (CH4) used for energy generation. This suits in municipals that yield waste which is high in biodegradable content and moisture. Thermal treatment, the most commonly used large-scale WtE technology, employs the traditional incineration and more advanced pyrolysis and gasification. While pyrolysis and gasification involve manual sorting and indirect combustion of MSW to mainly produce syngas, incineration involves a direct combustion of unprepared MSW that yields enough energy to power a steam turbine.

8. Material waste in the UAE construction industry: main causes and minimisation practices A. Al-Hajj, PhD, Heriot-Watt University K. Hamani, MSc, January 2016

In order to investigate the causes of material waste in construction sites and to assess the current material waste minimisation practices implemented by the UAE contractor’s two sets of information were gathered. First, four projects with different locations; sizes, types and at different stages of construction were visited to audit material waste management on construction sites and to find out from project managers about the processes used to minimise construction waste. The results obtained from this stage were analysed and combined with the literature

findings to design and to analyse the questionnaire survey. In the second stage a non-random sampling approach was adopted and only medium and large companies having construction and general contracting as their primary business were targeted.

III. RESEARCH METHODOLOGY

3.1 Aim

The strategy of adjusting and optimizing wastage, using systems and procedures so as to reduce requirements while holding constant or reducing total costs of producing the output from these systems.

Economic Cost– benefit analysis and return on investment are important considerations. What are the benefits and savings that are expected from a project? Where will the funds come from? How will they be earned and spent? Have the cost/benefit analysis been conducted? How long time does it take to achieve a return on investments.

3.2 Problem Statement

This study attempted to determine how profit and efficiency of construction projects could be increased using Lean Construction Management principles. This study also explored and evaluated differences between construction in India, by analyzing the methods of minimum wastage and by Lean thinking implemented in the construction projects. We reduce the cost and get more benefits.

3.3 Objectives

To improve the accessibility of a peripheral area, new network modernizations are not ends, but means.

To Analyze Functionally separate project over scaling investments are packed together without a preliminary economic viability check.

The first phase of a project's economic study does not incorporate the additional costs, making it more enticing.

Minimize energy costs/waste without affecting production/quality or environmental effects, and identify waste sources for specific construction site operations.

3.4 Flow of Project

Step 1 Defining Baseline and Alternative Projects include an effort to describe the state of the world to which the proposed project will be compared.

Step 2 Determining Whose Benefits and Costs Count requires a determination of who has standing, or the geographic scope over which the benefits and costs will be counted. That is, will costs and benefits be evaluated it.

Step 3 Estimate and Quantify the Impacts of the Project requires the identification of the project's physical impacts, defines them as costs or benefits, and assigns units of measurement. The list of costs and benefits considered depends upon how the project affects the people with standing. In other words, different costs and benefits may be considered depending upon who is determined to have standing.

Step 4 Monetizing Converting each of the costs and benefits to a common unit allows for the direct comparison of costs to benefits

Step 5 Discounting Benefits and Costs to Estimate Present Value (PV) adjusts the costs and benefits that occur at various times throughout the project into a single time period so they are directly comparable to one another. This process involves what economists call discounting or calculating a present value.

Step 6 Estimating the Overall Net Present Value (NPV) is equivalent to estimating

the net social benefit of the project. This is calculated as the present value of the benefits minus the present value of the costs (NSB = PV Benefits – PV Costs).

Step 7 Incorporating Risk and Uncertainty requires the sensitivity of outcomes to be evaluated

Step 8 Making Recommendations requires consideration of the projects NPV, sensitivity of NPV calculations, and any impacts that could not be quantified and/or monetized.

Waste identification
Source separation and collection
Waste logistics
Waste processingas
Quality management;
Policy and framework conditions

3.5 Methodology

In this investigation with reference to various papers, it is conclude that for any medium to large scale construction site applying lean technology or the

principles of the techniques we will increase the productivity and reduces wastage of the construction in following manner.

To find out the variables non value added activity for wastes in terms of material, time and efforts generated in construction activities are mainly due to its large fieldwork component by observation from project site visits.

To prepare waste identification matrix is meant for identification of waste in various operations involved in execution of an activity.

To collect all the data regarding the particular activity and component and analyze.

Apply the lean technology and the principles of lean technology to minimize the non- value added activity or wastage and increase the productivity of the construction industry.

To verify and re-evaluated the status of existing productivity and performances on construction activities and processes for construction industries.

The cost-benefits of design are made up of costs of value-adding activities and waste. The waste in the design process is formed by:

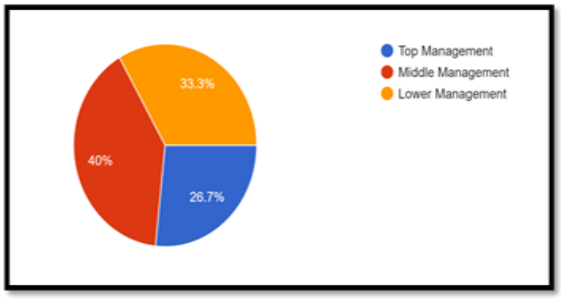
Rework (due to design errors detected during design)
Non value-adding activities in information and work flows

Proper relation flow is made for heavy equipment and for critical situation.

Minimize physical and process waste.

IV. DATA COLLECTION AND ANALYSIS

4.1 Data Comparison of Material



4.1 Impacts of GST and Maha RERA on the Construction Industry:

4.1.1 GST

General Information:

In Construction industry, there has always been a need to improvise the way of working to achieve better results, saving in time, energy and cost. In doing so, there are lot of shortcuts taken, lots of time saving activities are conducted which results in inadequate data regarding all aspects of the projects. There are certain things which are completely absent when it comes to documentation of all the project data on completion of project. In all these things, there exists a scope of improvement, in order to regularize this, the finance ministry has put up Goods & Service Tax (GST) in order to regularize the construction sector. Introduction of Goods & Service Tax (GST) by the government of India has led to a lot of ambiguity in the Construction industry because it's not only a new thing to deal with but, it will also regularize the so called "Unorganized Sector".

Goods and Services Tax in India:

As in similar fashion that VAT was introduced to gap the shortcoming of multi-point tax, the essence of GST is to correct the shortcoming VAT. Bringing service under tax net and taxes for input and output is not possible under VAT system. Hence, GST is more comprehensive, transparent and smoother in its functioning. This can be a better than the best solution for a country such as India, to reduce corruption, increase economic welfare and increase the standard of living of the individual.

The respondents were asked to indicate the positions they held in the respective companies and the duration for which the company is in operation. They were provided with options to choose from. About 26.7% of

the respondents who participated in the study are from Top management background, 40% were from middle management, while 33.3% were serving as a lower management as shown in the Fig. These respondents are well conversant with effect of construction waste management.

Questionnaire Survey
Have you heard about Construction Waste management?

Are you aware of waste management in your area?

Do you ever noticed Construction waste in the road, public area and Land?

In India, Do you thing Construction waste management is good?

Do you know India recycle just one per cent of its construction waste?

Do you thing Construction waste management is necessary?

Will you know construction waste management rule is mention from ministry of environment?

Have you ever heard about the importance of recycling in construction industry?

Do you use construction waste management system on your site?

Have you use any method for waste disposal or Recycling material?

Does it effect on quality using recycled material?

Does cost-benefit analysis affect the project cost?

Do you think there is enough information about the environmental impact due to Construction waste?

Do you think Construction waste management has impact on sustainable development?

Can you say that to increase project productivity by reducing and eliminating the wastes?

Do you think by decreasing waste we can decrease the project cost?

Do you think using recycle material benefit the total project cost?

Have construction waste management have effect on project cost?

Do you think most environmental issues in India could be minimized if Construction Waste is managed properly?

Do you think Cost benefits analysis should be done before starting construction?

Do you think by using automation technique wastages of material is decreased?

Do you use new technology for construction of building?

Is that affect in reducing wastages?

By giving proper training to mason increase the productivity of work and decreases the wastages of material?

Not following construction step induced rework and that also increase construction waste?

Does electrical and plumbing work increase the rework?

By proper storage of material on site reduced the wastages of material?

Do you think main reason of steel waste is because of irresponsible beam reinforcement and fabrication cutting?

Do you think using RMC over traditional method decreased the waste of material?

Now, do you use Construction waste management system on your site to increase the productivity and decreasing the cost of project?

V. RESULT AND DISCUSSION

1. Construction waste generation and composition on the site: The findings of the case study are discussed below. The discussion focuses on the composition and recycling of construction waste, and the economic feasibility of the waste minimization at the project site.
2. Reused and recycled construction waste materials on the site: The practice of waste minimisation i.e. reuses and recycling of construction waste materials is common on the site. In the project site, construction waste materials contain a large percentage of reusable and recyclables. It is estimated that 52.54% of the waste materials is reused and recycled.
3. The study tried to quantify all benefits and costs in terms of monetary value and also those benefits and costs that do not have monetary value which is defined as an intangible term such as A (intangible benefits) and A* (intangible costs).
4. The benefit–cost analysis followed a conservative method of estimation as it is an initial study and the beneficial value is based on the opportunity cost approach.
5. Total benefits: The direct benefits of reusing and recycling consist of purchasing cost savings by reusing and recycling of construction waste materials and revenue from selling of scrap materials. The indirect benefits consist of waste collection and transportation cost savings and cost savings from landfill charge by reusing and recycling of construction waste materials. Purchasing cost savings explain that the company saved money after reusing and recycling of waste materials instead of buying these materials
6. Total costs: Total direct costs of reusing and recycling are included with the costs of collection and separation of construction waste materials, equipment purchasing cost, storage cost and transportation cost. Waste collection and separation cost for reusing and recycling depends on the following factors in particular: the frequency rate of waste collection and separation in the site, average hours spending for collection and separation per day, total labour use for collection and separation per day, labour wage rate per day and the average amount of waste collection and separation per day.

CONCLUSION

- We have investigated economic aspects of different municipal solid waste management scenarios. A structure of costs was proposed for the evaluation of waste management scenarios.
- The benefits can be compared with the costs, and the net profit of each management alternative can be also determined.
- The case study demonstrates that construction materials contribute to the generation of large quantities of the construction waste.
- Waste minimisation is common in the project site where the waste material 38.25% is reused and recycled. Waste minimisation is economically feasible and also plays an important role for the improvement of environmental management.
- The net benefit of reusing and recycling of waste materials is estimated of the total project 15% budget. Thus, the construction industry can save money by implementing waste minimisation practices on the site.

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