ENVIRONMENTAL IMPACT ASSESSMENT FOR BUILDING CONSTRUCTION PROJECTS-REVIEW

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ABSTRACT-The environment is threatened severely by so many problems, some of which are caused by the activities of construction projects. Data for the study were collated through a questionnaire survey administered to stakeholders of building construction industry. Collected data were analyzed and ranked using Relative Importance Index (RII), result shows impacts listed are above the mid (RII) index of 3.0 suggesting that they significantly impact on the environment thereby causing environmental degradation. The research also reveals major environmental impacts of building construction projects to include environmental pollution, resource depletion and habitat destruction causing Destruction of ecosystem, Desertification, Soil Erosion and increasing Material Wastage. Waste Management, Pollution Control and Ecology Conservation were ranked as the most important environmental protection measures used in controlling building construction environmental impacts. The study therefore suggest that in order to reduce environmental degradation, building construction stakeholders must adopt fully environmental impact assessment document and other regulations relevant for environmental protection.

An Attempt is made to study the environmental impact of building construction project using checklist analysis methodology. The study focuses on various parameters such as total area, parking area, rainwater harvesting system, basement area, sewage treatment plant, water quality, solid waste, source of water, depth of ground water, distance from the city centre, nearest sensitive zones and overall settlement density. The plan seeks to define the project in a holistic manner and suggest possible mitigation measures for development. The paper argues that through early planning before the start of the project as well as through all phases of the project's development, if environmental concerns are considered simultaneously with other technical and economic criteria, it may be possible to develop the housing projects with the protection of natural resources of that area.

KEYWORDS-**Environmental impact Assessment, Building Construction Projects, Relative Importance Index, Checklist Analysis**

INTRODUCTION

LIFE-CYCLE ASSESSMENT METHODOLOGY

They can be used to holistically evaluate construction processes. After reviewing several types of hybrid models: tiered, input–output, integrated, and augmented Process-based, an augmented process-based hybrid model was used for the case study of the construction of a precast parking garage. [1]The dominant process was transportation, demonstrating the importance of setting standards related to procurement of local materials. Including construction service sectors was shown to be significant _20% of total GWP_; excluding the service sectors can lead to an incomplete analysis that may not represent all of the environmental impacts. Future research will further develop the hybrid model. The case study assisted in creating conceptual model and uncovering potential development areas. One example is the use of EPA's Nonfood program, which will allow for additional modeling of construction equipment in terms of type, horsepower, and emission standards. Additionally, this case study utilized the producer's construction contract value in EIO-LCA and then subjectively selected the service and construction equipment sectors considered relevant. [3]An alternative approach would be to determine the actual contract values of each support sector _i.e., architect, engineer, and construction manager_ and determine the relevant sectors for these activities. The results would then be direct impacts, instead of indirect impacts. Similarly, it is possible to determine the dollar values of the equipment, allocate these prices according to expected engine hours used on the project divided by the expected lifetime engine hours, and utilize these as direct inputs instead of indirect results. The model will also be expanded to include estimates of productivity and contract durations and will include several more construction processes. Additional research will be explored between the environmental externalities, bidding processes, and project delivery methods; specifically, developing the relationship between including the environmental costs with submitted bid prices. [4]The case study also revealed other areas necessitating further investigation including surveys of on-site energy expenditures, construction equipment with associated emissions, and an in depth investigation of construction sectors as represented in the current NAICS. On-site energy sources are usually provided by diesel, electricity, and natural gas. Determining the energy expenditures can be roughly estimated using Census reports for the construction sectors _US Department of Commerce 2000_; however, more site specific information is needed according to construction project, cost, and duration to further understand energy usage per construction project. [5]This information is currently being collected as a part of this research _Matthews et al. 2005_. There is a need to more fully understand the sector mapping for construction between U.S. Bureau of Economic Analysis's *I-O* tables, NAICS, and EIO-LCA tool. For most other sectors in the economy, there is an existing mapping between *I-O* sectors and NAICS industries. Attempts are being made to produce a clear mapping between I-O sectors, NAICS industries, and EIO-LCA construction sectors.

ROCKWOOL

The final results are interpreted from the total energy emissions evaluated using the Semipro software, the heating and cooling demand curves, cost efficiency and some numerical facts and characteristics of the materials. [6]Rockwool has excellent fire, water, acoustic and vibration and rot resistance. It has the least impact assessment when compared to other materials. It also has moderate cost. Because of its multiple resistivity property it is the most preferred. Glass wool also has good resistance to acoustics, corrosion, fire and water. Its properties are almost similar to that of Rockwool and it is most suitable for flat surfaces. It has lesser impact when compared to other materials but slightly more when compared to Rockwool and it is of lesser cost than Rockwool. [7]Mineral wool is durable, moisture and fire resistant hence it is considered as the most flexible and efficient material among the rest. It has moderate impacts and considerably alters the demand charts. Cotton fiber is the most easily installable material as it is very safe. Though it has high use of land and fossil fuels it is considered as the safest material for installation. It has the highest thermal resistivity among the five materials and is also cost efficient. [8]It should be permeated with a fire retarder and vapor retarder for increasing durability. It's not exactly suitable for winter climate due to this reason. Polyurethane foam has moderate impacts. It also has the highest thermal resistivity when compared to the other materials. It is combustible and should be handled carefully. It increases structural strength and also seals cracks efficiently. The foam is rigid and efficiently minimizes the air flow. It performs well in both hot and cold climate and has the best R-value. It is the costliest when compared to the other materials. [8]The efficiency improvements provide a platform for the designers to include the thermal properties beforehand and ensure the minimization of the loss of energy. The final results are interpreted from the total energy emissions evaluated using the Semipro software, the heating and cooling demand curves, cost efficiency and some numerical facts and characteristics of the materials are some of the important factors to determine the energy efficiency of the buildings. The site specific design which involves the orientation of individual buildings enhances the energy usage to a maximum extent.

FINITE NATURAL RESOURCES

To avoid the production of materials affecting the natural resources it is necessary to promote the use of the best techniques available and innovation in production plants and to replace, as far as possible, the use of finite natural resources with the waste generated in different production processes, closing the cycles of the products. [9]This involves committing decisively to reuse and recycling, and always minimizing the transport of the starting materials and products, promoting the use of resources available in local areas. The results of this paper should be considered as an approximation to real environmental impacts of assessed building materials. For the majority of the materials analyzed in this paper, the impact was observed to be, in the medium term, between 20 and 30% greater than the impact obtained in other studies. These differences are justified by the broader limits of the system considered in this study and other hypotheses related to the life cycle assessment method (data quality requirements, useful life, energy mix, end-of-life scenarios, etc.). [10]For instance, the GWP obtained in this study for an ordinary brick was 23% higher than in other studies that neglect some stages and processes (such as disposal and infrastructures) and consider other less pollutant firing fuels. Nevertheless the results show clear tendencies in the impact related to the use of such materials. With this we can conclude that it is important to extend, adjust and harmonies the existing inventory databases of construction materials to the characteristics and peculiarities of the construction industries in each country. [11]To facilitate this task, the public institutions must urge the manufacturers of materials to use EPDs (or type III ecolabels defined according to the ISO nomenclature), verified by independent entities that provide standardized information based on the LCA of the real impact of every product. This would then stimulate competition between materials manufacturers to launch more eco-efficient products onto the market, which would be more highly regarded by the construction sector as opposed to other products without EPDs, as they would be able to offer a new range of buildings that really do have a low environmental impact, not only due to their low final energy consumption, but also due to the reduced impact of the materials that comprise them. [12]In this sense, there would be accurate information on the impact of each product, which would facilitate a correct assessment of the impact of a building from an LCA perspective. Without this information, this impact can only be estimated approximately using existing inventories that, on occasions, are difficult to adapt to the reality of a specific geographical area. Currently, the demolition of buildings at the end of their service life makes it very difficult to separate the different materials, and most end up in landfills and/or incinerators. Therefore, for the recycling of construction materials to be possible, it is necessary to promote a radical change in the design of buildings, to favor the disassembly of the construction materials at the end of their service life. For this purpose, the joints between the different materials must be reversible, such as bolted joints, avoiding adhesion as far as possible. [13]This significant conceptual change is already a reality in the automobile sector for example, where the current regulations lead the manufacturers to design their vehicles to facilitate the recycling of the different components by selecting the materials, more and more from recycled sources, and assembly techniques well. Finally, any sustainable building strategy should be implemented within the framework of a more general strategy of sustainable decline, in such a way that possible rebound effects are avoided, ensuring a per capita decrease in the consumption and exploitation of natural resources. For this purpose, among other aspects, moratoria must be established for the construction of new buildings and large infrastructures, and a population decrease must be promoted. Nevertheless, the modeling of the effects of this decrease in the social, economic, energy and environmental areas is beyond the scope of this paper and should be approached in future work.

FABRIC OF THE BUILDING

It is evident that the more energy efficient buildings become, the greater becomes the importance of the embodied energy of the materials making up the fabric of the building. The contribution that can be made by bio-based materials is therefore of growing importance. In order to ensure long-term durability of bio-based materials when used for construction it is important to ensure good detailing, to avoid ingress of excess moisture within the system. [14]Research using the HIVE at the University of Bath's Building Research Park is producing insights into transient performance of bio-based construction materials, and further work is being done to improve their resistance to decay and to fire through the EU funded ISOBIO project. [15]With increased confidence in the robustness of such systems will come an awareness of the innate advantages that vapor active systems possess. The future of construction will become increasingly reliant on renewable materials, making research and development in this area a priority.

WINDOW

To analyze the impact of window design on building energy load, the window size, position, and orientation are changed in 65 scenarios, and the heating and cooling load of each scenario is analyzed. First, the size and position of the windows are changed in 29 scenarios. [16]The energy simulation result shows that the annual energy load significantly increases as the window size increases regardless of the window position. This indicates that the window size is the critical factor that should be considered during window design phase. In addition, the load variation by the window position in each size indicates that the position of the window has the biggest influence on energy load when WWR is 20. [21]In this case, the variation has insignificant impact as it is less than 30kWh, but the variation is expected to increase in bigger building case. In the next stage, the window position of each orientation of the building is changed in 36 scenarios. The energy load is the lowest when all the windows are located in middle height, and the load variation by window position shows that the east window has the biggest influence on total energy load. The variation is 1% of the total energy, which is 30kWh in this building, but it will increase when it is applied to bigger scaled building. Therefore, the east window position should be designed by considering the impact on energy load.

LOW ENERGY INTENSITY BUILDING MATERIALS

The embodied energy accounted for a considerable part, 40%, of the total energy use in these low energy buildings during an assumed lifetime of 50 years. About 37–42% of the embodied energy can be recovered through recycling. The recycling potential was about 15% of the total energy use during an assumed lifetime of 50 years. [17]From these 0gures it can be concluded that it is of great importance both to pay attention to the energy intensity of materials, and to include the recycling aspects in the design phase of new buildings. The predominant part, about 90%, of the maximum energy recovery can be achieved by maximum material recycling and combustion. The most important measure in order to facilitate future recycling is the use of recyclable materials and avoidance of constructions which are di1cult to disassemble or in which materials contaminate each other. [19]The importance of maintenance should not be neglected. Its importance will increase with increased service life of the building. Prolonging the lifetime of components=choosing materials with less embodied energy can reduce the part of maintenance. The embodied energy in those materials/components which are assumed to have a rather short maintenance interval, as well as their recycling potential, is found to be important. In this study,

maintenance accounted for about 12% of the total embodied energy. [20]Further research is of interest regarding the scope for increasing he recycling potential by an advanced design for disassembly, and the quantity of embodied energy that could be reduced by paying special attention to low energy intensity building materials. It is intended that this will be done in a following study of this building.

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