

Adoption of Green Building for Sustainable Growth of Rural India

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Travelling to home town creates an excitement in a person of any age, education and status. It was my summer vacation after completing first year of Master's in Civil Engineering. The only way to reach my tiny village "Piapali" in Bastardistrict of Chhattisgarh state in central India was by rail with breaks in journey, first to Raipur and further to Jagdalpur. It was a luxury to travel in AC-3 tier compartment due to tickets being sponsored by my grandfather to visit him at Piapali. Sitting in the air-conditioned train thinking about the beauty of nature and village life, it was a pleasant I realised after getting down from the train to face the scorching heat of central India. Since, I had a connecting train from Raipur to Jagdalpur I had no other choice but to sit in the waiting room which felt like a sauna in the middle of May. After 16 hours of tiring journey from Raipur I reached Jagdalpur station and was happy to see my me. We reached our village and excited and happy to meet my grandmother, relatives and cousins. By the time it was 8pm, suddenly the electricity supply was shut down. On enquiring I came to know that our village is facing 16 hours of load-shedding and electricity would resume only after that. I had a sleepless night with a single fan which was running on inverter and the entire family was compelled to sleep in one room which was suffocating due to lack of ventilation in the room. Next morning, I realised that it was difficult to manage regular chores and potable water was sourced from Indravati river near our house. Staying in an urban area with all luxuries of basic necessity like 24X7 water, electricity and

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other utility services, I never thought about the wastage of specifically electricity and water until I experienced it myself and concluded that the balance of utilisation of natural resources defines the sustainability for long-term human existence. The balance between urban and rural areas needs to be addressed for overall progress of any country. This thought gave birth to a need to carry out research and development in sustainability. Thus after returning, I zeroed down on a research topic for my thesis. After going through journal papers, research articles, technical magazines, books and further discussions with my guide, I started my journey on sustainability. Though, there was a lot of research available but there were very few papers on Indian spectrum for green buildings. After researching I got to know that there were two major institutions in India for green building, out of which one was state sponsored and is known as Green Rating for Integrated Habitat Assessment (GRIHA) and Indian Green Building Council (IGBC) which is a privately sponsored authority under the Indian Industry (CII). Apart from others like Leadership in Energy and Environment Design (LEED), Excellence in design for greater efficiencies (EDGE) and World Green Building Council (WGBC).

Meanwhile, in the first half of my thesis tenure I went to Vishakhapatnam to get training from IGBC and further appeared for the IGBC accredited professional exam and cleared it in the first attempt with flying colours, my next goal was to take training in GRIHA which I accomplished in Mumbai. After gaining a thorough knowledge of Green buildings I could not find a platform to calculate utility savings or reduced carbon footprints of green building as compared to the base case. Only EDGE had an online platform and was giving results in an output format for submissions to concerned authorities, since EDGE is developed by International Finance Corporation (IFC) it lacked India specific requirements. Further to a discussion with my guide to make a soft computing technique for IGBC and GRIHA code of practice, I zeroed upon making a soft computing tool in Microsoft Excel for my Master's thesis for appropriately calculating the credits with respect to the IGBC Abridge reference guide and preparing a case study using the same programme and comparing with an actual green certified building.

The study included the green building concept like sustainable site planning, building design optimization, energy performance optimization, renewable energy utilization, water and waste management, solid waste management, sustainable building material and construction technology, health, well-being and environmental quality. The benefits of green building have emerged which will prevent pollution, save energy and thereby save on natural resources and expenditure during operation which results in approximately in 60% reduction in energy consumption. Efficiency in offices and homes increases with natural non-glare light and proper ventilation in the room, which results in reduction of respiratory diseases by 20% and performance of the occupants upto 25%, which finally results in low utility demands in green building.

The environmental benefits include emission reductions, water conservation, strong water management, temperature moderation and waste reduction. The economic benefits include an energy and water savings, increase in property value due to lower operating cost and maintenance of building and decreased infrastructure strain, i.e., less demand on local power grid and water supply. The indirect cost benefit includes improved attendance, increased productivity, sales

improvement and development of local talent pool. The social benefit includes improved health due to better air circulation, proper lighting, lesser temperature variance etc., and attendance due to better environmental conditions, healthier lifestyle and recreation by use of alternatives to personal driving such as bicycling and public transport which also adds to health and benefits of occupants.

After completing my Masters thesis in Civil Engineering and ranking 3rd in the university, I was elated and it resulted in building my self-confidence to carry out further research by pursuing a Doctor of philosophy (Ph.D.) in civil engineering. After taking guidance from my guide, I decided to carry out my study on “Development of web-based decision tool for green building credit rating certification. During the review of various literature in soft computing techniques for green building I carried out a critical appraisal of my literature and zeroed upon the gaps in the literature and thus, defined the statement of problem for my study. Further to my above study, I found that in applying for green rating to the authorities, one has to engage various agencies in the field of energy modelling, water conservation, green consultants, project architects, project engineers, who thereby prepare hectic, large and complex documents to comply with the given intents so as to achieve the star rating of any green building, I intended to make a tool to meet the demands for quick, simple and free to use online web based decision tool to solve the complexities of the hidden methodology of resource efficiencies and cost savings in comparison to the base case without involvement of pocket burning expense by use of third party specialist to prepare and apply for green rating.

My objective of proposed study was to study all versions of GRIHA and IGBC rating system and to find a methodology for appropriate calculations of credit points with respect to requirements as given in abridged reference guide. The above work required me to prepare programming concepts which included a complex conditional statement, looping of the same, implementation of logic flow diagram for problem solving and communications. After studying the above, I realised the need to master myself in programming tools like PHP: Hypertext JQuery, Cascading style sheets (CSS), Hypertext Markup Language (HTML), Dot Net framework (.NET), C Sharp .NET, Dynamic-Link Library (DLL), Microsoft SQL Server and Java Script. On the hardware front, I had to study and find out the methods of storing data inputs through online and preparation of reports in the back-end for further research and development, front end reports for the users. It was decided by me to make a close source online programme which could be used as to avoid copying and redistribution of my programme. The above study also required testing and deployment optimization by the way of algorithmic efficiencies, resource allocation, virtualizing, terminal server testing, power management, data centre power optimization technique, operating system support and means of storage and cloud computing.

The expected outcome of my study will be a web-based decision tool for all green rating system so as to meet the demands of easy, faster, reliable and affordable tool which shall be used to plan and estimate the design of resource efficiency in order to boost green building growth in emerging markets and backend data for in-house research and development. My dream to balance the gap of consumables like water, electricity and for sustainability in rural and shall come true by adaptation of green building certification in urban area which will reduced the demand of water and electricity and which can be directed to the villages of India.