

SUSTAINABILITY ASSESSMENT MODEL FOR RESIDENTIAL BUILT FORMS IN INDIAN CONTEXT

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Abstract

‘Sustainability’ is a key issue in the rapidly developing world, especially in the construction sector. Pioneering efforts were made over five decades to apply the sustainability paradigm, and the ‘sustainability movement’ has gained significant strength and momentum. Undoubtedly, ‘ecological, economical, and socio-cultural’ issues are at the core of planning, construction, and operation of built environment. All developments in the contemporary world are related to the environmental issues like land, energy, water, resource consumption-efficiency; pollution at all levels, mitigating global warming and effects of climate change. Thus, it has become mandatory to adopt the principles of making and operating ‘sustainable built environments’ around the globe. Sustainable development, in India, is regulated by the National Rating System-GRIHA. The other rating system, LEED-India, has exercised considerable influence, especially in the commercial sector. However, it is arguable, if LEED-India or GRIHA is adopted in the diverse climatic zones of the Country, with the respective local societies, and culture having varying economies; whether these rating systems will ensure the much needed end result, sustainability! Mostly, LEED-India is designed to address environmental concerns and building standards. The national green building rating system, GRIHA, and LEED-India are following a single evaluation system for all climatic zones, compromising the influence of local and regional variations. A comprehensive literature review establishes that these rating systems mainly focus on the ‘environmental performance’ and ‘resource utilization efficiency’ assessment. These rating systems developers are predominantly concerned with environmental protection and utilization efficiency of materials and resources. Such systems have limited ability to address other sustainability issues such as regional variations. However, these rating systems do not effectively address the wider sustainability concerns of the Nation. These present rating systems also have failed to differentiate the wide variations in climatic zones, socio-cultural base, economic status, and varying resource availability across the Country. Therefore, it is necessary to develop an appropriate, robust, pro-active, simple yet comprehensive sustainable built form assessment system. The research considers local and regional specificity, and respective sustainability issues such as regional variations; the social, cultural, economic and wellbeing aspects. Further, the model appreciates the vernacular wisdom in such built forms with their near acceptable performance and draws lessons for sustainability. Methodology adopted in this research is ‘mixed-method’, involving a detailed review of ‘relevant literature’; followed by an opinion survey among the Indian construction industry stakeholders, mainly: Architects, designers, planners, engineers, green building consultants, developers, builders, owners, users, administrators, facility managers, NGOs, CBOs, environmentalists, ecologists, academics, and researchers, in order to pursue ‘sustainability issues and parameters’. Significant sustainability parameters are identified and categorized by using ‘Delphi technique’. The derived weights of identified and categorized sustainability assessment parameters; indicators, criteria and sub-criteria are assessed and aggregated using a multi-criteria-decision-making technique, ‘Analytical Hierarchy Process (AHP)’. Fuzzy Logic theory and technique are appropriately employed to develop the fuzzy scoring system for built form criteria and sub-criteria performance. Research developed a ‘robust, holistic and simple yet comprehensive ‘Fuzzy Logic Inference System (FLIS)’ for the fuzzy scoring performance of built form criteria and sub-criteria which leads a development of an appropriate methodology and a unique integrated ‘Delphi-AHP-Fuzzy Logic Model’ for sustainability assessment of built forms in local and regional contexts. Finally, the research developed an integrated *Excel and Matlab 2012a* based on ‘Graphical User Interface’ to ease analysis process of the built form assessment.

Keywords: Sustainable Built Form, Sustainability Assessment Model, Delphi Technique, Analytical Hierarchy Process, Fuzzy Logic Technique, Vernacular Built Forms, Traditional Built Forms