A Review of the Origin and Evolution of FSR Norms to Propose New Indices for Green Buildings

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ABSTRACT

Construction technology has transformed into hyper technological mode due to convergence of science of building materials, AI simulations and IOT tools of building management. However, the regulators evaluation of the built up space remains static for decades since the emergence of mega cities since the end of the World War II. There is a gap in the domain of building evaluation corresponding to the converging technologies. This paper reviews the origin of FSR (floor space ratio) and proposes suggestions for introducing new norms that are similar and comprehensive when compared to FSR norms. It would be a key policy measure to scientifically ensure sustainable development in the construction industry to stimulate resilient building designs and construction practices.

Keywords: built up space; building evaluation; floor space index; sustainable development; resilient building designs

1. Nomenclature
   AI - Artificial Intelligence
   IoT - Internet of Things
   FSR - Floor Space Ratio
   CRZ - Coastal Zone Regulation
   SDGs - Sustainable Development Goals
   GBI - Green Building Index
   HVAC - Heating, Ventilation and Air-conditioning.

2. Introduction

‘Carrying capacity’ is an elusive term with reference to spatial analysis of a building’s utility. When Thomas Robert Malthus introduced this concept of ‘carrying capacity’, with reference to population growth and available resources[1], he referred to finite resources delimiting an area’s inherent capacity to cater to certain number of individuals. In tune with this, the construction industry so far has been applying the scale of ‘floor space ratio’ index to adhere to the carrying capacity of the land and land use in a locality in an indirect manner.

Modern technology was not a factor for consideration by Mathus then. So, the carrying capacity of a place where a building is located needs a dynamic approach. In the age of modern construction tools and hyper technology at disposal for the industry in the 21st century such as application of artificial intelligence (AI) in building designs, internet of things (IoT), 3D printing of buildings, pre-fabricated construction techniques and application of blockchain technology in building material logistics mere reference to Floor Space Ratio will render an inadequate formula for sustainability in construction industry.

3. Contemporary green building designs and regulatory hassles

The floor space ratio (FSR) determined by the concerned planning authority determines the market pricing, rental rates and revenue rates conducive for government exchequer. Often the FSR determination is a policy
decision. This remains a matter of public policy which cannot be questioned in the court of law. That is, the fixation of FSR, revision and regulation of deviation from FSR are all matters of policy decisions of the government, a revenue related matter which cannot be questioned in court.

In a landmark case involving construction in a coastal zone, the Bombay High Court had held that the court will not question the intent of the legislature in confining the regulatory reference to the existing Floor Space Ration alone at the time of issue of Coastal Zone Regulation notification. The FSR shall freeze in time and applied to all the building constructed in that locality in the future. This view of the court has been upheld as valid in subsequent cases also stating “the building activity permitted under the notification in CRZ-II shall be frozen to the laws and norms existing on the date of the notification”[3]. Whereas the implication of FSR deviations and not upgrading this FSR based planning system is causing environmental roadblocks for new green and smart technologies. The town and country planning laws lack the means to evaluate resilient building designs for sustainable development.

Conventional construction techniques are increasingly found to be harmful to the environment[4]. But the land use regulation and planning laws that supported and approved the conventional construction techniques continue to govern green buildings also except for rating and certification process. Technological advances in construction are not met with technological advances in assessing and evaluating indices applied by the planning authorizes such as FSR.

The application of artificial intelligence (AI) in building designs, internet of things (IoT), 3D printing of buildings, pre-fabricated construction techniques and application of blockchain technology in building material logistics have to be taken into consideration in transforming the planning laws to upgrade the assessing criteria from mere FSR consideration to multiple interconnected indices which measure the total factors of sustainable development achieved by the building under consideration for approval. This sort of transformation of planning laws is required to scientifically ensure sustainable development in the construction industry and to stimulate resilient building designs and construction practices. In general the freedom of architectural expression of building designers[5] is curtailed by the regulatory hassles. The hassles include factors taken into consideration for approvals of design at the planning and approval stage itself. Landscape area remains the main factor in determining approval of building designs. This is a major challenge to the approval process of architectural designs which are unusual, contemporary, smart and green.

4. FSR Regime, Gap In Law And Green Building Index

Instead of FSR, the emphasis must be in developing an universal green building index (GBI). Such GBI must be based on public consultation involving stakeholder from the industry stakeholders, green building experts, consumers, and general public. Till 2020, the popular rating systems for green building designs around the world are institutionally developed. Though these rating systems have expanded the list of factors for consideration for a green building, they fail to account for the contemporary advancement in construction technology. Real time data monitoring for ratings and certification is still a distant reality for the industry. These ratings are not utilizing the full potential of three main tools of hyper revolution, namely, AI, IoT and blockchain.

The question “What is a green building?” is not conclusively answered in the regulatory world. In the legal point of view if this question needs to be answered in the light of ‘pure theory of law’ propounded by Hans Kelsen, then firstly, the grundnorm or the highest norm that determines a supreme factor which determines a green building must be framed. Then, the hierarchy of factors that assist in assessing the fulfillment of that supreme factor can be framed for regulatory purpose.
In the context of green building designs, the relevant factor is sustainable development as envisaged in SDG11 of the seventeen sustainable development goals[6]. The SDGs are interconnected, so the highest norm to focus on defining a ‘green building’ by design is to consider the highest goal of SDGs which is “to end poverty, protect the planet and ensure that all people enjoy peace and prosperity”. By all means FSR norms and current rating systems for green buildings are not oriented towards this highest norm of sustainable development. Hence there is a gap in regulatory law which must be met with transformation of assessing indices for a green building design.

5. Need For New Indices To Assess A Green Building Design

The simple reference of built up area for regulation under planning laws serves the purpose of revenue collection. Under the FSR regime the location, space and pricing is regulated and ultimately pressure on land by the increasing urban population is addressed. The recent HVAC considerations in addition address the pressure on health of the occupants of the building, regulated through green ratings. This remains the trend so far with respect to the green building. The considerations of sustainable development and climate resilience invite the pressure on the environment and mortality of the inhabitants and stakeholders is yet to be factored in for the green building evaluations. The approach of green building impact assessment has so far been of measuring the metabolism of the building rather than an evaluation based on circular economy involved in the life cycle of the building.

The current green building factors can be depicted in the following way for evaluation of Green Building Index (GBI) based on metabolistic approach.

$$GBI_m = A(\text{FSR}) + b(\text{Heat}) + c (\text{Ventilation and AC}) + d (\text{Water Source}) + e (\text{Landscape})$$

The ideal green building factors can be depicted in the following way for evaluation of Green Building Index (GBIc) based on circular economy involved in the life cycle of the building.

$$GBI_c = A (\text{Ecological cycle}) + b(\text{Radiation&Light}) + c (\text{Ambient Air Quality}) + d (\text{Local Hydrological cycle}) + e (\text{Soil mineral cycle})$$

Pandemic and other scenarios of disaster management expose the gap in regulating the environmental concerns which are not factored in assessing green buildings. The following table shows the paradigm shift that is necessary for the fundamental considerations for assessing a building to certify a green building.

![Figure 1: Comparing indexing approaches in existing buildings (left) and green building (right)](image)

The time has arrived for complex assessment of green buildings. The increased connectivity through 5G compatible devices and the nature of data flow must be utilized to truly ensure achievement of sustainable development through green buildings.
Building codes of each country address the assessment of the green buildings through rating systems. The green buildings are regulated but disembarked from ensuring ambient air quality for the community as a whole. The lack of integrated approach is resulting in neglect of the cumulative impact of the green building in preserving the hydrological cycle of a locality to preserve sustainable water source[7]. Soil health and mineral cycle in the soil are not considered under green ratings. Whereas, The High Court of Uttarakhand at Nainital had cited the alleged disturbance to the land-soil-vegetation system to be a ground for removing building structures meant for mining activities[8]. Soil testing is confined to the strength and longevity of the structure alone. The current assessing methods for green building do not consider soil health at and around the site. Net zero buildings adhere to waste management and recycling but do not actively monitor impact on soil health of the vicinity.

6. Conclusion and Suggestions

The gap in the law in regulating green building has resulted in unit based approach to assess and approve green building designs. Integrating into the larger layout of the land use plan of the locality is required. Adequate change in the policy making is required to introduce the adaptation of cumulative impact assessment model for valuation of green buildings. The various rating systems raise the need for the codification of assessment of green building designs. The factors considered for the said assessment must be based on consultation with ecological stakeholders of the locality. The overall approach must be towards supporting a cycle based approach to assess which involves hyper technological tools such as AI, IoT and blockchain to ensure real time data verification for rating systems as well as regulating authorities.

References

[1] William E Rees, Carrying Capacity and Sustainability: Waking Malthus Ghost, C E 8.
[2] Overseas Chinese Cuisine India Pvt Ltd. vs The Municipal Corporation of Greater Bombay & Others, Writ Petition No. 1761 of 1999.
[3] Kisan Mehta and Ors. vs. State of Maharashtra and Ors., Writ Petition No. 469 of 1996.
[4] Sara C Bronint, The Quiet Revolution Revived: Sustainable Design, Land Use Regulation, and the States, MINNESOTA LAW REVIEW 44. “If these buildings are built green, practical and ideological challenges to our current system of regulating land use will continue to mount.”
[5] Totem Queens Park Pty Ltd v Waverley Council—NSW Caselaw, [2004] NSWLEC 712, https://www.caselaw.nsw.gov.au/decision/549185663004262463ac3158 (last visited Jul 29, 2020). In this case the statutory provision did not address the unique scenario of assessing the unusual contemporary design of the building. It affected the freedom of architectural expression of the designers. The following principle was applied by the Australian court to resolve the issue of regulation approving the design. “Good architectural design does not exempt a building from being assessed for its impact on neighbors and its compliance with the objectives and requirements of any relevant local environmental plan and development control plan.” The proposal for the contemporary design building was rejected ultimately solely on the ground that the building did not comply with the law. The court also observed that the law is incompatible with the design per se.
[6] “The Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted by all United Nations Member States in 2015 as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030.”
[7] The National Green Tribunal in a recent case in 2016 (Bhagat Singh Kinnar vs. Union of India and Others, Appeal No. 14/2011(T) ) has emphasized that cumulative impact of the construction of the dam must be taken into consideration for validity of the environmental clearance of each stage of the construction process.
[8] Naveen Chandra Pant & Others vs. State of Uttarakand and Others (Write Petition (PIL) No. 16 of 2016.