

A Model for Managing and Evaluating Quality in Architectural Projects

Om Prakash Bawane

Principal

RV College of Architecture Bangalore, India

Abstract

Quality is obscure; hence difficult to define its attributes in precise terms. The perception of quality has been always subjective; thus the quality assessment of a product or service may vary with individuals. Manufacturing industry has successfully evolved a system of managing and evaluating the quality of industrial products. However, much greater challenge is involved in managing and accessing the quality of something which is yet to be translated into a product. Architectural design is one such creation where conventional approach of evaluating quality cannot be applied. This paper attempts to explain the concept of quality as applicable to architectural projects. This paper outlines a model that can be applied to in managing design quality in architectural projects. The paper provides an overview of some tools that are in use to assess the design quality. These tools define the relationship among three vital aspects of design quality i.e. impact, functionality and build quality. The buildings are major contributors to climate change. Hence, it is imperative that the issue of sustainability is addressed by the architecture community at early design stage. This necessitates to recognise 'sustainability' as fourth aspect of design quality. The paper proposes a pyramidic model with sustainability being the fourth vital indicator of design quality.

Keywords: Quality, Design Quality, Design Audits, Quality Indicators, Sustainability

I. INTRODUCTION

The concept of quality is ambiguous and has different meanings in different context. Most dictionary definitions refers quality as, degree of excellence that something has; notion of benchmark that reflects excellence; or the characteristics or features of something. Quality in context of design can be defined as "degree to which design fulfils the needs and expectations." (Nelson, 2006). The ISO definition of quality which states quality as "the degree to which a set of inherent characteristics fulfils requirements," can be interpreted in context of architecture by elaborating the meaning of word 'Requirement', which stands for 'need or expectation that is stated, implied or obligatory.' Accordingly, quality can be stated as "the degree to which a set of inherent characteristics fulfils stated, implied or obligatory needs or expectations." In architectural projects word 'Obligatory' would mean compliance with codes, standards, byelaws and statutes. 'Expectations' means the requirements defined by the 'customer', which include client or end users.

II. QUALITY IN ARCHITECTURE – HISTORICAL PERSPECTIVE

The modern concept of quality is few decades old phenomenon. Whereas, the history testifies that the master builders of the past era had perfected this art centuries ago. The most astonishing examples are the Egyptian pyramids which stand testimony to the level of quality the man had achieved in the field of architecture and construction at this early stage in history. Egyptians formalized quality control process in construction through the knowledge they had acquired in the field of arithmetic, geometry, and engineering. Centuries later also, these structures stand as architectural marvels. Greek Structures are another testimony of quest for quality, which is quite evident in their architecture. The culmination of Greek architecture in the 5th century BC was the perfect development and highest artistic expression of architectural orders comprising of beams and columns. Roman architecture that flourished during 100 and 400 century BC contributed significantly to concept of quality. The monumental Roman Structures in masonry were of such high quality that some are still intact and inspire present generation of architects. In structural engineering the Roman developed high quality reinforced concrete that was used in perfectly constructed hemispherical domes and many other lasting structures. Roman also mastered the art of designing the spacious interiors (Mitra, 2002). Significantly, the three tenets of quality in architectural design; firmitas (stability), utilitas (convenience), and venustas (beauty or delight) were established by the Roman architect Vitruvius (De Architectura) as illustrated in Fig. 1.

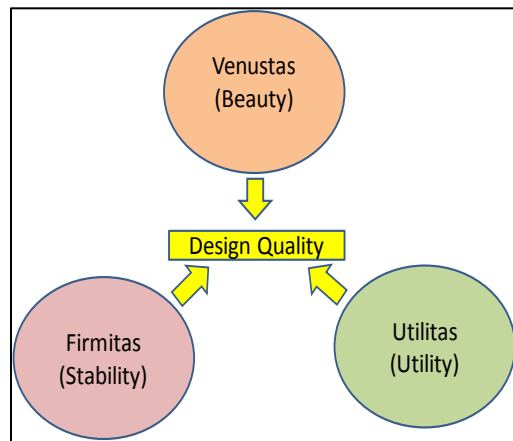


Fig. 1: Vitruvian three tenets of quality in architecture

Notably, most tools employed in evaluating the design quality are derived from the Vitruvian model of quality.

III. QUALITY CHARACTERISTICS OF AN ARCHITECTURAL PRODUCT

An architectural product is a corollary of a creative design process and a well-conceived construction operation. When an architectural design is transformed into a physical facility, the product may demonstrate several characteristics. These characteristics can be classified under three groups as shown in the Table 1 below.

Table - 1
Quality Characteristics of an Architectural Product

Characteristics	Elements
Functional Characteristics	Spatial aspects, appropriateness for intended use, accessibility, light, ventilation, etc.
Structural Characteristics	Strength and stability of structural elements.
Sensory Characteristics	Elements that influence the visual quality of built environment, character, innovation, form and material, etc.
Time-Oriented Characteristics	Sustainability, durability, maintainability, scope for future expansion, etc.

IV. SIGNIFICANCE OF DESIGN QUALITY

Buildings are fundamental part of our physical environment; hence the quality of their architecture becomes vital in shaping this environment. A well designed project will contribute significantly to the environment in which it is located. An enhanced built environment which incorporates the principles of good design can improve the quality of life of those who use it. The design costs of a building is merely about 0.5% of its life cycle costs but it is the design that makes the largest impact on the building's life time costs. Good design may initially cost a little more but economic, social and environmental benefits will far exceed the design costs. It is estimated that 5-7% of all construction costs are attributed to deficiencies in design, leading to rework. A good design demonstrates the personal perception of architecture but arises from the careful synthesis of several interrelated factors such as; creativity, functionality, efficiency, structural integrity, build-quality, flexibility, sense of space, responsiveness to site and context, security, lifetime costing, and sustainability. Fig. 2 illustrates the factors contributing to design quality.



Fig. 2: Constituents of quality design

V. MODEL FOR MANAGING DESIGN QUALITY

Managing design quality calls for a well-defined approach which begins with defining the aspirations of the primary stakeholders. A six-stage model for managing the design quality is illustrated in Fig. 3. The proposed model is an inclusive one which encompasses the issues pertaining to constructability and sustainability also.

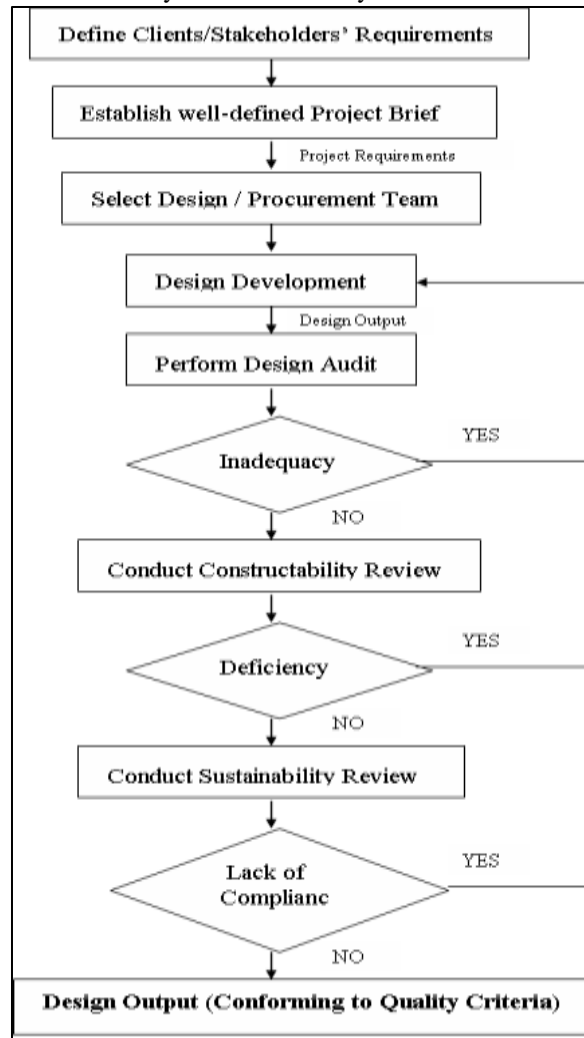


Fig. 3: Model for managing design quality

A. Client's/Stakeholders' Requirements

An important definition of quality is “meeting or exceeding the client/customer’s needs/expectations.” It is therefore crucial that the client’s requirements are fully understood. The client must be clear about the scope of the project. He must carefully define and assess the project priorities in consultation with all the stakeholders. An effective consultation among the stakeholders will help establishing a clear and well defined project brief.

B. Well-defined Project Brief

A well-defined project brief is vital to achieve high quality design. The project objectives derived from stakeholders’ aspirations forms the basis for establishing the project brief which serves as reference during the design stage. The project brief must clearly spell out the quality priorities as agreed by the stakeholders.

C. Design/Procurement Teams

Design and procurement teams play crucial role in delivering the project quality. Capabilities of every design/procurement firms must be evaluated against the well-defined quality criteria. Client must adopt Quality Based Selection (QBS) process, which emphasizes on appropriate balance of design skills, experience, innovation, and an ability to perform within the criteria of quality, cost and schedule. The design/procurement team can be selected on the basis of weighted score on the list of relevant factors such as; technical capacity, resources, previous experience and deliverability of the design. It is essential to physically verify the claims of bidding teams by inspecting the quality of major projects competed in recent years.

D. Design Audits

Design audit is crucial to quality design output. Design auditing is a systematically planned and documented activity to ensure the compliance with the objectives of the project as established in the project brief. The design input should confirm to the quality aspirations of the stakeholders. Auditing should be performed against the approved checklist. Thus it is necessary that a well-planned quality audit program is developed before the commencement of the design process to assure the conformity with the quality parameters. Audits should be scheduled periodically at the frequencies consistent with project and stakeholders' needs.

E. Constructability Reviews

The objective of performing the constructability review is to verify that the project can be constructed in adherence to design. The constructability review includes the validation of numerous considerations. Most of the items requiring validation are clearly the responsibility of the project design team. Constructability reviews contribute significantly towards the enhancement of the design quality as it minimizes the design related changes, helps developing a construction friendly specifications, improves contractors' productivity, promotes construction safety and reduces conflicts.

F. Sustainability Reviews

Sustainability is extremely vital in light of the impact of building activities on the climate change. The buildings contribute up to 40% of greenhouse gas emissions and approximately one-third of CO₂ emissions mostly from energy use during their life time. Hence, it is imperative that stakeholders address the issue of sustainability throughout the life cycle of the building. A sustainable design forms the basis for creation of buildings that will have minimum adverse effect on the natural environment. As much as 80% of operational cost.

VI. DESIGN QUALITY ATTRIBUTES OF ARCHITECTURAL PROJECTS

The subjective attributes of design quality relate to the individuals taste and perception; however other aspects of design those relate to functional, structural and time oriented characteristics of design can be assessed objectively. There is no particular globally accepted procedure of evaluating the design quality in architectural projects. However, there are few quality tools that are being widely used in UK, Singapore and Malaysia.

A. Design Quality Assessment Tools

Design Quality Indicators (DQIs), Achieving Excellence Design Evaluation Toolkit (AEDET Evolution), Design Excellence Evaluation Process (DEEP) and Quality Indicators in the Design of Schools (QIDS) are some of the design quality assessment tools that have been developed in UK and Scotland during last one decade and being widely used by architectural and construction organisations worldwide. DQIs tool was launched by Construction Industry Council, UK in 2002. The DQIs is generic in nature hence can be applied to all types of building projects. Whereas AEDET Evolution, DEEP and QIDS happen to be the sector specific tools designed for healthcare buildings, defence projects and educational buildings respectively (CIC, 2002. OGC, 2007. Scottish Executive, 2006). The noteworthy commonality among these tools happens to be the recognition of fundamental aspects of design quality described by Vitruvius as *utilitas*, *firmitas*, and *venustas*. The contemporary interpretation of Vitruvian framework of design quality refers these aspects as *function*, *build-quality* and *impact* respectively. The contribution of these aspects to design quality is illustrated through Venn diagram (Fig. 4), which shows that greater the overlap between the three, the higher the design quality.

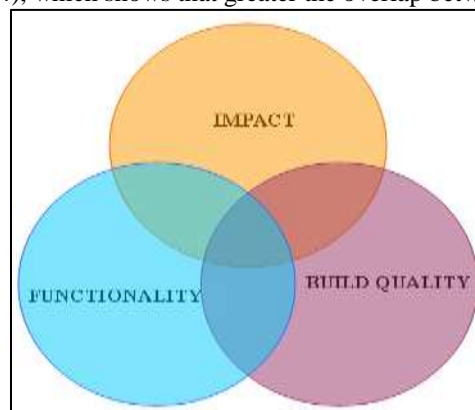


Fig. 4: Design Quality Indicators

The functionality aspects relate to level of efficiency that design can achieve in terms of accessibility, use of facilities, and interrelationship of spaces. The build-quality of the design refers to engineering performance of structural and engineering systems and soundness of construction, finishes and fittings. It also includes the integration of health and safety aspects throughout the lifecycle of the facility. The aspects of impact emphasize on capability of the design to yield into an impressive built environment

resulting from amalgamation of innovation, character, form, use of materials, and urban and social integration. It also refers to the ability of the building to create a sense of place and the influence it may have on the local community and the environment.

There are other quality systems which do not deal exclusively with architectural design quality but view architectural work as one of the constituents of overall project quality. Quality Assessment System in Construction (QLASSIC) and Construction Quality Assessment System (CONQUAS) are two such systems that are being used in Malaysia and Singapore respectively. QLASSIC system was developed by the Construction Industry Development Board Malaysia with objectives to establish quality benchmark for workmanship in the construction industry and to establish a standard quality assessment system. However, the system does not address the design quality issues during the development stage. It deals with assessment of quality of architectural work at the completion of the project. CONQUAS (BCA, 2008) was developed by the Building and Construction Authority Singapore. The objectives and the process adopted to measure the quality of a construction project are similar to that of QLASSIC. The scope of the system is limited to assessment of quality of workmanship of architectural finishes and components, hence has little utility at addressing the design quality issues.

VII. SUSTAINABILITY AS FORTH INDICATOR OF DESIGN QUALITY

The threat posed by the climate change to the survival of human race is real and architectural and construction community can ill afford to ignore it. The impact of building activities on the climate change has been well documented. The carbon dioxide emissions are directly linked to the energy intensiveness of the building during its complete life cycle. Most design decisions will have direct bearing on the natural environment. Thus, it is imperative that vital facets of design viz; impact, functionality and build-quality are built around the fundamental aspect of sustainability. The pyramidic model of design quality evaluation is illustrated in Fig. 5. The three facades of the pyramid representing impact, functionality and build-quality are built on the base called sustainability. The sustainability indicator must focus on consequences of design decisions on use of energy during the life cycle including the embodied energy, conservation of natural resources, and reduction and recycling of waste products, etc.

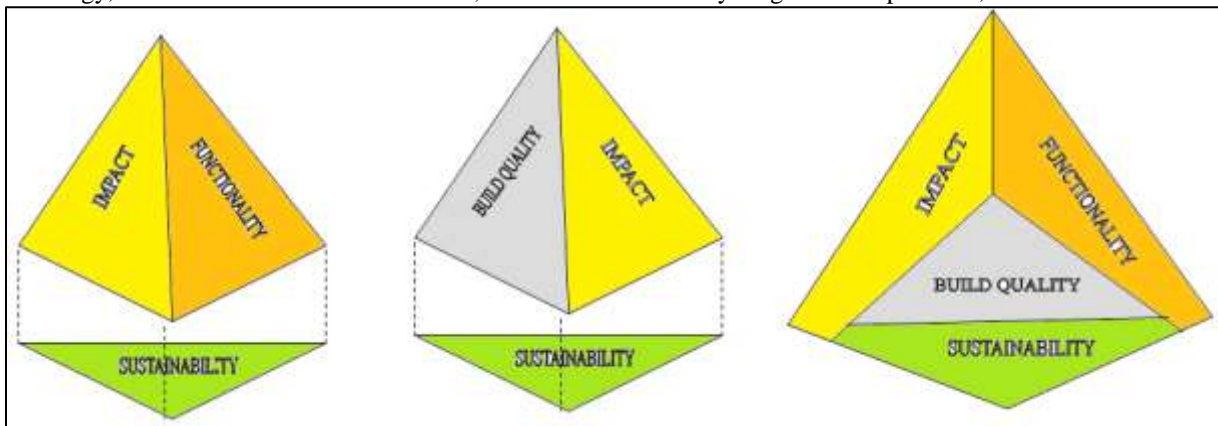


Fig. 5: Sustainability the fundamental indicator of quality

VIII. CONCLUSIONS

Evaluation and managing the design quality is crucial in ensuring overall quality in architectural projects. Quality of design also has bearing on the quality of the project during the construction phase. Hence it is important to evolve and adopt a well-defined approach to manage the design quality right from the early stage. Though, there may be apprehensions about addressing the subjective aspects of design quality, the issue pertaining to sensory characteristics can be effectively dealt by engaging the stakeholders at every stage of design reviews. Quality of the project is often impaired due to lack of construction knowledge on part of the design team. The proposed model of managing design includes constructability review as one of the important stages in the management of design quality, which would ensure the feasibility of design with respect to the available construction know-how and materials. Consequences of climate change are imminent and buildings have emerged as one of the major contributors to this phenomenon. The proposed quality management model includes the sustainability review of designs to address the issues pertaining to energy and environment. The proposed pyramidic design quality assessment tool recognises 'sustainability' as the forth and fundamental indicator of design quality.