BARC0151: Making Buildings

Synthesis Report and Critical Review

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This report comprises of a synthesis report that discussed the pre-design and design processes involved in the making of a building. It is followed by a critical review of the concept of a Post Occupancy Evaluation.

Synthesis Report

Pre-Design:

The first step in the pre-design process is to understand the site and its context through a site analysis. A site analysis is carried out through a series of surveying and data collection, data analysis and data synthesis. The execution of a detailed site analysis enables us to understand the site's constrains as well as its opportunities. This process involves studying site topography, local history and social context, climate, accessibility, infrastructure, urban scale landmarks and such. These studies can be classified as a Strength, Weakness, Opportunity or Threat (SWOT) which is a technique often used to analyse business models. Firm resources are not valuable in a vacuum, but rather are valuable only when we exploit opportunities and/or neutralize threats[2] making site analysis a key to extract site potential for a successful building design.

The next step is outlining the architectural intent and designing for a brief. A design brief outlines the purpose, constraints and rules involved in the design of a building and hence provides a criterion to compare against. A brief is essential as it provides a goal that allows us to evaluate our success. Vitruvius describes architecture as an intersection of utility, strength and beauty and a building design is incomplete if it doesn't encompass all three qualities[6]. The factors that can be used to assess architectural performance are design vision, innovation and originality, capacity to stimulate engage and delight occupants and visitors, accessibility, and sustainability, how fit the building is for its purpose and the level of client satisfaction[4]. A brief is a guideline that encompasses these criterion providing a bible to design by.

The engineering design intent involved assessing a buildings performance such as its environmental performance. A building can be benchmarked based on its environmental performance. Benchmarking is an essential part of the process as it sets a goal to compare against that can be used to evaluate the success of a project. This can be done by setting design targets for a project which are both technical (like temperature, air quality, ventilation rate, lighting, noise, operational energy, CO_2 emissions) and human (like aesthetics, historical context, quality of space use, security and privacy, perceptions of personal comfort). Comparing a buildings performance to the standards can hence help encourage an improved performance for the building and mandate some minimum standards. It is essential that this process is started early in the building design as even though sense-checking is a back and forth process, it is easier to make big changes early if needed. Benchmarking can be done by either using design targets (e.g. LETI) or empirical data (e.g. CIBSE guides). The former is more ambitious but covers simple targets, a smaller number of building types and has a less detailed use of breakdowns from sources in comparison to the latter. Life Cycle Analysis (LCA) is used as a tool to maintain the balance between embodied and operational carbon. Sometimes in order to make the savings in the longer run we end up increasing the initial capital put into the building. LCA is a comparative protocol.

Design:

The design process from an architectural point of view involves Concept Design and Spatial Coordination. The former focusses on developing a strong concept aligning with the brief while abiding by set restrictions and limitations. It is key that the designers, stakeholders and clients are kept in continuous conversation through the process. The latter focusses on specific organisation of the project while integrating the architectural and engineering concepts.

To discuss the design process from an engineering point of view, it's important to confer main causes for failures in delivering 'good' buildings focussing on Performance Gap and Post Occupancy Evaluation. The Engineering process in order to achieve the net zero target involves planning, masterplan, certification, HVAC/Load assessments and performance. The RIBA Plan of Work is an industry-wide used framework that explains the expected outcomes, core tasks and information exchanges throughout the life of a construction project. It consists of 0-7 stages. Stage 0 'Strategic Definition' defines the project, its objectives and outcomes before a detailed design brief is created. Stage 1 'Preparation and Brief' involves developing the initial project brief as well as reviewing industry regulations. Stage 2 'Concept Design' involves undertaking environmental and structural assessments as well as developing energy strategies and performance targets. Stage 3 'Spatial Coordination' involves responding to building regulations, environmental studies and optimising the design in accordance with these factors. Stage 4 'Technical Design' consists of verifying and detailing the design and reviewing and updating design target commitments. Stage 5 'Manufacturing and Construction' involves preparing handover and supervision through site inspections. Stage 6 'Handover' involves project performance review and induction and training of building users and facilities managers. Stage 7 'Use' involves the post occupancy evaluation and compiling and disseminating lessons learned from the process.

Energy efficiency in a building is essential. Knowing the purpose of a building is important to understand and judge its performance. A building can be analyzed on its technical performance, operational energy and CO_2 emissions or occupant satisfaction. Post Occupancy Evaluation and human experience evaluation are tools to assess the building after its in use. The Performance Gap describes differences found between design predictions and outturn performance measured in a post occupancy evaluation. These processes help understand know how to manage system optimization versus human needs.

Critical Review

Post Occupancy Evaluation:

One of the main concerns of architecture, engineering and building construction is production of high performance buildings, which maximize occupants comfort and satisfaction while minimizing environmental impact and cost. However, even in premium new buildings, significant deviations are frequently reported between anticipated and achieved occupant satisfaction, energy consumption and cost performance[5].While all major decisions are taken in design and construction phases, post-occupancy is the phase where buildings show

their actual performance and consume approximately 80% of a building's life-cycle costs[1].

"Post-occupancy evaluation (POE) is the process of systematically comparing actual building performance, i.e., performance measures, with explicitly stated performance criteria. These are typically documented in a facility program, which is a common pre-requisite for the design phases in the building delivery cycle. The comparison constitutes the evaluation in terms of both positive and negative performance aspects." [7]

Most of a buildings performance indicators can be quantified such as lighting, ventilation, thermal comfort, acoustics, etc. However, the POE process is not just quantitative, in terms of assessing the structural and environmental functionality of a building through comparison with benchmarks but it is also qualitative. This is essential as sometimes even if a building completely satisfies technical criterion, its occupants may still not be entirely comfortable and satisfied using it.

POEs can be achieved through three identified methods. Indicative, indicating a buildings strengths and weaknesses hence, highlighting the issues in building performance. Investigative, determining the cause and effect of the shortcomings in building performace. Diagnostic, establishing a relationship between the building environment and the occupants view on building performance. POEs hence help determine not only whether the building fulfils technical standards but also helps explore the cause-effect relationship between the building and its occupants.

The POE not only hence provides essential information on the functioning of a building system that is used as a positive or negative lesson for future building cycles. In addition they are, in the long run, essential in creating databases to produce guidance for the planning and design of specific buildings (offices, healthcare facilities etc.). POEs hence improve building quality in terms of health, safety, security, functionality, efficiency, cultural and occupant satisfaction. The lessons learnt from POEs also save maintenance and operational costs over a buildings life cycle. It is interesting to further note that due to standardization of data-gathering instruments and greater availability of base-line data and criteria with which findings from POE studies can be compared, the cost of conducting POEs has also reduced significantly.

A practical example of the integrated benefits of a POE can be drawn through an indoor light. The frequency of its replacement as well as its usage can be recorded. Its life expectancy and costs would have already been recorded. In addition, practical availability, ease of replacement, aesthetics and occupant satisfaction for the light could be ascertained and then used in the future with reference to that indoor light.

While the POE is extremely aiding, it can be argued that this critical review of a buildings performance should not just occur post-occupation, but also occur though out the building delivery process. The terminology of a 'building evaluation' is introduced that brings together the technical aspects of building performance and the occupant feedback creating a more comprehensive building feedback which could prove even more useful.

In addition, it has been established that even though there are known benefits of POE, the culture of evaluating the performance of a building, after it has been built and occupied by users for a while, has not been successfully embedded in the design and construction process. This can to some extent be contributed to the fact that the perception of a building users may

not be easy to translate into a designer's language. However, it is also possible that the builders are not interested in the buildings performance after the handover as they quickly move onto another project. Research suggests that resistance to adopt POEs as a standard part of the building process may also be due to lack of incentive for the architects[3]. Building users and occupants might not support the POE scheme as part of the procurement project because they might not understand how the benefits of the process would outweigh the inconvenience that any maintenance and repair work would cause them, and they might not be able to put the knowledge they gain from the POE exercise to use in the near future.

~1600 words

References

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