NECESSITY OF DESIGN MANAGEMENT IN CONSTRUCTION INDUSTRY

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Abstract: As the modern building designing processes are getting more complex, there is a growing necessity to establish collaborative practices in the process of building design and construction projects, as they are likely to involve a large number of diverse disciplines, many of whom will not have worked together before. They are likely to involve the co-ordination and integration of a great deal of complex information, procedures and systems. This has become increasingly true as today's project structures have evolved from the straight forward client - consultant - contractor relationship to more integrated structures with complex financing arrangements, early engagement of the supply chain and the introduction of sub-contractor and specialists design.

Design Management, Construction management

I. INTRODUCTION

The construction sector is a key driver for the Indian economy. The sector is highly responsible for propelling India's overall development and enjoys intense focus from Government for initiating policies that would ensure time-bound creation of world class infrastructure in the country. Infrastructure sector includes power, bridges, dams, roads and urban infrastructure development. In 2016, India jumped 19 places in World Bank's Logistics Performance Index (LPI) 2016, to rank 35th amongst 160 countries.

With such a high and ever growing demand of construction activities in various sectors such as buildings, transportation, power generation structures and the likes, with more and more complexities of modern buildings in today's competitive market place has put a pressure for improving the performance of design process in term of time, effectiveness and quality. It has become a fairy common practice of overlapping the design process with execution process to reduce the project duration and increase flexibility of product design.

Designing is the process of creating a solution the stake holders and client's fulfilment and then preparing instructions allowing that solution to be constructed. There is a need to plan and co-ordinate this process of design, to satisfy budgets, achieving milestones in a timely manner, and proper and unhindered communication of design requirements. The lack of design planning and co-ordination results in passing of insufficient information required to complete design tasks and inconsistencies within important construction documents. Poor communication between designers – executioners - stakeholders, lack of adequate documentation, deficient input information, poor resource allocation, lack of coordination between various disciplines, and erratic decision making have been pointed out as the main problems in design management (Cornick 1991, Austin et al. 1994, Koskela et al.)

Furthermore, these issues have become more prevalent as today's buildings have become more complex and technical, the range of products and materials has increased manifolds, standards and regulations have become stricter and specific, and there are a greater number of specialist designers, particularly in the early stages of the design process.

II. LITERATURE REVIEW

Design Management is beginning to become an increasingly important function in the construction industry. As the construction projects are becoming more complex and global and new contractual arrangements, which require alliances and partnerships among the designers and executioners are increasingly used[2]. Gray[2] suggests that design management is being done by construction firms because of the failure of various existing systems to achieve proper integration of the design and construction processes.

From the 1900's to 1980's, the preferred method of project delivery was design – bid – build and personnel in the construction industry were trained as such[4]. At the end of 1980's, architects and the different engineering disciplines became more and more specialized[5]. Today's highly complex, multi-stakeholder projects change fundamentally the dynamics of the relationship between design and construction and the management of activities between the two[1,2, 6]. In earlier times when design was completed before construction, design management was largely about the managing and planning the activities of designers', and outputs in an architectural or engineering consultancy[7]. This activity was relatively contained and it focused on the production of design documents for the client. With the advent of new contractual arrangements, design management now involves a much more complex set of relationships between the client and the specialists from design consultancies, vendors, manufacturers and contractors. Correspondingly the functions of design management are much broader and much less well defined[7]. It is this conception of design management that the construction companies, rather than design consultancies, are taking responsibility for in increasing numbers.

This role seems similar to the role of the chief engineer or architect/lead designer during the 1800's[1, 5]. During the 1800's, the architects and the engineers were solely responsible for the design and construction of complex construction projects[1, 5]. Due to the disparity in the amount of time, complexity, stakeholders, financial constraints, allowed risk and amount of design and construction integration required, roles in the 21st century are not the same as they were in the 1800's. A detailed account of the functions of design management is required if educational institutions and construction companies wish to provide adequate education for them into the future.

III. THE DESIGN PROCESS OF CONSTRUCTION

The process of design in any construction activity is generally be characterized by a series of actions: formulation, analysis, search, decision, specification, and modification. However, at the initial stages of development of a project, these actions are highly interlinked and many repetitions of design are expected to refine the functional requirements, design concepts and budget constraints, even though the tools applied to reach at a solution to the problem at such initial stage may be very crude.

For every construction project, a design team is formed, with a well-defined scope of work for each member of the design team which is documented and communicated to the rest of the team before the beginning of any design work. Typically, one member of the design team is appointed as 'lead designer' to direct and co-ordinate other designers in the consultant team as well as any specialist designers that are appointed.

The role of lead designer might include:

- Coordinating site surveys.
- Coordinating the preparation of information for making the project brief.
- Coordinating the preparation of designs and specifications.
- Integrating different aspects of the design and their interfaces into the process.
- Coordinating internal and external consultations and reviews.
- Defining the form and content of information to be prepared.
- Reporting to the client/stake holders on design matters and seeking approvals.
- Coordinating the preparation of schedules of inspections, tests, mock ups and samples.
- Coordinating consultations, negotiations and submissions to planning authorities and other statutory and non-statutory authorities.
- Coordinating the preparation of tender/bid documentation and reviewing submissions.
- Coordinating quality control systems.
- Coordinating the issue of production information to contractors and the review of designs prepared by contractors.
- Coordinating procedures for inspections, commissioning, testing and client training.

Team leadership is essential for ensuring the effective performance of the design team. Each team member will have their own strengths and weaknesses, specialist knowledge and experience. The way that the team works collaboratively and independently will influence the efficiency of the design process.

IV. THE MANAGEMENT PROCESS OF CONSTRUCTION

As stated by the Project Management Institute (PMI), project management is "the art of directing and coordinating human and material resources throughout the life of a project by using modern management techniques to achieve predetermined objectives of scope, cost, time, quality, and participating objectives." The PMI's definition to construction project management, wherein a construction project manager uses the same model to achieve the same goal, only in the context and boundaries of construction activities. At the most fundamental level, construction project management handles the planning, coordination, and execution of a construction project, whether it's residential, commercial, institutional, agricultural, industrial, heavy civil, or environmental.

To ensure that these activities and procedures are fulfilled for a successful completion of the project, clients'/stake-holders'/construction firms appoint construction/project managers to oversee these tasks which include:

- Putting together the budget and negotiate cost estimates
- To arrange the work timetables
- Choosing the most efficient construction method and strategies
- Staying in touch with the clients'/stake-holders for work or budget related issues
- Discuss about technical and contract details with workers and other professional parties
- Keep an eye on the personnel in construction onsite
- Cooperate with building and construction specialists

But, on a fundamental level, the job profiles of construction managers fail to include a way to mediate among stake holders – contractors – designers. Constructors would not expect to interact with designers and they would not expect designers to have input into their processes. People would try to stick with original estimates as they have traditionally done, because these estimates were once based on detailed design.

V. NEED OF DESIGN MANAGEMENT IN CONSTRUCTION

The aim of design management is to provide the design team with the leadership, management systems, information, support and training to enable the achievement of their aims of quality, value for money and timeliness. Effective management enables the design team to integrate with procurement and execution personnel's' to maximum advantage **(Fig 1)**. It is also flexible, being tailored to the needs of each project and client.

Design management is important as it:

- Defines what, how, when and by whom work is done
- Establishes an efficient timeline for all parties to follow
- Identifies program interfaces, interdependencies and resource clashes
- Encourages individuals to deliver within schedule

To successfully manage the designing process, the following should be considered:

- Each work milestone should be centered on one person based in the design team
- The design management team should work as part of the design team
- The design management team should achieve good working relationships
- Management should be proactive rather than reactive
- The process should be objective, relying on critical assessments of design process and rigorous forecasts of project cost
- The process should also be flexible, being tailored to the needs of each project and each client
- Processes and management services should facilitate the design team

In order to oversee and link the client – contractors – designers' heads, the construction industry requires to inculcate a position of Design managers. The design managers initially emerged in construction organizations as they started undertaking a part of design, which involved their specialist sub-contractors. The design manager has a coordinating role, but does not act as a designer themselves. The role is different from that of the lead designer, who heads the decision making and co-ordination of the actual design, or with the lead consultant, who directs the work of the entire consultant team.

The important tasks of the design manager are to:

- Establish clear communication and collaborate between relevant parties and thereby an effective flow of design, procurement, and execution methods information.
- De-risk design problems by finding solutions before they materialize.
- Contribute to planning and co-ordination in a way that adds value to the processes.
- manage and secure all-heads ownership of an integrated design program.

This requires a great deal of experience, and it is important that design managers are good forward planners, capable of managing project timescales, and with the requisite knowledge for ensuring the design process is in accordance with current legislation, standards and codes of practice.

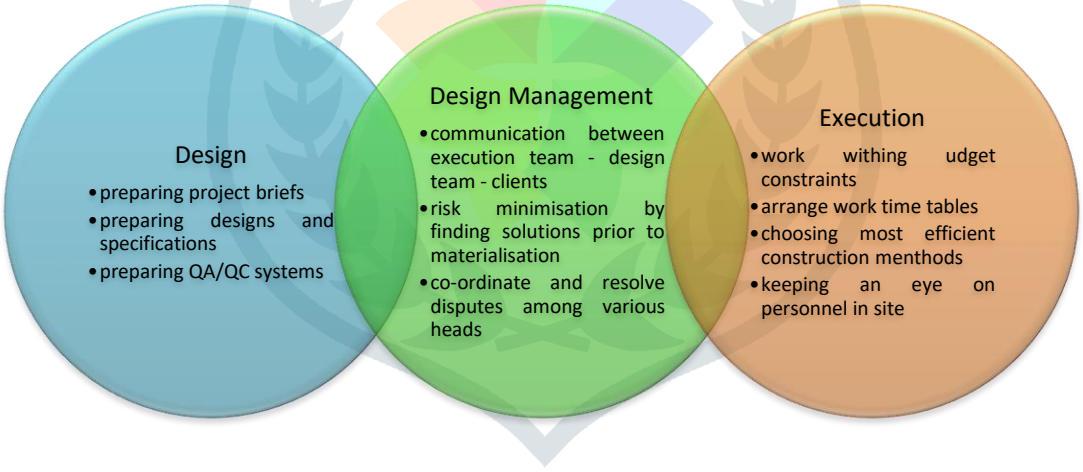

Figure 1

VI. Roles for Design Management

With so many aspects of designing being applied in various construction related departments, it has become essential to develop an appropriate design management approach. The complexity of the professional field can be addressed in two dimensions: the management context (where design management is focused on the managerial aspects), and the design context (where design management is focused on the function of design).

The resulting roles reflect the variety of goals that design management intends to achieve: some are aimed at increasing organizational performance (leadership level), others at directing the application of design (directing level). In its most mature form, design management assumes a visionary role in both of these dimensions and helps the organization to clarify its purpose and give it direction.

- Execution – oriented roles: Implementation of designs through planning of activities and project management.
- Enabling – oriented roles: Enabling design through coordinating and organizing demand and supply between clients.
- Direction – oriented roles: Directing design through connecting stakeholders in decision-making and leadership in design-related activities

While the established roles and profiles of design management can be found in the design departments of organizations, a new set of profile is emerging in parallel where other departments, like branding and marketing, are looking at the benefits of design management. Also design consultants are looking for qualified professionals with design management competencies who can assume novel roles, such as that of service design, design research and design strategy, that are in demand within their organizations. In short, design management is now becoming an integral part of organizational structure, and the design managers' tasks are consequently growing in scope in order to meet new requirements. Various professional fields that are available to design managers can therefore be identified in the context of construction field.

VII. Design Management Services

The services to be rendered by design managers should be clearly laid out by client in deliverables to reduce the risk of inefficiency from design managers part. During the entire designing, planning and execution stages, the management controls to be implemented and documented should be set out and defined in the Project Execution Plan (PEP) which is the live document used as the management tool for delivery of the works. The purpose of the PEP is to capture the project brief, the role of designers, scopes and responsibilities, Schedules of deliverables, design review dates shall be established too and often these are the basis for the structure of the delivery program and the approach for delivery.

To ensure that the design is complete, each design deliverable (i.e. drawings, reports and specifications) should be identified and at regular intervals during the design progress each of the deliverables should be tracked against the program and the 'state of completeness' identified and reported.

Regular design progress meetings should be held, with progress against the agreed design deliverable identified and feedback given from the client, where relevant. These need to vary in content, sometimes including all disciplines, thus allowing holistic co-ordination issues to be explored and resolved. At other times it may be more appropriate to have targeted sessions on key packages (e.g. HVAC services or general fittings).

Designers' progress needs to be quantitatively measured, rigorously checked and any slippage must be identified so that corrective action can be taken timely or additional resources as required shall be mobilized. This may well provide a challenge to a design manager and thought will need to be given on whether the progress is measured against time duration elapsed or a percentage of physical completion of deliverables. This choice will depend on the structure or the terms of appointment of each design package.

Regular reports can then be prepared highlighting the design progress, key issues and risks, client decisions pending and key actions for the next period. Design management is a fundamental part of the role often undertaken by our Project Managers and, with many of our team originating from consultancy disciplines, we are well versed in this activity.

Principal services in the design management field are:

1. Design planning
    - Schedules of deliverables
    - Monthly task lists — an alternative to deliverable schedules
    - Milestones for approvals and decisions
2. Value management
    - Critical review (from clients' side)
    - Desk testing and optimization of design if required
3. Organization and control
    - Design team organisation
    - Design team procedures
    - Managing information systems
4. Monitoring and reporting
    - Progress assessment
    - Document control
    - Forecasting completion dates
    - Management reports
    - Recovery plans

To deliver the projects successfully, the following techniques are made use of in design management perspective:

- Programming — master and discipline hierarchy
- Deliverable schedules
- Monthly task lists — an alternative to deliverable schedules
- Value management — to optimize design
- Communication—using internet collaboration technology

VIII. Conclusion

This paper investigated how the barriers to managing the design process affect the success of a project and organization undertaking design management. Construction companies experience great difficulties in trying to manage the design process

To improve design management performance, the understanding of the very nature of the design process must be improved and more use should be made of the tools that are available to manage the design process. It is evident that the role of design managers as such needs to be structured well in context of construction projects and there must be well laid out guidelines and well-structured hierarchy to better implement the design management process, which will not only expedite the project schedule but will cut on a great deal of avoidable disputes among various disciplines and clients.

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