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Managing design in architecture, engineering and construction

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Abstract
Design management in the architectural engineering and construction (AEC) sector is a rapidly evolving discipline, with many interpretations and applications. Management of architectural design is essential for delivering design intent and maximising value. This has resulted in the rapid growth of design managers working for contractors and greater attention to design management issues within professional consulting firms. It reports a qualitative, exploratory study of leading and managing projects. In particular, the paper reports findings that relate to managing and leading projects whilst maintaining conditions that are stimulating and motivating for creative workers. This article explores the origins of design management in AEC, provides an overview of the practical application of design management by contractors and professional consultants, and concludes with some thoughts on current trends and future developments.

Keywords: Architectural Management, Design management, Project management Practical application, AEC

1. Introduction
Since the turn of the century there has been a rapid increase in the number of construction design managers employed by major contracting organisations as contractors seek to provide better value to their customers and increasingly recognise the strategic power of design. Many of these individuals have previously held positions as architects, engineers, project managers and cost consultants and now find themselves, through choice or circumstance, in a new and rapidly evolving role. Terms such as 'design manager' and to a lesser extent 'design integrator' or 'design coordinator' have become commonplace, although according to research by Tzortzopoulos and Cooper (2007) [1] the exact nature of the construction design manager's role is not well defined or understood. Part of the confusion appears to stem from the wide interpretation of the role between different contracting organisations; part from the paucity of education and training programmes for construction design managers; and part from the way in which the terms design management and design manager are used in separate fields of literature, such as industrial product design, architecture and construction [2].

The purpose of the current paper is to report a qualitative investigation of the design management process as led by those in architecture. The architecture industry has been selected for two reasons. First, architecture is a professional, essential service to the building industry and the starting point of most building projects. As a result, professional architects commonly find themselves leading and managing projects, sometimes in a de facto capacity and sometimes in a role clearly defined as such. The study of architects in their capacity as project leaders is limited within the extant literature, so the current paper aims to make some contribution to understanding. Second, architecture is categorised as a creative industry. Project management in the creative industries is also little dealt with in the project management literature, and in fact, in the traditional Project Management paradigm of activity and outputs involving cost, time and quality, there appears little room for creativity. However, practice tells us that creative industries do operate projects, and where they do they most often comprise the application of creativity to business or commercial objectives. Architecture is one such example-in fact, commercial projects define architecture and underpin opportunities to pursue creative development in the sector [3].

We need to discuss the issues associated with project management in the specific context of creative industries, issues emerging from the literature followed by a description of the methodology employed to address them [4]. An agenda for design management research needs to be established, based on a conceptual foundation for operations management. Design processes can be conceived in at least three different ways: (1) as a process of converting inputs to outputs, (2) as a flow of materials and information through time and space, and (3) as a process of generating value for customers. All three conceptions are appropriate and necessary. However, the conversion model has been dominant in the AEC (architectural/engineering/construction) industry until very recently. Emphasis should be laid on current thinking and practice of design management, suggest fundamental hypotheses, then propose an agenda for design management research based on those hypotheses [5].

2. Origins
Many reports have questioned the ability of the construction sector as a whole to deliver value to the construction client (customer) and by implication the wider society. Clients are increasingly demanding better value from those employed to deliver a physical artefact. These reports have brought about pressure to change, with the adoption of new forms of contract and shifting roles and responsibilities within the AEC sector. One of these changes is the development of the design manager role in contracting organisations. The need to manage design activity has been recognised for some time, in industrial product design, architecture and more latterly construction. In the concise review offered here, the origins of design management are explored from three perspectives; that of

design management in industrial product design (generic design management); the field of architectural management; and also the construction design management discipline [6].

2.1 Generic Design Management

It is the field of industrial product design that design management is most established. An early publication *Design Management* by Michael Farr [7] put a convincing case for the design management role as an essential aid to attaining and maintaining competitive advantage. Farr made the observation that the design management role was not particularly well understood at the time of writing his book, since which time the design management field has developed. The creation of the *Design Management Institute* (www.dmi.org) in the United States in 1975 was instrumental in legitimising the role of the design manager and has helped to stimulate a growing knowledge base. Although this body of work does not address design management from the perspective of a construction professional, it is possible to see parallels between the literature and the specific characteristics of construction projects. Many of the generic approaches appear to offer some value to construction design managers and may, with care, be applied to the management of construction design. The message is that:

- Design management is integral to new product development
- Design management relates to the entire life cycle of the product
- Design (management) is a strategic asset

An all-embracing definition that has relevance to the AEC sector can be found in Boyle's book *Design Project Management*. 'Design management involves understanding, coordinating and synthesising a wide range of inputs while working alongside a diverse cross-section of multidisciplinary colleagues' [8]. From this we can deduce that design management is concerned with interfaces (people, places, processes and products) [9].

2.2 Architectural Management

In the architectural literature the term 'architectural management' first appeared in the 1960s in the book *Management Applied to Architectural Practice* [10], although it was not until the 1990s that the term started to be used more widely. Architectural management describes the synergy between the management of the professional office and the management of individual projects. The vast majority of publications concentrate on the management of the business or the management of projects. Indeed, it is the synergy between the management of the business and the management of individual projects that comprise the project portfolio that makes architectural management unique.

In 1992 the first international conference on architectural management was held at the University of Nottingham and such was the interest in the subject area that a working commission was set up by the CIB (International Council for Research and Innovation in Building and Construction. Selected proceedings of the Nottingham conference were published as an edited book by Nicholson in 1992 [11], although there was no attempt to provide a definition of the field. This followed a few years later in Nicholson's PhD thesis [12]. Since 1993 the working commission has been active in organising international conferences and publishing peer reviewed papers. It was not until 2009, however, that the first book by members of the CIB W096 was published *Architectural Management: international research & practice* [13]. While this book reflects the work of the commission, it also forms a foundation for future research and practice. The message is that:

- Architectural management is integral to the successful management of individual projects and the business
- Architectural management relates to a wide range of activities conducted by building designers
- Architectural management is a strategic asset; however, the role of the architectural manager is rather vague. It should be noted that within the domain of architecture the term 'design management' tends to be used to describe the effective management of the design process and the management of design content within individual projects (Allinson, 1997), [14] with the majority of publications addressing the subject from the perspective of individual projects. Although this body of knowledge addressed design management from the architect's perspective there is significant overlap between this and construction design management [15].

2.3 Construction Design Management

In the construction management literature the term design manager started to be used in the 1990s as procurement shifted in favour of design and build, early examples being a seminal report by Gray *et al* (1994) and the resultant book *Building Design Management* by Gray & Hughes [16] in which the growing importance of the design manager in construction was noted. In 2007 the Chartered Institute of Building (CIOB) in United Kingdon recognised the term 'design manager'. However, the need to improve design management techniques and to better understand the design management role from a contractor's perspective illustrates the fact that the discipline is still developing. Bibby [17] noted that while there was growing interest in design management within the construction sector, there were a number of barriers to be addressed before design management could be successful. These barriers related to the nature of the design process and (then) current construction practices. Tzortzopoulos and Cooper [18] suggest that the issues also relate to a lack of clarity and understanding of the design manager role within the industry. Clearly the lack of guidance to construction design managers is an issue to be tackled as the role matures. The message is that:

- Design management is implemented at the level of the project; it is not integral to the successful management of individual projects *and* the business (as argued in the architectural management literature).
- Design management is largely a coordinating and integration function, and does not yet relate to the entire life cycle of the product (built asset), as argued in the generic management literature.
- Design management is not yet considered a strategic asset, although the role is evolving.

Similar to the architectural management literature, this body of knowledge is rather modest and lacks clear terms and definitions. Although there is some variation in interpretation within the literature it is evident that the construction design manager is responsible for managing the process of design implementation within projects on behalf of the contractor [19].

3. Design Management by Architects

It is still not common to hear the term 'design management' (design manager) or 'architectural management' (architectural manager) in the daily workplace. Hardly anyone can discuss the design manager role with any confidence. None of the architects and other persons at the offices feel that they need a design manger or an architectural manager since the roles are implicit in the work of individuals within the office. The senior members of the generally claim to have the experience to manage design projects and their design businesses. This is questioned by the less experienced members, with the majority claiming that there is very little evidence of managerial skills in the practices they work in. People have received little or no training in design management or architectural management during their training and that they are left to learn on the job. Examining this scenario we can tentatively propose that there is a need to:

- Explain the benefits of architectural management to practitioners. This should include giving clear guidance on the role of an architectural manager.
- Educational institutions need to do more to include architectural design management within the curriculum.
- Professional bodies need to do more to promote architectural management to all members of the profession [20].

4. Current Practice of Design Management

Generally, the management of design and engineering is felt to be problematic in AEC projects. Coles (1990) [21] found that the most significant causes of design problems are poor briefing and communication, inadequacies in the technical knowledge of designers and a lack of confidence in preplanning for design work. Common consequences included slow approvals from clients, late appointments of consultants, and inadequate time to complete design documents carefully. In his study on technical design of buildings, Sverlinger found that the most frequent causes for severe deviations during design were deficient planning and/or resource allocation, deficient or missing input information, and changes. In his study of construction defects, Josephson (1996) [22] found that when measured by cost, design-caused defects are the biggest category. From design caused defects, those originating from lack of coordination between disciplines are the largest category.

5. Guidelines for Architectural Management

The following guidelines can help integrate new systems for management into the practices of architecture. These are set up to meet the agenda, challenges, and objectives outlined previously.

1. Perceive design as a non-linear, inclusive system where advances from many areas become organized in ways that enhance societal strengths and reduce societal ills. Design needs to be used for context-building, as distinct from context-using. An interesting example of what this means is seen in a major Swedish design, construction and finance firm.
2. Hold broad-based company discourse into salary and other reward differentials within the organization. Since salary has become such an important indicator of value it is critical to have general appreciation on the meaning of salary differentials. This will clarify why and how employees should invest their scarce resources. In most Japanese companies, and many European companies, the differentials are much less than in US firms.
3. Insure that the organization makes resources available for investing in the making of a better future. This can be exhibited and can become manifest by insuring that at least 1% of turnover goes into R&D to finding better ways to do what is normally done, as well as ways to identify and articulate the non-normal that can become desirable. Virtually no design firm ever considers doing this. The argument against is that it can't be afforded. Evidence illustrates that an organization can't afford to not do it.
4. Find ways to continually integrate the building process. Future work in the building industry will need a management strategy that supports integration of the entire process from materials refinement to financial instruments. For some architects this will mean being taken over by a large construction firm. For others it will mean having a management strategy that allows an architectural firm to independently adapt to changes faster than others.
5. Emphasize both the local and global aspects of building while shifting away from concern for the national. This guideline comes from study of a wide array of small to large building projects. Local and global issues of building location and natural environment have grown in importance while national agendas were largely responsible for generating them and have largely failed to respond since. In addition, much of the regulatory, tax and financial power bases behind projects are being shifted from their traditional national bases to local and global bodies.
6. Strive to continually improve efficiencies in process and product. This will help any employee who gets lost and doesn't know where he or she is or what he or she is doing they needs only to return to the overriding objective.
7. Question and improve these guidelines so they can better meet the needs of effective management, but insure that they don't exceed seven. The timeless measures of success will be quality and efficiency, where both always have been and will be context sensitive, just as managers must also be. Guidelines that are too numerous are almost worse than none. This is because the complexity they generate becomes counterintuitive [23].

6. Conclusion

After all the data and discussions, the question which arises is what is happening within the architectural engineering and construction (AEC) sector. Similar to the literature, there appears to be differences between the architectural community and the contracting community. Whatever terminology we choose to employ, be it design management, architectural management or construction design management, it is clear that the role is rapidly evolving within the AEC sector. In many respects it is the construction industry that is setting the agenda, with the majority of research following industry application and the architectural profession yet to respond. Given the relative scarcity of research into construction design management and architectural management there appears numerous opportunities for researchers. Reviewing the literature reveals an incomplete picture, which is typical of an emergent discipline. Currently there are inconsistencies in philosophy, theory and use of terminology. This appears to be mirrored in industry with wide variations in interpretation, application and understanding. Indeed, Tzortzopoulos and

Cooper have argued for clarity so that different stakeholders can apply appropriate tools and methods to establish the most effective processes and hence generate best value. This could be achieved if more contracting organisations were to publicise their operating methods in regards of design management. Unfortunately, the majority of contractors regard their internal operating procedures as confidential and of competitive advantage, hence there is a shortage of published information about what design managers do. Special editions of the peer reviewed journal *Architectural Engineering & Design Management* and similar other journals and books may go some way to help illustrate the complexities of design management. However, it is clear that more needs to be done to both promote and clarify the design manger role within the AEC sector. This applies equally to the construction design management field and the architectural management field.

The concise summary of the points mentioned in this paper is not meant to be conclusive, indeed, the main finding is the need for a more structured and rigorous study

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