CONSIDERING DESIGN AND PPP INNOVATION: A REVIEW OF DESIGN FACTORS IN PPP RESEARCH

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It is claimed that the PPP procurement provides incentives that foster creativity and drive innovative outcomes. Key to this encouragement of innovation is the idea that when design risk is transferred in a PPP project this provides an incentive for better design and design quality. Compared to traditional procurement it is argued that PPP designs better address the project's fitness for purpose requirements prior to construction. Therefore, it is important to begin to understand how design might or might be a positive factor in PPP procurement. However, in the fields of construction economics and management design and construction are often seen as separate and distinct fields of knowledge. This is despite the fact that in theory they are integrated in the PPP model. This paper will begin to question this distinction by surveying how design has been examined in PPP research to date. In order to achieve this aim the methodology of this paper involves compiling all relevant PPP/PFI papers published in Construction Management and Economics and ASCE's Journal of Construction Engineering and Management since 2000. The information gathered is used to develop a simple taxonomy based on how design is recognised as a factor in these research narratives. The paper then discusses any obvious trends in the way that design has been treated as an object of research in the research reported in these journals. The results of this review will help to better position design as a relevant discourse in PPP research and point to a more integrated understanding of design and construction in future research.

Keywords: design, public-private partnership, PFI, research method.

INTRODUCTION

Design is a key process in the construction delivery and operation of Public-Private Partnerships (PPPs). PPPs or PFI projects have often been argued, in theory at least, to deliver superior outcomes in terms of design and design innovation. The conceptual design of a project and design decisions made during the bidding stage can have an obvious impact on whole-of-life costs and revenues during the concession period of the project. The impact of design on operating revenues and expenses is particularly important in the case of social infrastructure such as hospitals, schools, courts and housing. This is because these facilities support complex functions and business processes as well as serving as a focus for the local communities in which they are situated. The design may also determine the project's constructability and if this involves non-standard or untried processes of construction this might have an obvious impact on the projects time and cost outcomes (Raisbeck 2008). For contractors and those responsible for the delivery of a PPP project the initial design is the primary means through which the contractor may meet the client's fitness for purpose requirements as set out in the brief. (Gruneberg *et al.* 2007), Often, these requirements

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are not fully tested until or known until the facility enters the operating phase and any mismatch between the initial brief and design may result in increased operating expenses. The design will also determine how easily the facility can adapt to change in the future; facilities functions may be expanded or changed in order to maximise operating revenues with changes in the business environment. Moreover, the overall design, and indeed the conceptual design, of the facility and the way in which it organises and integrates services will also impact on a facilities future success. In other words design factors will determine a facilities ability to be easily adapted to whole of life issues related to IT, energy expenses or even future abatement regimes needed as a result of government policy. Given these issues it is thus important to look at design factors and identify the way these factors have been identified and investigated in PPP research. This will assist in framing any future research that seeks to examine in detail the complex issues, claims and counter claims surrounding design factors and design innovation in PPP projects.

PREVIOUS REVIEWS OF RESEARCH METHODOLOGIES AND METHODS

Very little published research has looked at the PPP research as a field of knowledge with its own traditions and patterns as PPP markets have evolved. This may be because reviews of research methodologies and methods in the Construction Management field have tended to focus on relatively broad issues. The examples discussed in this section indicate the type of surveys that have been undertaken since 2006. In some instances these reviews have sought to identify the different domains of knowledge and schisms that exist within the field. One discourse that has been identified as having occurred in Construction Management is the debate about the role of theory in the field and the relevance of "rationalist research paradigms" within the field (Dainty 2007). In a review of 107 journal articles in “Construction Management and Economics” (CME) Dainty revisited an earlier debate in that took place between methodological purists and those arguing for a broader range of methodological approaches in the research field. Dainty notes how this prior debate seemed to coalesce around diametrically opposed research paradigms or tendencies: qualitative versus quantitative, theory versus practice, buildings versus people, pure versus applied research. Dainty concluded that the Construction Management community was still dominated by "reductionist approaches to social enquiry" and that research in the Construction Management field reflected the construction industry's "adherence to "instrumentalist and rational solutions" (Dainty 2007).

In contrast, a specific survey of AI methods in the journal Construction Management and Economics (CME) by Hua used journals to document the rise AI methods within the field. He concluded that despite the rise of AI techniques in the field conventional techniques still predominate. (Hua 2008). Moreover, as he contends these techniques are able to extend "the representations of economic behaviour to take complexity into account. He goes on to state "neoclassical economic models only describe decision making as a process of constrained optimisation" (Hua 2008). In a much larger and more comprehensive study of subject matter in CME between 1983 and 2006 Pietroforte concludes that "the body of knowledge published in CME has expanded with the addition of new fields of enquiry pertaining to the strategic and operational aspects of firms, and the management of projects (particularly the planning and design phases) and contractual clauses" (Pietroforte 2006: 9). In Pietroforte's taxonomy of topics in CME design comes under the category of Project management and organisation, design management, and project quality. Within this category design is

related to "design and value management with a total of 46 papers counted of between the years 1983 and 2006. (Pietroforte 2006: 9)

These previous reviews of published construction management research have guided the methods employed in this paper from a number of perspectives. They also indicate why design might fall outside of some of the prevalent research paradigms in the Construction Management field. If design is associated with qualitative or "soft" modes of research this may explain why it is not fully addressed in the literature. As Harty and Leiringer contend "advocates of subjectivist and interpretive approaches have always been a persistent, although minority voice within the CM research canon" (Harty and Leringer 2008: 228). They go on to note "this type of research remains limited by the difficulty of producing hard measurements of impact on industry, or quantified evidence of the relevance and utility of its outputs." (Harty and Leringer, 2008: 228) One approach to this study would have been to identify in the PPP literature the various quantitative or qualitative research methods used by different PPP researchers. However as design was rarely an object of direct study in the journal articles linking this concept to different methodological modes was obviously not possible.

Design in the PPP and PFI context

One way to define design innovation is to see taking place in two broad and overlapping phases. In the first phase innovations are generated or proposed through the creation of design knowledge. In this phase design knowledge captured and communicated via a range of media including, sketches, plans or digital models. In the second phase these innovations are then implemented in the construction process. This definition, whilst seemingly simple, presumes that design and construction are integrated and that for a particular design innovation to be implemented it will have both a design dimension and a construction dimension as it approaches constructed realisation. This integration is a key concept in procurement theory because the PPP model is seen as procurement system which integrates both construction and design. As Masterman states this model “incorporates all of those methods of managing the design and construction of a project where these two basic elements are integrated and become the responsibility of one organisation, usually a contractor” (Masterman 2002). This is an important concept given that in PPPs design risk is transferred form government sponsors to contractors in the PPP consortia.

This integration in Construction Management theory it has never really been fully tested in the research field. Yuan *et al.* argued "the existing literature is generally concerned with examining PPPs at a broad social or organisational level but provides few insights into the management of inter-organisational relationships and process control". They claim that the PPP research landscape is characterised by two different research approaches: Firstly, an approach focused on the requirements and drivers of PPPs which have "the aim of resolving the problems in the pre-implementation phase." Secondly, an approach which "stress the successes and problems of PPPs" (Yuan *et al.* 2009: 256). To remedy this dichotomy or gap Yuan *et al.* propose that PPP studies should focus on the "control of project process" and that "all factors must be considered if they may affect the process, implementation and success of PPPs" (Yuan *et al.* 2009: 256). Using this perspective these authors examine and "extensively investigate" the processes and other project factors that influence the performance of a PPP project during its lifecycle. Surprisingly, these authors make

scant mention of the role of design and design management or the role of design and system integration in the PPP lifecycle.

Other construction management researchers have pointed to the need to understand PPP construction innovation in a wider disciplinary context. For example, Eaton et. al. has looked at innovation in PPPs in relation to issues of creativity, a concept clearly linked to designing and he sees innovation as being the "successful implementation of creative ideas" (Eaton *et al.* 2006: 6). Whilst these authors provide a comprehensive study of innovation theory and creativity drawing on both management and construction studies they do not link design to either creativity in project management or construction innovation. For example, in a table describing over 42 "detailed stimulants of creativity" across four 4 PFI case studies no mention is made of design. It is surprising that the activity of design is not mentioned at all given that this is an obvious area were creativity takes place during the construction process and the case studies analysed at the "External, Organisational, Project and Job role levels"(Eaton *et al.* 2006). In other research on PPP contract negotiations Ahadzi and Bowles acknowledge design as a critical factor in PPP or PFI arrangements but as they note it are "ironic that a key objective of PPP-encouraging innovation in design solutions--is rated so lowly as a success factor in negotiations by all concerned" (Ahadzi and Bowles 2004: 972).

AIMS AND OBJECTIVES

The above examples suggest that design, is integrated with construction in procurement theory but this link has not been well understood or tested in the research field. The aim of this paper is to highlight if this is indeed the case. The objective is to suggest ways that design can be treated more substantively in future PPP research. To these ends the hypothesis of this paper is that: within the field of CM design has been perceived as a separate and distinct field of knowledge that lies outside of PPP research. In order to begin to test this proposition the paper examines how design concepts and factors have been dealt with in a selective survey of published CM PPP research to date.

RESEARCH METHOD

In order to extend the above studies a different approach was taken in order to begin to understand how design is seen as a discourse within CM studies. In order to begin to do this the methodology of this paper involved compiling all relevant PPP papers published in “Construction Management and Economics” and ASCE’s “Journal of Construction Engineering and Management” since 2000. These two journals were chosen because of the A* ranking as determined by the Australian Business Deans Council (see: http://www.abdc.edu.au/3.36.0.0.1.0.htm). These journals were also considered to contain a significant number of papers that related to PPP or PFI projects and seen to be representative of the CM field at large. Other journals such as “Engineering Construction and Architectural Management” were not included in this survey because of their slightly lower ranking under this system but this is not to say that a wider survey could be conducted using more journals at some point in the future.

Journal articles since the year 2000 directly related to Public Private Partnerships or the Private Finance Initiative were identified in each of the two journals. All of these are listed in the reference section of this paper. But it should be noted that not all of these are cited within this paper. This included papers with either PPP or PFI in their

title, abstract or key words. This included papers whose research methodology had related to projects or project contexts directly related to PPPs. Each journal paper was then recorded and a search for words related to design was undertaken.

TAXONOMY

The number of words related to design and design related words in each article was then identified and counted. A semantic analysis was made and the design related words were then categorised into a number of categories. The categories identified in this process were are as follows:

4. Descriptive (D): Design related words simply describing the procurement system (e.g. design-build) or particular stakeholders (designers)
5. Phase (P): Design related words describing design as a phase or a stage in PPP procurement.
6. Factor (F): Design related words which identify design as an influencing factor in PPPs.
7. Research Methodology (RM): Design related words related to research design and methodology of the paper.
8. Other (O): Other design related words; For example, words related to the design of procurement systems or payment mechanisms.

The results are described below and then following this these results are related to a number of key studies that were conducted outside of the CM research field in the same period (2000-2009).

RESULTS

Table 1: Results, number of words.

No of Articles	D	P	F	RM	O	Total
CME 10 papers	53	8	18	18	5	102
JCEM 8 papers	62	7	26	0	4	99
Total 18	115	15	27	18	9	201

Design was more often used as a descriptor to describe the procurement system with reference to the words "design-build" or "design-construct." It was also used to describe designers as participants in the PPP process. Architects were not mentioned or named in any of the papers. Occasionally in the papers factors related to design were raised such as "design risk", "design and constructability" "design flexibility", "design changes", design freedom" and "over-design." Whilst these concepts and factors were mentioned and sometimes noted as being of importance in PPP procurement they were often given equal or lesser weighting in relation to other factors. Most, if not all of these concepts, were never defined in strict terms. In other words, none of the papers presented definitions of the design factors or analysed how they might influence a PPP project. Whereas, a whole range of other factors were often identified, defined and cited as being worthy of investigation in the PPP context. For example, these predominant factors ranged across a number of issues for example: economic viability, appropriate risk allocation, sound financial package, favourable investment environment and strong technical strength. (Zhang January 2005: 9). In this context it is difficult to know what "strong" refers to. Paradoxically in some

instances these prevalent concepts or factors appear almost as ambiguous and subjective as the notion of "design quality" itself.

From the above analysis across the journals examined it can be seen design is not considered to be of any real interest to CM researchers investigating PPP procurement. This is despite design being used repeatedly as a word to describe aspects of PPP procurement with reference to the design-build concept. It is slightly ironic that in one paper PPP procurement is argued as being different to traditional procurement because "the separation of design, construction and maintenance or operational phases is often criticised for creating confusion and conflicts between stakeholders resulting in buildings that deliver poor services" (Robinson and Scott, 2009: 181). From the above evidence it can be seen that design and construction integration is an issue that requires much more examination in the PPP research context.

DISCUSSION

Of the articles surveyed only one directly addressed design in its methodology or research design. Whilst this article raised questions regarding "design freedom" its contribution was to examine notions of innovation in a PPP context. This article did point to some of the claims concerning design made by proponents of PPPs or the PFI project both in government and in the consulting professions. Indeed, it is worth pointing out that in a number of public reports and government reports claims about the design efficiency of PPPs have often been made. For example, in the UK one of the first comprehensive studies of operating PFI projects was sponsored by HM Treasury just prior to 2000 and conducted by Arthur Anderson (Treasury Taskforce 2000). The included a survey of project managers opinion on “what drives value for money” in PFI projects (Treasury Taskforce 2000). The survey of project managers concluded that there were 6 key drivers of value for money in PFI projects: risk transfer, the long term nature of contracts, the use of output-based specifications, competition, performance measurement and incentives and private sector management skills. (Treasury Taskforce 2000: 2). In the report it was claimed that savings against the PSC was in part due to “strong design” the report rejected the idea that the PFI encourages the “over-use of cheap standard designs” arguing that “the whole of life costing incentives in PFI projects are more likely to result in high quality buildings than under conventional procurement” (Treasury Taskforce 2000: 13). In reporting in detail the responses of the project managers surveyed it was claimed that getting the design signed off prior to the actual contract sign-off facilitated the transfer of design risks. (Treasury Taskforce 2000: 21) It was also argued that the use of output based specifications led to “improved design and service solutions” and this led to the design of an asset that had given higher priority to whole life costs (Treasury Taskforce 2000: 56).

In contrast, the Mott Macdonald report published in July of 2002 identified design complexity as one area of risk related to PFI projects. This was defined as “where the complexity of design including requirements, specifications and detailed design is such that it needs significant management to reduce the impact on project outcomes (Mott Macdonald 2002: 55). A subsequent study by the NAO entitled PFI construction performance published in 2003 echoed some of the positive conclusions about PFI claimed in the Arthur Anderson study. This study looked more closely at issues related to the quality of design and construction. It tested a number of research questions including whether or not the PFI encourages "better integration between

design and construction" (NAO 2002: 7) as and if “The whole life cost approach under PFI encourages good quality design and construction” (NAO 2002: 4). The report concluded that PFI project managers were “satisfied with the design and construction of their PFI buildings.” (NAO 2002: 4). Despite surveys of user satisfaction being incomplete in the report it was nevertheless noted that user feedback in regards to quality of design and construction was “favourable.” (NAO 2002:4).

All of the above studies external to the field of CM research point to the many issues that surround design within the PFI context: design complexity, integration with construction, the transfer of design risk, quality of design, post occupancy user reporting, and whole of life costs. The above studies completed early in the period examine here also point to some of the prevailing myths about PPPs, if they can be called that, such as: the relationship of output specifications to improved design solutions and cost savings through strong design. In the research literature studied in this paper these claims appear to remain largely untested. It is also notable that a number of studies in the field which identify best value, critical success factors, key performance indicators and risk miss design as a concept. However, given the more general and global claims of the PPP model it would still seem important to investigate the claims made on and behalf of design in order to understand how design risk is transferred and then managed.

The lack of direct research into how design knowledge is created and managed in the PPP arena in research undertaken by CM researchers since 2000 can be explained in a number of ways. This may be the result of disciplinary boundaries and patterns of territorial knowledge. Researchers in the CM field may have been trained in construction and the engineering professions, which is quite different to training in architectural design. This may suggest an in-built bias with the result that they overlook the claims and complex issues surrounding design and architectural design in the PPP context. Countering this is the suggestion that this bias against design reflects research focused on economic infrastructure such as roads and bridges as compared to social infrastructure. However such bias amongst CM researchers may also be evidence of what Dainty identified as reductionist approaches to social enquiry (Dainty 2006). Further research would need to clarify if there is a lack of design training and or knowledge regarding different modes of design thinking in the CM research community.

FUTURE RESEARCH

Future construction management research should more directly address the role that design plays in PPP procurement. One reason why there is a gap in design knowledge in PPPs may be because it is difficult to relate design and fitness for purpose requirements to whole of life costs and often data and information about these are not always available. As suggested above another area in which construction management researchers could focus on is in the area of design risk. This factor was identified in some earlier, pre 2000 PPP research by (Akintoye *et al.*1998) but interestingly not highlighted in later research. In a study of executive contractors, client groups, and lenders Design Risk was ranked as the number 1 risk factor in PFI projects Akinotye *et al.* noted "the risk of design changes is an important one" and this was particularly important for PFI consortiums where the contractors have the "overall control of the design" (Akintoye *et al.*1998: 5). Further research could focus on different categories of design risk, their likelihood of occurrence, likely impact and how such risk might be mitigated. From this perspective the key point in the PPP cycle is the transfer of

design risk from government to the PPP consortium. How this takes place either before or after bidding and how design knowledge is then managed by contractors not familiar with design thinking would be an important avenue of future research.

CONCLUSION

The tendency to elide design in PPP studies is further evidence supporting Dainty's suggestion that construction management researchers "show and entrenched adherence to positivist methods" and there is a reluctance to "adopt radical qualitative research methods" (Dainty 2007). This suggests that design as a subject of study within PPP research and possibly the broader CM field lies outside of existing paradigms of the research field. Given the more general and global claims of the PPP model it would still seem important to investigate the claims made on and behalf of design. Despite all of the efforts the primary question that remains to be tested is wither or PPP/PFI procurement improves design outcomes and does not lead to standardised designs produced in an effort to lower costs. Further research into the literature prior to 2000 may identify the original sources of these design-orientated concepts and trace their history in procurement studies. Such research might conclude that efficacious properties of design were a useful way to mask the machinations of capital. It is a pity these claims have not been more thoroughly tested in the CM field.

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