

# THE PERFORMANCE OF INTEGRATED D&B PROJECT TEAMS IN UNEXPECTED CHANGE EVENT MANAGEMENT

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Increasing emphasis on the meeting of client needs and improvement of project performance within the UK construction industry is a factor in the escalating use of integrated 'design and build' (D&B) construction project teams. Such an approach significantly departs from traditional approaches wherein design and construction functions are separated within distinct organisations. D&B system advocates argue that such integration of design and construction results in a seamless procurement process, along with improved team relationships, and a product delivered more efficiently. This paper presents research that explored the operational efficiency of integrated D&B project teams within the context of one UK national D&B contractor. The approach taken was to determine the perspectives of project team members on how effectively the team as a whole responded to unexpected change events occurring during a D&B project. Despite the benefits of integration, the research suggests that cultural and professional interfaces remained which both impair team performance and also undermine structural change management protocols. The result is a team operating in effect as work-groups in a similar way as would be expected under a traditionally procured contract. The construction team were largely excluded from the process of change management. A methodology for exploring these discontinuities further, and for addressing intra-work-group conflicts, is proposed.

Keywords: construction team efficiency, design and build, change management, work group conflict, communication flow.

## INTRODUCTION

Traditional procurement approaches lead to an inevitable fragmentation of the design and construction processes as the design has to be substantially complete before the construction work is let to a contractor. This procedure has been widely criticised for the multi-point responsibility that clients have to endure, and the conflictual relationships that it engenders (Franks, 1998). Clearly, such conflict is bound to be preponderant in industries such as construction with its proliferation of human relationships (Kumaraswamy, 1997). Moreover, the subordinate position of the contractor within the hierarchy of relationships forming the traditional design-management-construction process makes inter-organisational conflict inevitable, as it allows the apportionment of contractual responsibility for problems occurring later in the project. Thus, pressure is continually applied to those at the next level down in the process hierarchy (see Greed, 1997).

The inherent weaknesses of the separated traditional procurement approach have led to the increasing use of 'design and build' (D&B) procurement systems. D&B in its various forms promote single point responsibility, and an inherent reduction in inter-

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organisational boundaries within a project organisational system. D&B has been seen as a potential panacea for the problems of the traditional procurement system, in that it removes the 'check and balance' between the design professional and the constructor (Miles, 1996). It is now the fastest growing procurement system in the UK on the basis of value (RICS, 2000), and could account for half of all projects by value by the end of the century (Franks, 1998). Furthermore, it is a potential route for many of the new ideas about construction to be put into practice, such as fair and equitable relationships, continuous performance improvement and changes in management and culture (Downing, 1998). Thus, D&B procurement has a central role in facilitating many of the performance improvement mechanisms advocated by the Latham (1994) and Egan (1998) reports.

The growth in D&B procurement should not be seen as conflicting with other recent developments such as the UK government's 'Prime Contracting Initiative' which also emphasises the need for a seamless design/construction interface through the client forming a single contractual relationship with the construction team for a series of projects (Delargy, 1999). There is clearly an emphasis within the industry on the development of harmonious relationships between the project team members. Such relationships are acknowledged as being essential for the project's speedy completion (New Builder, 1994). D&B organisations have responded by diversifying their traditional constructor role to embrace the entire design/construction process, and many have removed departmental barriers by creating multi-disciplinary teams (Chevin, 1996).

### **Potential weaknesses of the D&B system**

Despite the obvious advantages of D&B, there are indications that its operation is not always as effective as could be expected. For example, it has been suggested that D&B is not appropriate for complex or prestigious projects (Smit, 1995), that D&B contracts are becoming more litigious (Nunn, 1994) and that there remains a necessity for clients to appoint additional external advisors to safeguard their interests (Masterman, 1992). Why these weaknesses should exist is currently unclear. However, assumptions that integrated project teams eliminate the differentiation which results in separate organisational units (see Walker, 1996) rely upon the supposition that professional and communicative interfaces will have little negative influence within the project team environment. However, in reality bringing people together from different backgrounds maybe the very reason as to why they fail to achieve their objective (Applebaum *et al*, 1999). Hence, if the problems inherent within the traditional procurement system are carried forward to the D&B environment, then this may affect the ability of D&B teams to operate coherently. Such interfaces could be structurally determined (through the formally defined procedures, systems and communicative patterns that team members use or promote); or culturally determined (through professional, attitudinal or behavioural factors brought to bear on working relationships at an informal level).

Research on D&B procurement has not identified the extent to which professional interfaces are negated by the common purpose of the team. Hence, it is not known if professional objectives conflict with those that are operationally determined, or if inter-professional collaboration can achieve a collective, production problem oriented paradigm in which mature and responsible individuals are willing to adopt new forms of organisation to solve problems; the so-called post-industrial paradigm (Banner and Gagne 1995). Accordingly, this paper reports on research which explored the

formative aspects of D&B project interfaces within the context of a project completed by one UK integrated D&B contractor, and the way in which those involved with the project reacted and interacted with each other in response to unexpected change. The aim was to identify where inter-dependencies had the potential to impede the efficient resolution of crises and the management of change. The decision to focus on change events was because these are commonplace in all construction projects, and their analysis offered a convenient measurable performance target for identifying the system's performance. However, this work represents part of a wider research programme exploring the nature of intra-team cultures and operational effectiveness in such environments, the scope of which is explained at the end of the paper.

## **METHODOLOGY**

In order to explore D&B team dynamics, the nature of team response was explored in relation to a range of crises defined as unexpected change events (UCEs). By establishing communication flows, involvement patterns and other behavioural responses to UCEs, the nature of any professional and cultural interfaces can be established, and points of discontinuity within the team identified. This approach was used to highlight where group members were marginalised or excluded from activities where their contribution could have enhanced team performance. This approach was appropriate given the importance of effective communication in responding to crises (see Smallman and Weir, 1999).

A large (c.£40m) project was chosen for the study which was using a fully integrated D&B approach, undertaken by an experienced organisation committed to D&B. All design, construction and financial specialists were employed in-house as opposed to being bought in specifically for the project. The anticipated collective paradigm which should result from this suggests that few team integration and communication difficulties would exist in comparison with a fragmented, multi-organisation project group. However, the technical complexity of the project still presented many challenges to those responsible for its delivery, and provided many opportunities to explore the abilities of the team in dealing with UCEs which were occurring throughout the project.

Team members were interviewed towards the end of the project programme in order that they could reflect on the team's performance over the duration of their involvement. All of those interviewed were actively involved in the project at the time of interview, and represented the three key functions of the work group (design, commercial and construction teams), together with the Project Manager with overall responsibility for the project. In-depth semi-structured interviews were used, where informants were allowed to freely discuss the issues raised. Initially, each informant was asked to describe their relationships with the other members of the project team, and the level of their interaction at various project phases. They were then asked to give specific examples of how the project team had reacted to UCEs, detailing their own role in managing the response. Finally, they were asked to identify the strengths and weaknesses of the project team's dynamics, and where they felt there was scope for improvement. The data were transcribed, broken down and conceptually labelled independently by the two researchers, and analysed using the NUDIST qualitative data analysis package. Finally, the original informants were given the opportunity to respond to the findings and validate their accuracy in reflecting the nature of the project team dynamics. The key themes emerging from this analysis are presented below.

## **FINDINGS**

The project studied was delivered to time, within budget and to the specified quality standards, and so was successful against traditional project performance criteria. However, the interviews revealed many examples of reactive management that had been necessitated by a lack of team integration as follows:

### **Structural organisation and team composition**

The client had engaged a fully integrated D&B organisation in order to centralise responsibility for the design and construction. As with many D&B projects, in order to reduce project duration, the construction phase began before the building design had been completed. This placed considerable emphasis on the management and control of design changes throughout the project. These occurred as a consequence of design developments, client imposed alterations and 'buildability' issues. Their resolution required the combination of design, construction and commercial expertise throughout the project, although this was facilitated to some extent by all of those involved having experience of working under D&B arrangements. Figure 1 shows the team composition and structure.

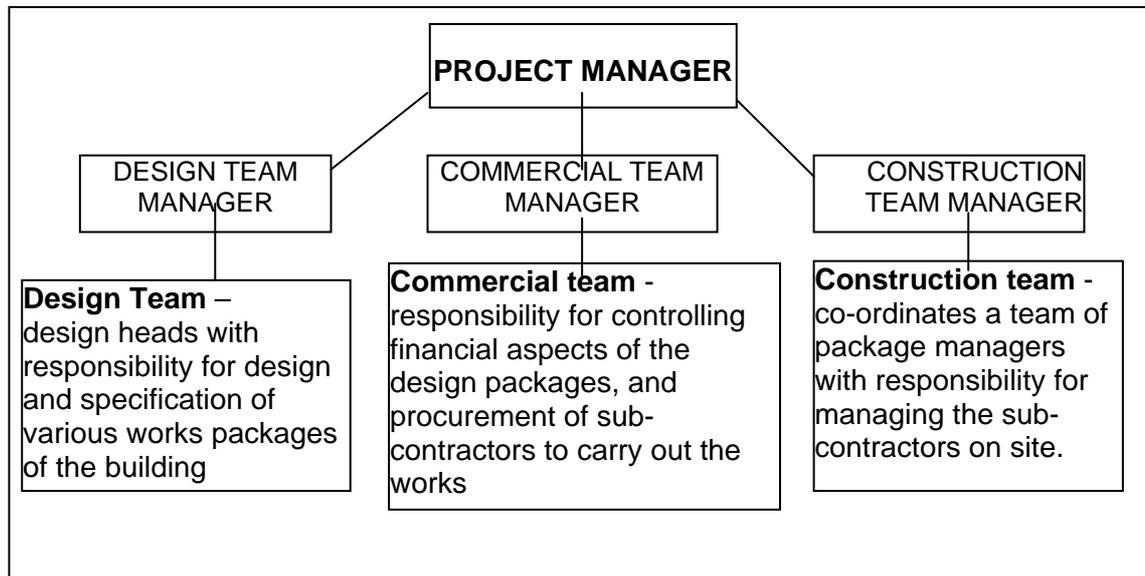
The functional heads had not selected their respective teams themselves, and some members were moved to other projects during the course of the project, or divided their time amongst several contracts. This resulted from the functional matrix structure operated by the wider organisation, which presented employees with both project and functional organisational responsibilities. This also had implications for the physical proximity of the team members, with some being office based throughout the project, whilst others were permanently based on site. The design team was office based, as was the commercial team in the early design stages. In the later stages the commercial team joined the construction team on site, with the designers visiting the project to deal with design problems. The construction team's involvement did not commence until the construction phase, and this team remained on site. The project manager divided their time between the office and site, but spent the majority of the construction phase based on site.

The team's composition varied considerably through the lifetime of the project. In the early design stages only the design and commercial functions were staffed, resulting in an excellent working relationship between the commercial and design team members, but markedly weaker relationships and integration between the construction team and the rest of the parties. However, perhaps the most surprising aspect of the project team composition was that the project manager changed twice before construction commenced on site. As such, no single individual had co-ordinated the work of the team for the duration of the contract. This may explain some of the subsequent lack of team coherence discussed below.

### **Change management, communication and culture**

The project manager had a great deal of confidence in their project team, and merely sought to co-ordinate the three functions as opposed to managing them directly. This level of empowerment was universally appreciated, and proved to be one of the strongest aspects of the project's operation. However, the technical complexity of the project, the overlapped nature of design and construction and the fragmented nature of project team responsibilities, required the development of a comprehensive change management system for the duration of the contract. Change had been a major feature of the project, with over 150 significant design alterations having taken place by the

time of the interviews. Accordingly, a bespoke change control protocol had been developed to integrate the role of the three functional areas through a rigid communicative mechanism (represented in Figure. 2).

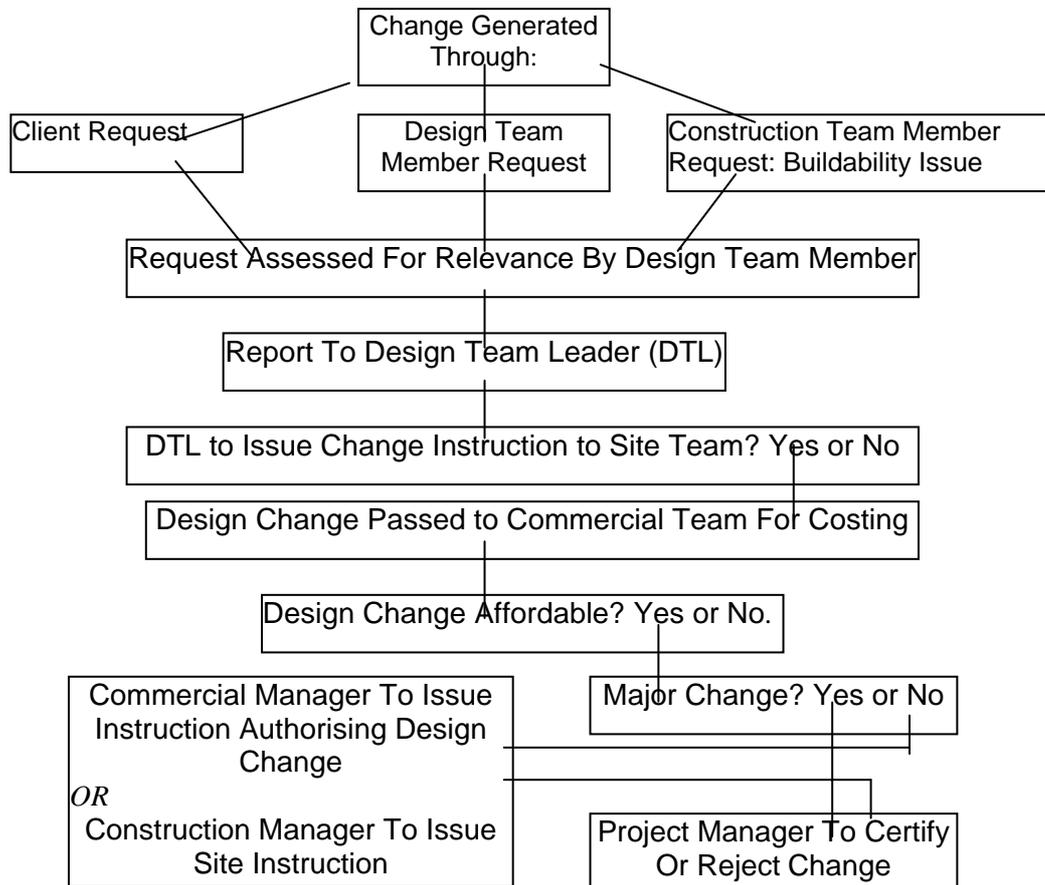


**Figure 2:** Project Organisation Chart

The design change control system was designed to allow the implications of design changes and development to be explained both in cost and design terms. Changes could be generated in one of three ways: (i) through requests from the client; (ii) through requests by a member of the design team; or (iii) through a request from one of the construction team in response to a buildability issue. It was clear that the effective working relationship of the design and commercial teams had been facilitated by the design change control procedure. They had encouraged the involvement of specialist sub-contractors in the design stage, which had helped to foster good relationships and to engender trust later in the project with these external parties. However, the construction management team was often excluded from this process. In some cases designers had travelled to site to issue design change instructions rather than implement them through the relevant construction package managers. At least one design team member had refused to deal directly with the construction team, causing the design team leader to act as an intermediary. This discontinuity in the way in which the processes were operated stemmed in part from the team having not remained consistent since the outset of the project. This was exacerbated by there being no explicit means of integrating new project work-group members as allies to the project objectives, and by the team’s dispersed locations leading to communication difficulties.

A surprising contravention of the design change protocol was where designers had carried out design work without authorisation from the commercial team. This suggested the existence of communication difficulties between team members who were based in the same office, and who generally believed that they had worked together effectively. These actions also demonstrated a degree of ambivalence towards formal project operational procedures, and left the D&B organisation having to bear the cost of abortive design work. Such actions also led to the design team imposing last-minute changes on the construction process. This is typical of the traditional procurement approach, and is generally regarded as being symptomatic of

an inequitable relationship existing between the design and construction functions. Such behaviour leads to a reactive management process from all of those involved, and creates the potential for tension within the team. This suggests that traditional professional boundaries and responsibilities may be hard to break down, even where good working relationships exist.



**Figure 3:** The Design Change Protocol

Communication barriers between project work-group members had left the construction team almost peripheral to the design development, despite the importance of their responsibilities in managing the implementation of design changes. The construction manager had attempted to implement formal procedures to facilitate his team’s inclusion in collaboration with the project manager, but these systems had failed as the design and commercial team continued to operate at their exclusion. In addition, distinct cultural interfaces also existed *within* the functional disciplines. For example, within the design team architects, structural engineers, building services engineers and other specialist design functions were involved, all of which had their own cultural and professional identities and practices.

## DISCUSSION

Considering the complex nature of team interactions within the D&B project environment, it is perhaps unsurprising that a distinct, integrated project culture had

failed to develop on this project. The lack of consistency in the membership of the work group and the physical proximity of those involved presented considerable difficulties in addressing cultural boundaries. The company had done little to attempt to bring the various groups together before or during the project, other than to allocate them all a common working space in the form of an open-plan office area. However, this had little more than a cosmetic effect.

It was clear that a traditional demarcation of responsibilities existed throughout the project work-group. Whilst this in itself is not necessarily detrimental to effective team performance, in this case professional divisions between team members had led to discontinuities and ineffective responses to UCEs occurring during the construction phase. For the construction staff entering the project work-group later on, becoming an integral part of the decision making process was difficult, and professional prejudices based on the hierarchy of relationships under the traditional procurement system had reinforced their exclusion. In effect, the team comprised a series of strategic alliances and barriers bounded by the professional and cultural prejudices of their members.

The resulting project team comprised a diverse range of professionals working towards distinct objectives. The design team had a clear emphasis on design quality, whilst the commercial team concentrated on financial aspects and the construction team on delivering the project on programme. This delineation of team members' project priorities is unsurprising as they reflect those under traditional fragmented procurement approaches. However, it does not suggest the existence of a single-focus for the project team, and places an emphasis on the managerial ability of the project manager in pulling these diverse functions together. In the project studied, staffing and logistical difficulties meant that the project manager joined the team late on in the project. Moreover, other members joined only when construction commenced. This left the project manager powerless to prevent the traditional design/construction interface from emerging, which inevitably created intra-team conflict, and eventually ineffective change management processes.

Perhaps the most worrying result of the design/construction interface remaining as a discontinuity, was that technological solutions had tended to have been found to problems which did not address the intra-organisational issues that had caused them. This reflects a team emphasis on reactive problem solving as opposed to problem avoidance. Many of these occurrences related to issues concerning the 'buildability' of the project, where a lack of construction management input had led to a failure in foreseeing the impact of impracticable designs. Designers were often required to deal with construction issues, and construction management staff were often excluded from design decisions. Thus, despite their overlap of the design and construction phases, the transition from design to construction was seen as being akin to process under a traditionally procured contract. This is perhaps the clearest example of how the supposedly integrated team failed to respond to UCEs as anything other than a work-group.

## **CONCLUSIONS AND PROPOSALS**

It could be argued that construction represents a largely collectivist activity. However, this paper has suggested that D&B team performance may be adversely affected by traditional professional cultures and roles, which impair team integration. By focusing on the process of how a supposedly integrated team managed change, it has

identified an ingrained demarcation of project responsibilities within that team which are akin to a traditionally procured contract. Furthermore, it seems apparent that no matter how well developed the structural change response mechanisms are, if the underlying culture is grounded within a 'traditional' operating framework, then the team will under-perform relative to its potential.

When logistical difficulties of composing and maintaining project teams in the context of variable workloads and geographically dispersed project locations are considered, the development of culturally project teams in construction appears extremely problematic. However, all of the parties involved must work together effectively in order to avoid discordant design change, and so measures to improve this process must be geared towards integrating project members into the team, and engendering a single focus and culture of co-operation. Efforts to develop such a culture will be expensive, as they will require the entire team to be brought together at the outset of the project, and for a close physical proximity to be maintained throughout its duration if communicative and attitudinal barriers are to be broken down. However, the operational benefits of such a process should outweigh the additional costs through an improved response to unexpected events, better project performance and hence, enhanced client satisfaction.

The range of potential barriers to team efficiency in dealing with UCEs identified within this paper suggests a need for a wider study examining intra-team cultures across a range of D&B project scenarios. This research would need to explore the professional, communicative and attitudinal interfaces that have a detrimental effect on information flow and problem solving efficiency. A potential method for such a study could be to explore team relationships longitudinally by recording team communication and behavioural patterns in response to change events. The aim would be to develop causal models to show the impact of cultural interfaces on the change management process. Such an insight could inform D&B organisations of where to focus management efforts in order to improve project efficiency and ensure a seamless design/construction process in the future.

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## REFERENCES

- Applebaum, S H, Chahrazad, A and Shapiro, B T (1999) The self-directed team: A conflict resolution. *Team Performance Management*, 5(2): 60-77.
- Banner, D K and Gagne, T E (1995) *Designing Effective Organisations*. Sage Publishing Inc. Thousand Oaks, California.
- Chevin, D (1996) Top drawer advice. *Building*, 2 August: 42-43.
- Delargy, M (1999) It's Prime Time. *Building*, 11 June: 48-51.
- Downing, M (1998) Design and Build: a specialist contractor's view. *Construction Manager*, November: 21.
- Egan, J (1998) *Rethinking Construction* (Report of the Construction Task Force). DETR/Stationery Office, London.
- Franks, J (1998) *Building Procurement Systems: A Client's Guide*. Longman, Essex.

- Greed, C (1997) Cultural Change in Construction. *In Proc. 13th Annual ARCOM Conference*, Kings College Cambridge, September, **1**: 11-21.
- Kumaraswamy, M M (1997) Conflicts, claims and disputes in construction. *Engineering, Architectural and Engineering Management*. Blackwell Science Ltd. Oxford.
- Latham M, 1994. *Constructing the Team*. HMSO, London.
- Masterman, JWE (1992) *An introduction to building procurement systems*. Spon, London.
- Miles, R S (1996) Twenty-First Century Partnering and the Role of ADR. *ASCE J. of Management in Engineering*, **12**, May/June: 45-55.
- New Builder (1994) Set Store By Teamwork., *New Builder* 10 June 1994, Thomas Telford Ltd., London.
- Nunn, D (1994) Design and Build. *Contract Journal*, July 28: 16-35.
- RICS (2000) *Contracts in Use*. Davis, Langdon & Everest, London.
- Smallman, C and Weir, D (1999) Communication and cultural distortion during crises. *Disaster Prevention and Management*, **8**(1): 31-41.
- Smit, J (1995) Projecting Success. *New Builder*, 17 March 1995, Thomas Telford Ltd., London.
- Walker, A. (1996) *Project Management in Construction*. Blackwell Science Ltd, London.