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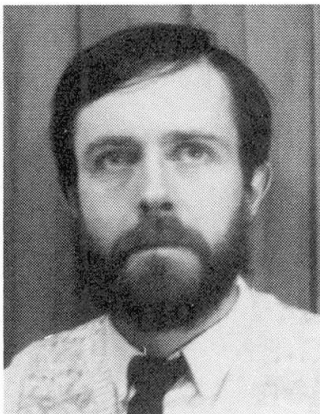
Design-Construction Organisation

Organisation du projet et de l'exécution

Organisation des Bauprozesses

Steve ROWLINSON

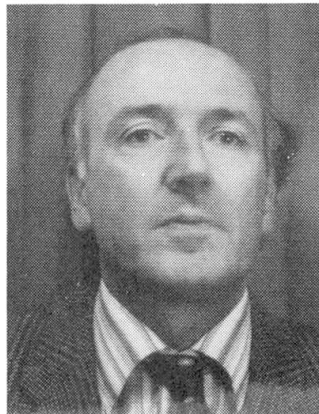
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SUMMARY

The paper addresses the problem of categorising and analysing the performance of the design and construction team organisations which operate at present in England. The important aspect of client satisfaction and reaction is investigated and results of research are reported.

RÉSUMÉ

Cette communication décrit et analyse la performance des équipes de projet et de construction, telles qu'elles fonctionnent actuellement en Angleterre. Un aspect important concerne la satisfaction et le comportement du client. Des résultats de recherche sont présentés.

ZUSAMMENFASSUNG

Dieser Beitrag behandelt das Problem der Analyse und Beurteilung der Leistungen von Planungs- und Ausführungsteams, wie sie gegenwärtig in England in verschiedenster Form tätig sind. Die wichtige Frage der Zufriedenstellung des Bauherrn wird untersucht und anhand von Fallstudien dargestellt.



1. INTRODUCTION

1.1 Objectives

This paper addresses the problem of categorising design and construction organisations for the purpose of performance comparison. In England, organisation structures for design and construction are quite diverse and this diversity has been increased recently as a response to the economic recession within which the construction industry has had to operate.

The study reported here is based on a recently completed three-year research programme within the Construction Study Unit. The programme was sponsored by the Science & Engineering Research Council of Great Britain under their Specially Promoted Programme in Construction Management. The objective of the research was to compare the performance of contractor led design build projects with that of traditional, architect led, projects in the provision of industrial buildings.

1.2 Research Model

The research model is presented in Fig 1, indicating the hypothesised influences on project performance. Fig 2 indicates the objective performance measures that were utilised in the statistical analysis; five subjective measures of client satisfaction with time and cost performance of the project, quality and function of the completed building and client satisfaction with the procurement method chosen were also obtained. The variables which made up each of the dimensions in the research model are listed in Fig 3, a more detailed summary of the impacts of these will be made available in a forthcoming, extensive report of the work (7). In drawing up this model a number of researchers were identified as making key contributions to the area of study: in particular, Cherns and Bryant (1) concerning the client; and Sidwell (2) and Ireland (3) in terms of procurement form; Walker (4) and Morris (5) in relation to the Construction Process.

2 THE BUILDING INDUSTRY

2.1 Impetus for Change

With the drastic reduction in building and civil engineering construction in England over the past decade has come a period of critical self analysis from within the construction industry. The need to maintain turnover, and so company viability, has pushed contractors into the consideration and adoption of contract procedures which are novel and innovative. The concept of design build, once the domain of a few specialist organisations, has been entered by many organisations. This has brought about changes in traditional patterns of relationships.

Perhaps for the first time, many design organisations have linked up with their construction counterparts to provide package deal services. This has brought with it the need to develop more extensive and concurrent communications, the builder providing an extensive and commercially-based input during the design phase. Relationships, previously based on separate terms of engagement, have had to be adapted to suit this new partnership.

Thus these changes have been both inter- and intra- organisational. On the one hand, coalitions and joint ventures have been formed to win contracts and on the other hand each organisation has had to adapt and adjust its attitude to the expertise that the "other" team can provide. In the long term this

should be to the good of the industry but in the short term it is highly likely that the interchange of expertise will be sporadic. The next section outlines the approach taken to this issue in the current, short term situation.

2.2 Procurement Forms

In order to undertake this research it was necessary to define the types of building team arrangement currently used in Britain. The following is the taxonomy employed, it is based on the relationships between the building professions and the leadership of the team; that is it reflects the viewpoints of the building teams, their specific competence and the point where responsibility for design and construction decisions rests.

Pure Design Build

Both the design and construction teams are parts of the same organisation and all necessary design expertise resides within the organisation. This type of organisation rarely undertakes other than design build projects. The advantages of team working can be realised fully.

Partially Integrated Design Build

Although the majority of the members of the design and construction teams are part of the same organisation, not all of the design functions are undertaken internally. Items such as architectural design are subcontracted. Most work is design build, but more traditional projects are undertaken. Many of the advantages of team working are realised.

Disparate Design Build

The majority of design work is subcontracted under this system. Typically the builder operating this system will take the majority of his turnover from traditional tendered contracts. The advantages of team working are not inherent, a great deal of effort is expended in coordinating different participants.

Traditional approach

This system was the norm in Britain at the time of the Banwell Report (6), 1964, where the Architect is the first member of the building team to be appointed and he advises on the selection of other consultants, coordinates their work and then oversees the construction work undertaken by a contractor selected in competition. This system rarely allows the builder any practical design input and requires most inter-organisational supervision.

Design Manage Construct is not treated separately as it can fall into any of the first three categories and reflects no organisational difference, it is a difference in the allocation of risk between client and building team expressed in the method of payment for work undertaken. Management contracting was not considered as part of the research although its study is important.

It is worth pointing out here that the research has shown that as much as 26% of industrial construction is undertaken using design build variants and up to



20% of all construction generally. This compares with 5% at the time of Banwell and 10-15% in 1974 (Sidwell).

3 THE CLIENT

The arbiter of the effectiveness of any system must always be the commissioner of the project, the client. In order to further this research the viewpoint of client bodies was canvassed and is reported below.

3.1 Categorisation

In the first instance clients were classified according to their size, building experience and the type of production process which they employed; it was found that the latter two had a profound influence on the priorities that were assigned when undertaking a construction project. The following are the findings which led to the final formulation of the performance measures.

High Technology industries emphasise:

- Comprehensive brief development prior to construction
- Involvement at all phases
- Capacity to change works throughout

The above suggest that pre-planning is an absolute essential in a high risk industry but, as a state of the art industry also, changes are inevitable.

Distribution industries emphasise:

- Accuracy of cost estimates
- Speed of construction once the decision to build is made
- The "right building", one that aids the distribution process

Such priorities suggest that budgets rather than the building required are defined precisely and this may well be due to competition for funds with other departments within large companies and a lack of control over corporate decision making by the client department.

Mass & Batch production industries emphasise:

- Low running costs
- Functional buildings
- Accurate time and cost estimates

Developers emphasise:

- Accurate time and cost estimates
- Private - communications with the design team
- Public - standard contracts & competitive tendering

It is interesting to note here the different emphases recorded by publically accountable developers (i.e. local authorities) and those recorded by private and public companies.

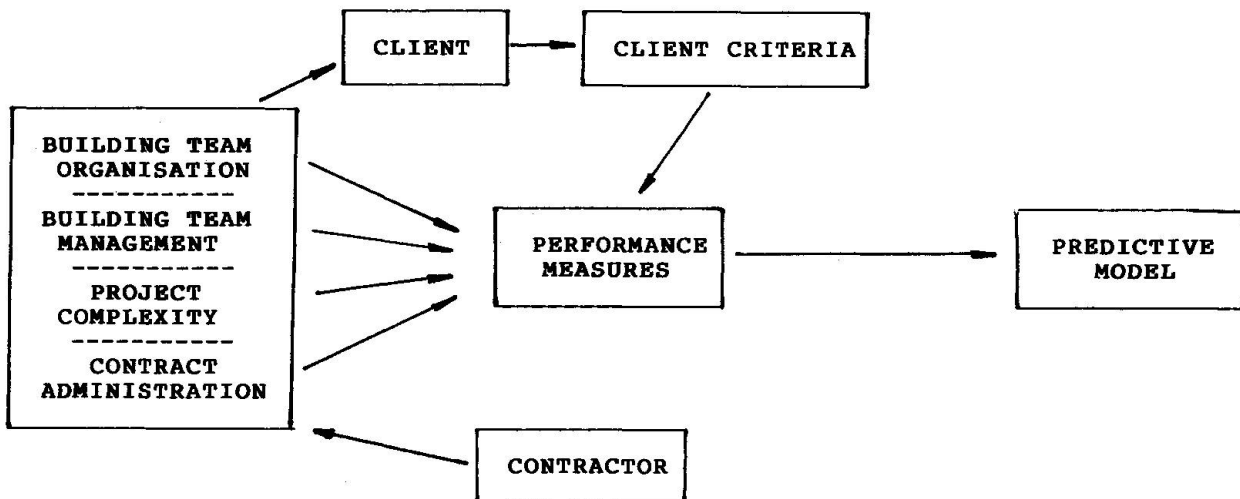
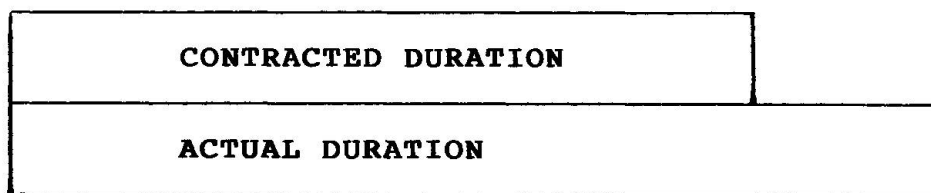
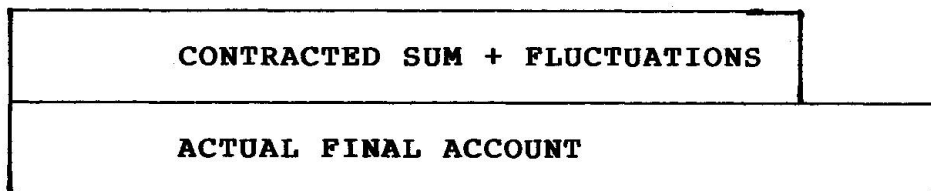


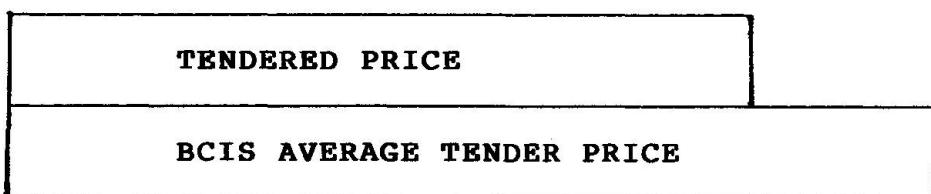
Fig 1. RESEARCH MODEL



TIME YARDSTICK



BUDGET YARDSTICK



COST YARDSTICK

Fig 2. PERFORMANCE YARDSTICKS



The overall ranking of priorities for the sample as a whole is shown below:

- 1 Communications with the designer
- 2 Accuracy of cost estimate
- 3 Functional building
- 4 Accuracy of time estimate
- 5 Confidence in the building contractor

3.2 Success

An interesting phenomenon surfaced in the study of clients' perceptions of the success of a project. The direct link between achieving cost and time targets and satisfaction existed but a significant number of clients expressed satisfaction when either or both were exceeded. A number of reasons may explain this phenomenon. Often, experienced clients allow a contingency in their internal budgets for the construction phase. More strikingly, if the client has built up a rapport with the building team and is informed regularly and accurately of time and cost implications throughout the project, he will not be dissatisfied with overruns; this is not likely to apply to the less than competent building team however, only a professional team and approach can build this rapport and predict with accuracy.

4 CONCLUSIONS

Design and construction organisation has altered markedly over the past decade in England, the initial impetus for this change being a need to become market as well as production orientated in order to survive the economic recession. This forced change has led to innovative approaches to procurement and varied levels of success in the implementation of these procurement forms. The design and construction team has been driven to consider its communication requirements in order to coordinate and integrate the design and construction processes and provide effective feedback from one to the other.

Research findings suggest that important contextual variables to be considered in choosing an appropriate design-construction organisation are project complexity and the client organisation and its criteria for judging project success. These criteria have been found to be much more complex than the simplistic check list of time, cost and quality and are extended to cover concepts such as accuracy of estimates given, communications and flexibility of the design and construction processes. The variables affecting performance can be seen to be multitudinous, Fig 3., and it has been concluded that an holistic approach to their study is both time consuming and difficult. However, a contingency approach to selecting an appropriate form of design-construction organisation does appear to be worthwhile, the factors to be used in selecting the most appropriate procurement form in any particular circumstance being the contextual and managerial variables outlined in Fig 3.. An expert system is at present under development to aid in this selection process.



| VARIABLE | EXPRESSION OF VARIABLE | VARIABLE | RANGE OF OPTIONS |
|-----------------------|--|-----------------------------------|---|
| <u>THE CLIENT</u> | | | |
| Charter | Purpose builder/Developer; Co Ownership | <u>BUILDING TEAM ORGANISATION</u> | Team Form Traditional - Design Build |
| Context | Co Size; Group Dependence | | Contractor choice Open tender - Negotiation |
| Awareness | Building Experience; Building Staff | | Payment Fixed Price - Fee |
| Technology | Specialised buildings; Production Process | | Team Leadership Architect - Builder |
| Finance | Source of Finance | | Scheduling No Overlap - Overlap |
| Decision Making | Number of levels; Timespan; Formalisation | <u>BUILDING TEAM MANAGEMENT</u> | |
| <u>THE PROJECT</u> | | | |
| Location | Inner city/Green field | Project leader | Different - Same Organisation |
| Complexity | Complexity of design & construction | Builder Design | Not involved - Involved |
| Technology | Client Production Process | Sub Design | %; £; Nomination |
| M & E Content | % of Cost in M & E work | Cost Monitoring | Client - Contractor |
| Subcontractors | Status and numbers employed | Cost Estimating | BoQ - Work Packages |
| Non-Subs | Status; Number Employed; Value of work | Scheduling | Gantt - CPA |
| <u>THE CONTRACTOR</u> | | | |
| Regionalisation | Company deployment; service, departments | Site Supervision | Staff |
| Service | Design Build - General Contracting; All Works - Specialised | Super' Experience | Staff experience |
| Experience | Previous work; Company age | Site Operatives | Subcontractor - Direct Labour |
| | | Project Management | Decision making Staff & Mechanism |
| | | <u>CONTRACT ADMINISTRATION</u> | |
| | | Contract Form | JCT - Own form |
| | | Bill of Quants | Yes - No |
| | | Liquidated damages | Yes - No |
| | | Tender Documents | Completion % |

Fig 3. VARIABLES - Contextual

Fig 3. VARIABLES - Contextual

Fig 3.(cont.) VARIABLES - Managerial



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