PLANNING AND ESTIMATING DESIGN WORK - A REVIEW OF BRITISH PRACTICE

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Abstract
This paper deals with the methods adopted by Architects and Engineers to plan and estimate the cost of their professional services and reviews techniques used by design managers to predict and plan the staff resources which are necessary for effective and efficient design work. The paper considers the significant trend towards fee competition amongst design professionals shows that there is a growing need for practices to more accurately assess and realistically programme their staff resource requirements. The paper also considers the extent to which cost control systems adopted by design managers are used to predict the cost of future design work and describes under traditional arrangements, against a background of the need for compliance with predetermined quality standards.

Keywords: Design Management, Planning, Estimating, Cost Control, Questionnaire Survey Design.

1 Introduction

In recent years the environment in which Architectural and Civil Engineering design organisations operate has changed dramatically, partly as a result of changes within the construction industry. There is evidence of a marked shift from traditional contractual arrangements towards, in particular, design and build arrangements (RICS, 1991) which radically alters the role of the designer. Design and build arrangements require a different range of design services from those required under traditional arrangements; for example, the designer, being employed by the contractor, may be required to produce fewer drawings and may not be required to be directly involved in contract administration (Architects Journal, 1991a). Additionally, professional practices which are heavily involved in design and build syndicates may, through unsuccessful bids, encounter an increased amount of work which generates no revenue for the practice and expenditure on this work must be absorbed elsewhere. Consequently, designers require methods other than recommended fee scales to determine the value of their services.

The relationship between clients and their professional advisors has been fundamentally altered by external pressures, with the philosophy behind scales of professional fees having been under review by the Monopolies and Mergers commission since 1967 (Rowdon et al, 1988), and vigorously attacked by the Office of Fair Trading (New Builder, 1991). Although the Restrictive Practices Bill which would have banned fee scales was not included in the 1991 Queen's speech, the industry has in reality adopted fee competition (Architects Journal, 1991b) despite widespread opposition from the construction industry design professions, (RIBA Journal, 1991 New Civil Engineer, 1991a).

The imposition of greater competition amongst design organisations has also occurred in the public sector with the new Local Government Bill extending compulsory competitive tendering to professional services. A further development affecting Civil Engineers was the privatisation of the Water Industry in England and Wales which resulted in many Local Authority Agency agreements being critically reviewed and re-defined.

However, the risks associated with allocating design work on a least cost basis alone appears to be recognised in the recently produced "Guidelines for the Design of Government Buildings" (DelaFons et al 1991), which noted that "good design can achieve benefits in terms of operational efficiency and quality of product that are much more significant than a marginal difference in fees".

Furthermore, in November 1991 a consultation document was published by the Government which proposes a two envelope system for compulsory competitive tenders for design work whereby financial bids would only be accepted if they conformed to predetermined quality standards. (New Civil Engineer, 1991b).

The effects of increased fee competition, either through traditional contractual arrangements or through design and build arrangements, against a background of the need for compliance with predetermined quality criteria, will inevitably require a higher degree of accuracy in the selection of necessary design resources and the estimation of design fees for fee bids than had been required under recommended scales of fees. There can however be no certainty that design organisations' planning and estimating systems, which have been developed over many years during which fees were rigorously controlled by recommended scales, will be adequate for the new competitive environment. It is therefore possible that the inherent quality of construction projects will be influenced as much by the effectiveness of design managers' planning and estimating systems as by the technical expertise of the designers.

Consequently, a programme of research has been initiated by Dundee Institute of Technology in conjunction with Loughborough University of Technology to identify, and consider the adequacy of, existing practice with regard to planning design work and estimating design fees as adopted by design managers in Architecture and Civil Engineering in the UK. This work is being supported financially by Tayside Regional Council, Water Services Department. The remainder of this paper is concerned with part of that research programme which constitutes a survey of planning and estimating practice in the context of design work.
2 Literature review of existing practice in planning and estimating design work

Literature on planning and estimating design work is scarce with the emphasis mainly on planning and cost control functions rather than the estimating process. A study of Consulting Engineers in the UK (Rowden et al., 1989) suggested that "many professional practices earn substantially less than they should, due in large measure to ineffectual planning and control", and furthermore "many managers and supervisors do not plan because they consider their type of work does not lend itself to planning". Rowden's paper suggested that a work-package approach should be adopted for design work and that the planned design resources required for each package should be estimated, in consultation with the staff involved in the design work. Significantly, no methodology was suggested for estimating these resources. Another study of a multi-disciplinary practice (Davis et al., 1987) proposed a simulation approach to determine the overall manpower requirements for such practices but again omitted to describe the means of identifying the resources required for the various design activities. Standard guide books for design professions, whilst again emphasising the planning and cost control functions of design managers, contain only an outline of the estimating methods which can be adopted by design managers. The RIBA Handbook of Professional Practice and Management (RIBA, 1991b), Section A1.3 makes reference to the fact that architects should be competitive, competent and adaptable, and Section A4.5 acknowledges that commissions for professional services will be let through competitive bidding and negotiation. However, the only apparent reference to assessing resources, which would be a necessary stage in developing a fee bid occurs in Section A8 of the Architects Job Book (RIBA 1988). The approach described would seem to relate to design work let on a percentage of the value of the project, presumably on a fee scale basis. In the context of fee competition, such an approach would not be desirable since design resources would then be allocated to design work in response to the "market value" of the commission. A more appropriate approach would be to determine the fee bid as a result of a careful consideration of the resources which would be necessary to provide an adequate level of professional service.

Considering Civil Engineering practice, a guide on the management of design offices (Rutter et al., 1991) identified the following four methods of estimating design resources which were based on:

(i) projected incomes from the project;
(ii) historic cost data of schemes which are broadly similar;
(iii) process-related data expressed in terms of required design input for likely quantities of reinforced concrete, weights of connections in relation to the tonnage of structural steelwork etc, which could be taken as measures of the complexity of a project; and
(iv) the number of drawings required together with an estimate of the necessary man-hours to produce a drawing.

However, this text did not deal specifically with the means of collating, manipulation and application of data to produce cost estimates although limitations affecting the accuracy of data collected through time-sheets was discussed.

3. Survey of existing practice in planning and estimating design work.

In order to gain more information on the techniques used by design managers and their frequency of application, a comprehensive survey of UK design professionals is currently being undertaken. This work has been divided into three stages:

(i) a series of interviews with practicing design managers in order to verify whether the approaches suggested by the literature review are being adopted by design managers to plan and estimate design work. This enabled an appropriate questionnaire to be developed;
(ii) a postal survey of suppliers and producers of software to determine the availability of commercial software to assist design managers in these functions;
(iii) a postal questionnaire survey of three hundred design managers to test any conclusions drawn as a result of the series of interviews.

3.1 Interviews with design managers.

Eight organisations, six of whom had previously expressed an interest in the research work were selected as being representative of a range of construction industry design offices. The sample comprised:
- the head office of a large firm of consulting engineers (800 Staff);
- three regional offices of consulting engineers (100 to 20 staff);
- the head office of a multi-disciplinary design organisation (200 staff);
- the regional office of a medium sized architectural practice (100 staff);
- the office of a small architectural practice (20 staff);
- a local authority water services department design section (80 staff).

An outline pilot questionnaire was developed consisting of:

(i) a section relating to the type of work carried out by that office;
(ii) a section relating to planning and estimating procedures;
(iii) a section relating to the influence of fee competition on planning and estimating procedures; and
(iv) a section concerning quality management procedures and the relationship between this and planning and estimating.

This questionnaire was sent to senior staff in the selected design organisations in advance of visits to their offices where the senior staff were interviewed using a semi-structured interview based on the pilot questionnaire. Whilst these interviews gave only an overview of current practice in design management, a remarkably consistent approach to planning and estimating design work emerged. In discussing the outline pilot questionnaire, a model of the planning and the planning and estimating process was developed as shown in
Figure 1 and this model was consistently adopted by all organisations. There are several features of interest in this figure which are highlighted below.

It was found that the responsibility for developing an initial estimate of the design resource requirements and the initial programme of design work was delegated entirely or partially to the Engineer or Architect responsible for the design of the project. It also transpired that a range of techniques were adopted to estimate resources, and that these were similar to the techniques identified in the literature review. The techniques mentioned during the interviews included:

1. To make a broad comparison with previous projects of a similar nature with the estimates of the necessary man-hours of the various grades of engineer being derived by the engineer on the basis of experience rather than from "hard data";
2. To estimate, based on experience of projects of a similar nature, of the number of drawings required for a project and the man-hours associated with a drawing;
3. To make a broad estimate of the cost of the completed works and, through consideration of recommended scales of fees (with suitable adjustment), determine required man-hours of the various grades;
4. To apply a central data-base containing data on the necessary resources for specific activities. Only one of the organisations claimed to have such a system but admitted that it was not widely used and that completed projects were not always appraised and therefore the central data-base was not always up to date and reliable.

All of the organisations interviewed used most of the above planning techniques at some time and also at some stage of a project's development although technique (d) was considered to be impracticable by some of the organisations.

The significance of the "commercial decision", which is an unavoidable element in the process of bid formulation was discussed at length in relation to fee competition. All organisations currently consider that the cost of design work is predominantly estimated as result of a broad estimate of the necessary resources required to adequately design the project in a professional manner and that this estimate is then compared to the recommended fee scales as a check on its validity. Furthermore, the level of the fee bid would be considered against commercial criteria but this would not greatly influence the bid. If an organisation considered they could not win a project and adequately resource its design they would decline to submit a bid for the work.

The role of the organisations' cost control system was discussed at length. It was generally agreed that traditionally the cost control systems was the main management function since estimates had been based on fees scales and resources could be selected to match the given fee. However, as a result of the increasing trend toward fee competition, the organisations conceded that the data currently used for cost control could be utilised further for estimating future projects. Some were considering the development of more formal links between the cost control and estimating functions but there was no evidence of any such links currently in operation.

The concept of quality of design under fee competition arrangements was discussed and most organisations considered that some form of Quality Assurance would be required to ensure that high standards were maintained. Not surprisingly, all organisations considered that their current Quality Assurance procedures were adequate but two firms had additionally sought and received third party certification in accordance with BS5750. Most organisations did not readily perceive a link between Quality Assurance system and their planning procedures although one company did develop a quality plan for each project as part of the planning and estimating process.

In general, the interviews provided a useful overview of planning and estimating practice and at this stage some preliminary conclusions can be drawn which are:

1. Because of the widespread application of recommended fee scales, design managers were traditionally able to work from a known fee to identify permissible resource requirements and ensure profitability through the application of comprehensive cost control systems.
2. Planning and estimating of design work is still perceived by design professionals to be a "flying by the seat of the pants" activity and consequently empirical methods not supported by specific data, such as an estimate of the number of drawings or a broad comparison based on experience of similar projects have been adopted to estimate design resources.
3. Whilst most consultants recognised that, in the current competitive environment, a more rational approach should be adopted to planning and estimating resources for design work and were considering changes, none of the companies were actively reviewing their estimating systems.
4. The design managers agreed that the data in their cost control system was not used directly to assist estimating but most considered that the information would be of value.

Clearly, in view of the size of the sample of design organisations, no definite conclusions could be drawn at this stage and therefore two postal surveys were developed to investigate further the initial conclusions.

3.2 Survey of software developers and suppliers

It was apparent at a recent construction industry computer exhibition that a number of software companies were offering office management packages for professional practices. These included modules which would deal with contract administration, accounts systems including the issue of fee notices and sophisticated staff time recording and cost control. In addition, many companies offered sophisticated estimating packages for contracting organisations but in contrast none of the companies had an established system for estimating consultants' fee bids. As software development is market-led it can be concluded that the absence of fee estimating systems is indicative of a lack of demand amongst professional practices for this facility which tends to confirm the preliminary conclusion above. A survey of software developers and suppliers was therefore initiated and a list of 30 companies who claimed to provide management support software to
the construction industry was compiled. A letter was sent to each company explaining the overall objectives of the research project and requesting information on any appropriate software which could be used by professional design organisations for planning and estimating design work fees. At the time of writing, responses have been received from twelve companies and the breakdown of software packages on offer was as follows:

4 general planning packages;
3 professional office management packages, each with cost control modules but excluding an established fee estimating system;
4 contractors estimating systems;
1 contractors accounting system.

The response to date from software companies indicates that cost control software for design practices is available but fee estimating software is not. This tends to support the preliminary conclusion that design management is biased toward a cost control approach.

3.3 Questionnaire survey of design offices

In order to further test the initial conclusions drawn from the series of interviews, a questionnaire survey of design offices has recently been sent out to obtain information from a larger and hence more reliable sample. Response rates from postal surveys can be as low as 25% (Oppenheim, 1986) but a previous survey by Dundee Institute of Technology (Jack, 1989) on contractors' planning systems demonstrated that if initial telephone contact was made prior to the dispatch of the survey a response rate of 78% could be achieved. A total sample size of three hundred was adopted and telephone contact was made with the majority of the recipients. The sample consists of:

100 Architectural Practices;
100 Consulting Civil Engineering Practices;
100 Others, consisting of a combination of Building Services Engineers, Local Authority departments and Water Companies.

The questionnaires were targeted at individual offices of firms rather than head offices since the interviews suggested that individual offices would be responsible for their own fee estimating and cost control. The offices were selected at random in firms with less than 20 employees were excluded from the survey. The questionnaire was designed to further test the initial conclusions from the interviews, and the layout generally corresponded to the outline pilot questionnaire. The first section was designed to gain general information on the respondents office and areas of work. The second section was designed to determine the frequency of use of the various planning, estimating and cost control techniques which were identified during the interviews. Three questions in the second section were specifically designed to establish if there was any formal link between design managers' cost control and estimating functions. The third section of the report deals with the role of quality assurance procedures in the planning and estimating process and the final section seeks to verify the accuracy of the planning and estimating process model as shown in Figure 1. Unfortunately, data from the questionnaires survey is not available at the date of publication of this paper but should be available at the conference.

4. Conclusions and outline of future work.

Despite widespread opposition from design professions, the construction industry has adopted fee competition for professional services. This move away from recommended scales is likely to increase the need for the application of more accurate planning and estimating techniques by design managers. Whilst final conclusions can not yet be drawn from the survey described in this paper, initial indications are that design management is generally achieved through the application of cost control systems which are intended to ensure that design resource input for a given project does not exceed a predetermined level. However, the survey suggests that an empirical approach based on qualitative judgement is generally used in the determination of the required design resource input. Furthermore, there is little evidence of the application of cost control data to predict the design resource requirements for future design work.

This must raise doubts about the practicality of accurately assessing the necessary levels of design resource input and therefore this gives rise to concern about the quality of design work in an increasingly competitive environment, particularly in times of recession when fee bids are likely to be particularly keen.

The survey described in this paper forms part of a larger programme of research on the suitability of design management planning and estimating techniques in competitive conditions. Future work in this programme aims to both measure the effectiveness of existing management techniques to develop a planning and estimating system for design work based on data from a cost control system. This work will be case study based, initially in one sector of the construction industry, namely the design section of Tayseide Regional Council, Water Services Department who are collaborating with and sponsoring the research programme. It is anticipated that this work will be extended to other sectors of the industry and the authors would welcome any comments and suggestions from the Architectural Profession.
Figure 1: Model of the planning, estimating and cost control sequence for design work under competitive conditions.

5. References

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