R G Pearl[1] & P A Bowen[2]

Construction time prediction: The forgotten service

Abstract

The effective management of construction project cost, quality and time is essential for the attainment of client objectives. While consultant's roles in respect of cost (price) and quality issues are well recognised, less attention is paid to the equally important aspect of construction time assessment. This article describes an experiment conducted with South African contractors and consultants to determine the way in which they forecast project construction time, within the constraints of a preferred procurement model.

Keywords: Contract duration, time prediction, estimating, forecasts, procurement, project planning.

KONSTRUKSIETYD-VOORSPELLING: 'N VERGETE DIENS

Die effektiewe bestuur van konstruksieprojek-koste, -gehalte en -tyd is noodsaaklik vir die bereiking van kliënte se doelwitte. Hoewel die rol van konsultante met betrekking tot koste (prys) en aspekte aangaande gehalte erken is, word minder aandag geskenk aan die ewe belangrike aspek van konstruksietyd-raming. Hierdie artikel handel oor 'n eksperiment waarin Suid-Afrikaanse kontrakteurs en konsultante betrek word om vas te stel hoe hulle te werk gaan om projek-konstruksietyd te voorspel, binne die perke van 'n verkose verkrygingsmodel.

Sleutelwoorde: Kontraktydsduur, tyd-voorspelling, beraming, voorspelling, verkryging, projekbeplanning.

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1. Introduction

The perceived lack of attention paid to the manner in which construction duration is estimated is not a new phenomenon. Flanagan (1980) critically describes this shortcoming among UK-based architects and quantity surveyors, reflecting a situation still existing in South Africa. Relatively little research has focussed on this important field of professional expertise. Previous research in the field of construction time forecasting tended to concentrate on identifying variables that lead to time overruns experienced on projects (Ahuja & Nandakumar, 1984; Almohawis & Al-Sultan, 1994; Nkado, 1994; 1992; Walker, 1980).

A possible reason for this disregard could be that, in many instances, clients insist on a definite 'completion date' for their project, thereby removing one of the service functions of consultants. It can be argued, however, that even under such conditions, there is a need for consultants to provide the client with a report on the impact which various project time-scales can have on the accompanying aspects of cost and quality. Another possible reason for the complacency displayed is the impression of clients and consultants that most building projects are completed within the contract period or an authorised extension thereof. While some may be pleased that clients are satisfied with time provisions in contract documents, this does not necessarily prove that construction time allowances are optimal or even feasible. Some critics suggest that consultants can ensure client 'satisfaction' by inflating project cost and time allowances by a factor that will not result in the abandonment of a contract, but that provides a useful contingency allowance during the design and construction phases.

2. Responsibility for construction time decisions

Nkado *et al* (1999) indicate that private sector clients in South Africa have a greater tendency than their public sector counterparts to stipulate completion times. Both groups, however, are more likely to set construction completion times on their projects than clients in the UK. Where does the responsibility lie when the client does not stipulate a completion date? Clearly, depending on the procurement model in operation, one of the principal consultants, namely, the project manager, architect, quantity surveyor, or engineer, should take this responsibility.

Recent legislation has resulted in the promulgation of a new suite of Parliamentary Acts, which determine the activities of various professional participants. None of the Acts, which pertain to the professions listed above, specifically refer to the provision of project duration forecasts. Similarly, standard forms of contract do not indicate where this responsibility lies. The importance of the effective handling of this function is emphasised by the findings of Bowen *et al* (1999), who found that clients have dramatically unrealistic expectations of project time.

The engineering sector of the construction industry accepts that the engineer will usually perform this function. However, the situation is not as well defined within the building sector. When a project manager is appointed as the client's principal agent, it would seem logical that this activity should form part of his sphere of responsibility. In situations where there is no project manager, it would be common practice that the decision on project duration is a joint decision between the architect and the quantity surveyor. Quantity surveyor respondents in Nkado *et al*'s (1999) survey clearly indicate that they play the more significant role in this process, with approximately 70% saying that they normally perform this duty.

Are built environment consultants adequately equipped to provide a 'scientific'/professional service in respect of project duration forecasts? In answer to this question, one primary indicator concerns a study of the 'trainee' professional's exposure to construction planning and programming while he is attending a university or technikon. A study of the curricula at South African tertiary education institutions reveals that this topic is virtually omitted from the courses for architects and engineers. However, several courses for students in quantity surveying address this skill, although not in detail. This situation is unsatisfactory, particularly as it is recognised that South Africans undertake little 'in-service' training in the built environment, once they have completed their basic tertiary education.

3. Techniques for predicting project duration

Atkin *et al* (1993) describe two main categories of time prediction models, namely, construction planning, and statistical analysis techniques. Bowen (1993) discloses that very few South African consultants produce even fairly simple construction plans during the pre-tender stage of the building procurement process. This study also indicates that virtually no local consultants use statistics-

based techniques for cost planning. It is thus highly unlikely that statistics-based techniques are used for time forecasting. What then are the techniques used?

Nkado *et al* (1999:168) note "experience is a common basis for the exercise of professional judgement by quantity surveyors". They categorise this to include 'personal experience' (based on past projects), and 'corporate experience' (using in-house data/ records). Both these categories imply the use of systems based on some form of record-keeping for completed projects. The most common form of record-keeping will likely involve a cross-referencing of construction time to financial turnover/ contractor's output or a typical cash flow profile.

These 'formal' processes are in sharp contrast with those used by practitioners who claim that they use 'gut feel' as their preferred method of establishing project duration — a process which ostensibly does not use formal records, but reflects the user's opinion as to a comparable construction allowance on a previous project. A comparable time is applied to the new project, without analysing the unique conditions relating to the earlier project, or questioning whether or not the contractual time allowance in the previous project was an optimal one in terms of balancing the client's needs concerning the interrelated factors of quality and cost. This 'system' can only be described as highly questionable — it provides a service for a paying client who is entitled to expect a consultant to use a 'scientifically-based' method of project duration estimation.

4. A South African experiment on project duration forecasting

An extensive research project on South African project procurement issues, conducted by a number of South African and international universities, was recently completed with a series of report-back workshops held in Durban, Johannesburg and Cape Town during August 2001. In their research on the nature of the briefing process on South African building projects, Bowen *et al* (2000) established that out of 12 contractual factors considered important during this stage of the project, the most commonly agreed-upon/finalised at this stage is the decision regarding the contract completion date. It was therefore decided to conduct an 'experiment' as part of the workshop sessions to establish the nature and potential performance

standards of various built environment professionals in respect of project time forecasting.

The experiment was conducted at 2 workshop sessions in Cape Town, attended by a total of 142 built environment participants including 12 architects, 53 quantity surveyors, 12 engineers, 11 project managers, 43 contractors, 5 clients and 6 participants from 'other' disciplines. The experiment used the 8 well-established procurement assessment criteria (PAC) developed by NEDO (1988). Turner (1990) provides detailed examples, using 12 case studies of different project and client types, of how the PAC (including project time allowance) can be used in choosing an appropriate procurement path for clients.

Participants at the local workshops were given the full details of one of these case studies, suitably adapted to reflect local conditions. The project described a new supermarket development of 18 600 m^2 on the outskirts of Paarl, with appropriate delivery facilities, customer and staff car parking, and landscaping. The participants were given a full description of the hypothetical client's wishes regarding the 8 PAC (programme timing, degree of variation expected, complexity of the design, required level of quality, degree of price certainty desired, extent of price competition, allocation of responsibilities, and nature of risk avoidance/allocation). In addition, detailed descriptions/definitions of 9 potential procurement solutions were made available. These comprised 3 variants of 'design and build'; 2 forms of 'design and manage'; the 'traditional/conventional' system (using bills of quantities); an 'accelerated traditional' model (e g Provisional BOQ/schedule of rates, etc); and 2 variants of management contracting.

Following an opportunity to address any outstanding queries, participants were asked to state their opinions on 3 specific issues relating to the case study, namely:

- The procurement method considered most appropriate
- Their estimation of the optimal construction time period for the project, from site handover to construction completion
- The basis upon which estimation of the project duration would normally have been made in practice. The options provided were: 1) gut feel; 2) experience; 3) a formula basis such as Rand turnover per month; 4) comparison with projects in which they had previously been involved; and 5) a detailed analysis of primary activities (e g bar chart).

The rest of this article is devoted to a discussion of the findings. Insofar as the choice of procurement system is concerned, the selections of participants are given in Figure 1.

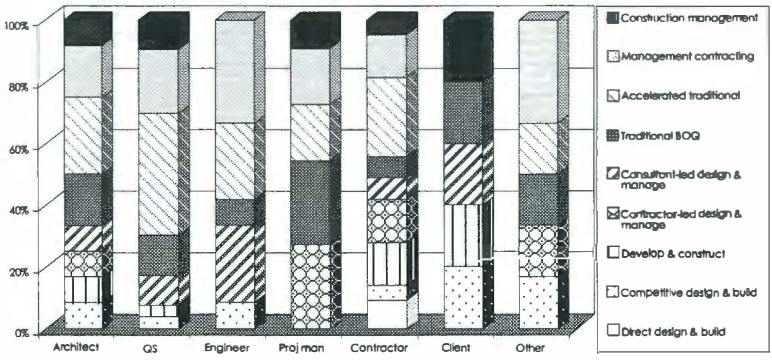

Figure 1: Choice of procurement selection

The 'accelerated traditional' procurement model was clearly the most popular solution chosen for this hypothetical project, followed by 'management contracting'. This was also the preferred choice in the 'real life' case study described by Turner. In reality, the supermarket was constructed using a system employing drawings and bills of approximate quantities. Upon completion of the contract, the review process indicated that the project was successful in terms of meeting programme, price and quality requirements.

It can be inferred from the above that the participants at the local workshops made an appropriate informed choice. Subsequent discussions with many of the respondents, however, indicated that this is not necessarily the case — their choice of procurement route was influenced to a large extent by their personal knowledge of/experience with the various models, which were generally restricted to the traditional method or its variants. There is a strong indication that this is the case by comparing the responses of quantity surveyors and contractors. It is also noted that clients seem to be unaware of the potential advantages of the 'accelerated traditional' and 'management contracting' models which are the preferred routes for all other respondents. The second aspect of the case study was the anticipated project duration period. The results of the workshop survey are shown in Figure 2.

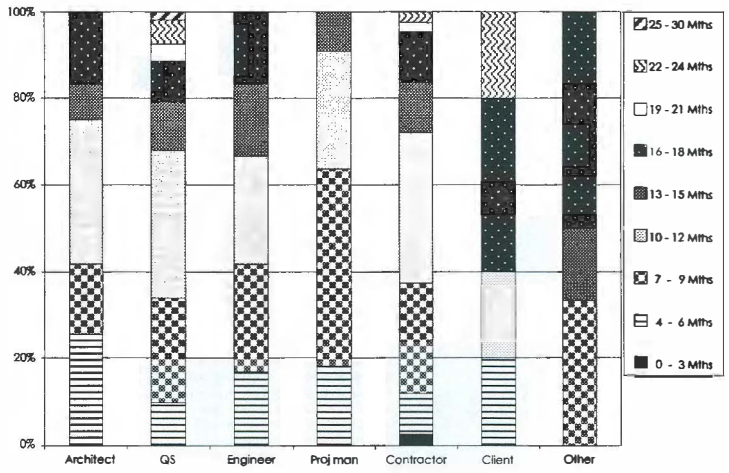

Figure 2: Project duration estimates

The participants were asked to predict the optimal time allowance for the project, expressed in months. The classification of the data into time groups as set out in Figure 2, graphically illustrates the findings most effectively. It is obvious that most workshop participants estimated a project time scale of between 7 and 12 months. A few noteworthy observations can be made with regard to the responses from various respondent groups.

First, 25% of the architects suggest that this project (involving a built area of 18 600 m^2) could be built effectively in less than 6 months. At the other end of the time estimation scale, 17% of this particular respondent group proposes an optimal construction period of more than 16 months. Whereas fewer quantity surveyors felt that the project could be built in less than 6 months (9%), 21% of this group felt that the optimal construction period would exceed 16 months. In fact, 12% of the quantity surveyors suggested that a construction period of more than 18 months was ideal. This response is fairly similar to that submitted by contractors, 11% of whom estimated a construction period of less than 6 months, and 16% indicating that a contract period of more than 16 months was realistic. Four percent of this group estimated that a construction period in excess of 18 months was appropriate.

The last issue raised at the local workshop sessions examined the processes normally used by local built environment professionals to decide on a contract time period. The aggregate results are shown in Figure 3.

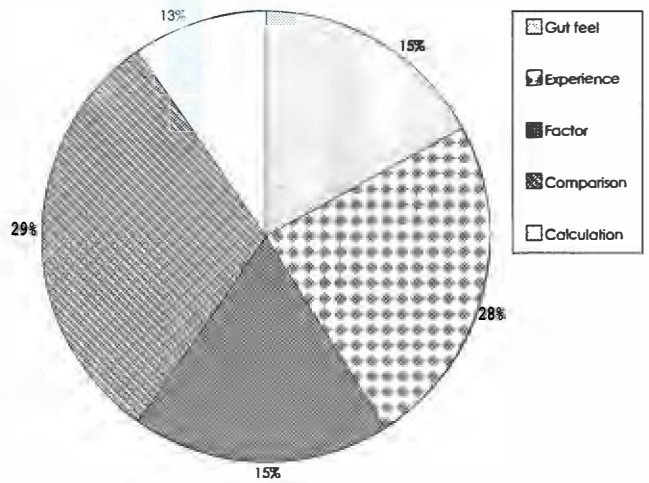

Figure 3: Procurement duration prediction method

An analysis of the aggregate responses reveals that 72% of the participants admit to performing this important function without basing it on a 'scientific' or structured analysis. Whereas contractors could be expected to generally apply a resource-based approach to establish the project duration, only 13% of the contractor respondents indicated that this was the case. A greater proportion (15%) of contractors indicated that they used a 'factor' approach to this problem, normally plotting time against an anticipated monthly financial turnover.

An analysis of the responses from the specific professional groupings provides further insight into the preferred methods applied by architects and quantity surveyors, in particular. It should be noted, however, that the sample size for architects is small which renders the results questionable. The responses from this group indicate that 17% use a 'factor' approach, and 17% use a system which involves a detailed analysis of primary activities (e g bar charts, etc). This response still leaves a majority of 66% of architects who base their calculations on gut feel, experience, or a form of unstructured comparison with previous projects.

The group generally recognised as playing a major role in establishing project duration, namely, the quantity surveyors, was well represented at the workshop sessions. The stated preferences of this group of professionals for establishing construction time are indicated in Figure 4.

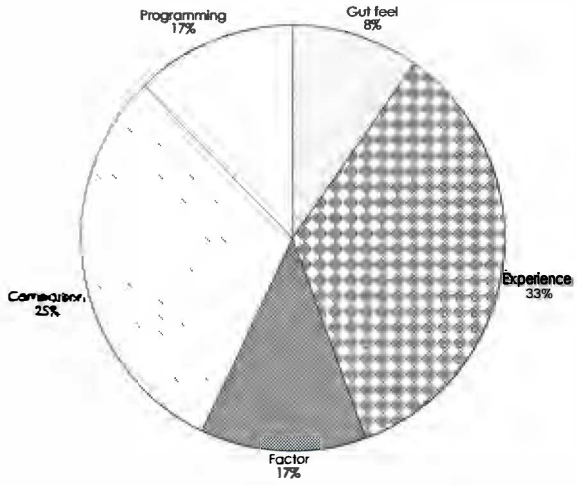

Figure 4: Methods of time prediction preferred by quantity surveyors

This group could be expected to favour the 'factor' approach (e g based on contractors' anticipated monthly turnover) to contract time estimation. However, the number of quantity surveyors who indicated this method as their preferred model (17%) is only marginally the average for all respondents. This preference is in line with Nkado *et al*'s (1999) findings that approximately 15% of quantity surveyors used this method of time estimation. The 17% response rate for using a programming technique is higher than anticipated, as Nkado *et al*'s (1999) research clearly indicated that only 7% of quantity surveyors were adequately equipped to undertake this form of time projection calculation.

Figure 5 compares time predictions between those respondents using a detailed analysis of primary activities and those respondents using more subjective methods to establish contract duration.

be able to plan for a more reasonable construction period if he does the usual pre-contract resource-based planning and scheduling.

5. Summary

This article reviewed the way in which randomly selected contractors and built environment consultants establish what procurement system should be adopted on construction projects, and how they determine the construction period for incorporation in contract documentation.

The widely variable responses concerning the optimal time allowance for the case study, and the way in which the activity usually takes place, supports Nkado *et al*'s (1999) findings that local built environment professionals lag far behind their international counterparts in most aspects of construction time estimation. This is particularly relevant for the quantity surveying profession, which claims this responsibility for the majority of projects in the building sector. The time estimation problem may be linked to a lack of in-depth knowledge of procurement systems throughout the construction industry in this country. A further reason for poor time estimating performance by consultants could be a lack of knowledge of the actual construction process, making it impossible for them to produce detailed, resource-based programmes.

It would appear that the most practical solution to overcoming these deficiencies lies in tertiary education institutions, whose curricula should include a detailed study of these issues. In addition, the various built environment professions must provide appropriate training within their continued professional development programmes, where theoretical knowledge mixed with practical experience can enhance the service ultimately provided to clients.

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