HAZARDS OF ESTIMATING WITHOUT PRICE DATA

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INTRODUCTION

Cost engineering within the South African building industry has traditionally been undertaken by quantity surveyors as an integral part of the package of services offered by them on construction projects. This is largely the result of the organisation of the local building industry being based on that of the United Kingdom, utilising the procurement models which evolved there.

There are, however, major differences between the structures of the two industries which need to be considered by cost engineers in the performance of their duties.

Firstly, South Africa is a large country, with many different geographical influences impacting on the pricing structures of construction within the various areas. The ability of a professional consultant to conduct business in different geographical locations is therefore largely dependant on local representation of the firm, but more specifically on the availability of pricing data which may be unique to each district.

It has been suggested that even in the U.K., the number and diversity of projects that are available within one quantity surveying office are not sufficient to provide a satisfactory data base for effective cost management, including the price forecasting function. This situation is exacerbated in South Africa, where firms are far smaller than their counterparts in the United Kingdom (Billett, 1990). The average South African practice comprises a total staff complement of less than 13, inclusive of partners, associates and administrative personnel. Consequently, a large number of very small firms survive by "charring" (assisting the larger practices) when work overloads occur, and are awarded very few (if any) projects for their own account.

The traditional approach to the provision of price forecasts during the design phase of building projects follows the work stages in the Practice Manual of the Institute of South African Architects (I.S.A.A., 1981). The document is generally modelled on the R.I.B.A. plan of work (R.I.B.A., 1980), describing the tasks to be performed by, and responsibilities of the various parties during the building procurement process. This, in turn, has resulted in the current

theory of price forecasting in the South African context largely corresponding to that prevailing in the United Kingdom.

DATA AVAILABILITY

Since some part of almost every contract can be expected to lie outside the experience of any one estimator, or that of other people with whom they have to communicate, the provision of relevant alternative sources of price information is of paramount importance to the success of the price forecasting function. Cost engineers performing this function in countries where almost no historical cost data is made publicly available, need to consider unique solutions to this problem in order to produce a satisfactory service.

Price information available to the cost engineer is often classified into two main categories. These are, published price information from a number of external sources, and `in-house' price data obtained from projects previously handled by the consultant's own organisation. In-house price data, the scope and quantity of which undoubtedly is a function of organisational size, generally consists of project price analyses compiled by individual quantity surveyors, and the priced bills of quantities submitted by successful tenderers.

Published price information

Price information in the United Kingdom is available from a wide variety of sources, the principle ones being: the technical press (such as *The Architect's Journal*, *Building*, and *Building Specification*); builders' price books such as *Laxton's Price Book* and *Spon's Architects and Builders Price Book*; information services such as the *Building Cost Information Service*; government literature (for example, publications such as the *Schedule of Rates* issued by the Property Services Agency of the Department of the Environment); and that emanating from university and polytechnic research.

South Africa however, is poorly served by published sources of price information, other than a reasonable distribution of building price indices and general economic reviews. Only one price book, *Merkels Builders Pricing and Management Manual*, is produced annually and the data included in the overseas price books is unsuitable for local use. The dearth of locally published price books may, however, not be a crucial problem, especially if one considers the

opinions of authors in the U.K. who reveal that there is great variability between individual rates contained in the various price books produced there.

Building cost and tender-based price indices

In South Africa three cost / price indices for use in the building industry are published. These are: (a) the Building Industries Advisory Committee's contract price adjustment provisions (Haylett Formula - P1051); (b) the Contract Price Index for Buildings (P0153), compiled and published by the Central Statistical Services; and (c) the Building Cost Index of the Bureau for Economic Research, University of Stellenbosch. A major problem relating to the use of these indices however is the irregular publication patterns (particularly that of the Central Statistical Services documentation), and the fact that there is an average delay in publishing data of between 3 and 6 months. In addition, a few local commercial publications reflecting the present, and forecasting the future patterns of activity in the building industry are produced.

In-house price information

Price data contained in the bills of quantities of successful tenderers is generally considered to be the primary source of price information available to the construction cost consultant in South Africa. The reasons for this are twofold. Firstly, in terms of the Quantity Surveyors Act (Act 36 of 1970), practices are required to retain all contract documentation for a period of not less than three years after conclusion of the final account on any project. This requirement theoretically has the effect of forcing quantity surveyors to establish a form of data bank, however informally controlled. The second reason is the almost complete lack of published price information in the preferred form of reference, namely item rates.

Data derived from bills of quantities may be presented as individual rates for measured items of work, total prices for use with single-price rate methods of approximate price forecasting such as a rate per square metre of floor area, or in the form of an elemental analysis. The application of non-traditional forms of price forecasting such as regression and parametric price models, is hindered by the necessity for a substantial database. This is almost certainly beyond the individual capabilities of most professional cost engineering firms, whilst comprehensive, centralised databases, unlike the situation prevailing in the United Kingdom, have yet

to become a reality in South Africa.

Price Analyses

A decision was taken in 1977 at the Golden Jubilee Congress of the Association of South African Quantity Surveyors to establish a building cost information service similar to that initiated by the Royal Institution of Chartered Surveyors in the United Kingdom. The intention was to institute the formal collection of elemental price data for the production of an `Elemental Building data' (E.B.D.) service. The Elemental Building Data service, administered by the Department of Quantity Surveying at the University of Cape Town, was initiated in 1982 but was discontinued in 1984 due to lack of support on the part of the building professionals. It is considered unlikely that an elemental price information service will come to fruition in South Africa in the foreseeable future. Furthermore, journals in South Africa do not contain published elemental price analyses along the lines of that contained in the Australian journal *The Building Economist*. Consequently, the only real source of elemental price data accessible to the quantity surveyor in South Africa is that compiled from in-house priced bills of quantities.

USE OF DATA

As reflected above, South African price forecasters have access to a limited number of sources of cost data providing several different types of information. Several studies of the patterns of usage of such data for forecasting purposes by quantity surveyors have been conducted both in the UK and South Africa.

Detailed research undertaken in the U.K. discloses that quantity surveyors demonstrate a preference for bills of quantities as the main source of cost information, although there is also a tendency for referring to more than one type of source. In addition, there is a noticeable preference for using price data derived from projects with which they are personally involved. Only if the required information is not available from these sources are other alternative avenues pursued. Firstly, information from other sources within the same organisation are entertained. These are followed by reference to the British Building Cost Information Service or published data such as price books. Most estimators consider bills as too old to be reliable if they are two years old or more. This opinion, which is attributed primarily to the effects of changes in tendering

climate and differential inflation on prices, presumably indicates a lack of confidence in the reliability of price indices normally used for updating purpose.

Another major feature of the estimating techniques adopted is represented by the approach adopted by quantity surveyors in the utilisation of cost data. Unit rates used to price a new project are normally derived from a single project. Current practice is to identify a previous contract which most closely resembles the project to be estimated, either from the surveyor's own files or from the immediate office files, and to price the new project with rates taken almost exclusively from the selected priced bill of quantities.

In establishing South African trends in data use, studies by Billett (1990), and Bowen (1993) have recently been conducted by means of postal surveys. Both questionnaires were submitted to all quantity surveying practices in the country. Billett (1990) received 73 replies while Bowen's (1993) findings are based on the response of 99 quantity surveying offices.

The response to comparable questions incorporated within the two questionnaires is generally similar. In the later study, Bowen investigates the availability of data and indicates that, with the possible exception of price books, almost all the firms retain all the various forms of price data available. A significant feature of Billet's survey however, is the indication that only 23% of firms have a library of rates for estimating purposes.

The studies confirm that quantity surveyors demonstrate a distinct preference for in-house data. The most popular form is price rates obtained from bills of quantities and is followed by elemental / component rates derived from price analyses of previous projects. Both studies clearly indicate that rates from previous similar projects, obtained from bills of quantities and suitably updated, are used extensively by estimators throughout the various stages of design.

One of the few areas of difference relates to the use of `first principle' pricing. Whereas Bowen's study reveals that this approach seldom occurs, Billet's evidence shows that up to 38% of the firms calculate individual new rates during the later stages of the design phase. Billett's study also suggests that `gut-feel' rates are used fairly extensively (up

to 34% of firms indicated its usage) during the inception and feasibility stages of the project.

OPINION SURVEY ON THE IMPORTANCE OF PRICE DATA

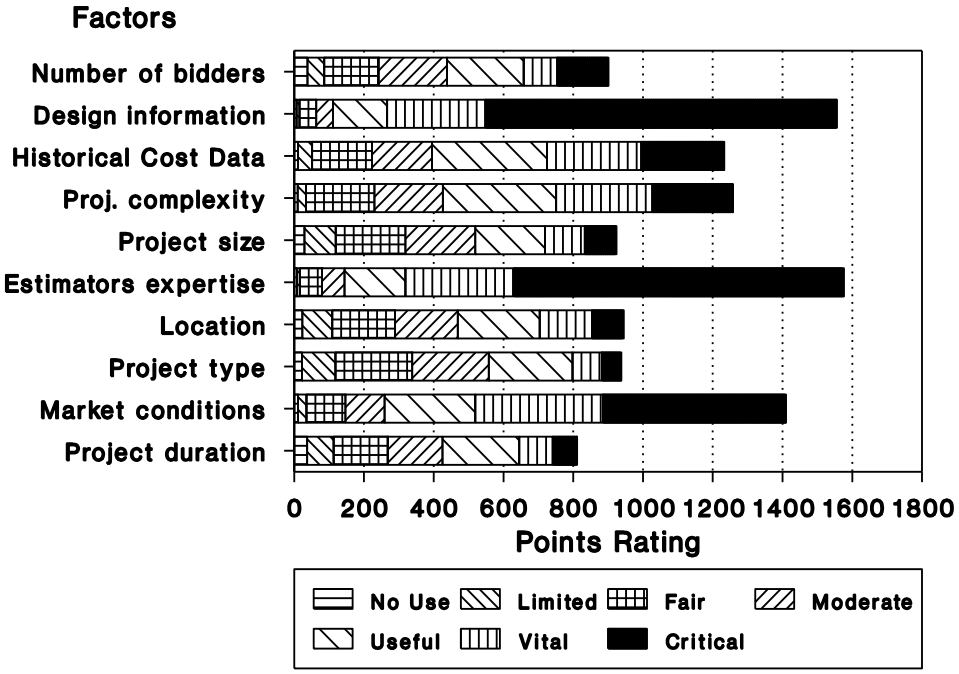
In a South African study conducted in 1992, a postal survey was used to determine the opinion of quantity surveyors regarding the importance of historical price data as one of the factors to be considered when attempting to improve estimating accuracy. This survey forms part of a detailed research project, the results of which are documented elsewhere (Pearl, 1992). Although a total of 557 offices were registered with the Association of South African Quantity Surveyors at the time of the survey, it was found that only 498 of these offices were actively engaged in quantity surveying practice conducting price forecasts. 234 of these firms (47%) submitted returns upon which this study is based.

Because the questionnaire used reflects a number of similarities with one designed and used by Ogunlana (1989) in his study of construction price forecasting accuracy, it provides the opportunity to compare the local results with those achieved in the UK.

In testing the effect of environmental conditions on accuracy, Ogunlana required the participating firms to rate factors considered to affect the accuracy of price forecasts. The results of the opinion survey, although only carried out on a small sample, are generally consistent with previous studies conducted.

The two factors ranked highest by respondents are:
(1) *historical cost data*, and
(2) *estimators' expertise.*

A `ranking exercise' portraying the views of estimators in South African quantity surveying practices on the relative affects on estimating accuracy of the factors identified by Ogunlana, is implemented in order to facilitate a direct comparison with the results of his survey. The overall cumulative results are reflected in Figure 1.



Overall Ranking of Factors

FIGURE 1 IMPORTANCE OF FACTORS IN PRICE FORECASTING. (Pearl, 1992)

The descriptions used for the legend of Figure 1 relate to a 7-point rating scale applied by both Ogunlana and Pearl, indicating increasing importance of the factors listed. The rating points shown are calculated by multiplying individual ratings by the total number of responses for each category.

While the graphic presentation in Figure 1 does indicate the basic nature of the support for the various factors, the simple depiction of perceived importance requires further manipulation in order to clearly establish the true level of affirmative opinion. The method used by the writer follows that of Ogunlana (1989) indicating `strength of feeling'.

The results of this test are almost identical to those indicated in Figure 1, the ranking being indicated in Table 1.

Ranking	Factor	Strength of Feelings
1.	Design Information	36.37
2.	Estimators expertise	36.07

3.	Market condition	31.57
4.	Project complexity	27.23
5.	Historical cost data	26.43
6.	Number of bidders	20.87
7.	Project location	20.47
8.	Project size	19.72
9.	Project type	19.59
10.	Project duration	18.39
Mean = 25.67	Standard Deviation = 6.65	Range = 17.98
Median = 23.65	CV = 25.90%	

TABLE 1: IMPORTANCE RANKINGS OF S.A. ESTIMATORS
(Pearl, 1992)

The most notable difference between the South African survey and that of Ogunlana (1989), is the relatively low ranking by the local estimators of `historical cost data'. This is particularly noticeable in the number of respondents signifying that this factor is of `critical' (i.e. a rating of 7) importance. The reason for this is not clear, but a possible explanation could be that the limited availability of such data in South Africa is accepted as a *fait accompli*, and is therefore considered to be a static condition which cannot be improved upon. If so viewed, other factors which the estimators feel are capable of being improved, may have received a higher grading.

Approximately 47% of the estimators' replies indicate that formal records of estimate / tender comparisons are kept with the specific purpose of using the data for future estimates. An analysis of the data however, discloses that of those signifying that such records are held, only 63% make a detailed comparison of estimates on all projects. Clearly, if all projects are not analysed, the records kept would be incomplete and the replies from those estimators falling in this group can be ignored. At best therefore, 30% of quantity surveyors keep full records

which can be used to assist in the development of estimating control systems.

There is reason to believe that the position is worse than indicated above. Several instances of respondents to the questionnaire from the same firm giving contradictory answers are evident. Furthermore, when local quantity surveyors were personally contacted in a pilot study, even this level of data recording was brought into question. Although required by law to keep records of all projects for a period of 3 years after the settlement of final accounts, most firms struggled to produce even the most basic records of recent projects, such as priced bills of quantities, client tender reports etc.

THE RESULTS OF A LACK OF SUITABLE DATA

Price forecasts are used for a variety of purposes by both the client and design team. An estimate should contain a balanced amount of detail in relation to the quality of the estimate requirements, and should be aimed at serving the needs of the end-user in the best possible fashion. Client bodies in South Africa have recently indicated that there is some dissatisfaction with the accuracy of estimates being provided. Since one of the primary objectives of price forecasting is to present the client with reliable cost advice, the need to investigate means of improving this service is clearly established.

Recent studies conducted in South Africa indicate that approximately 79% of client bodies and architects expect construction estimates provided by consultants to consistently be within 5% of the accepted tender, and a further 19% of these parties suggesting that estimates which vary by more than 10% from the tender are unacceptable. Quantity surveyors producing these price forecasts are of the opinion that they meet this requirement. Respondents to the writer's postal survey in 1992 were of the opinion that 71.2% of their estimates were within the range of 5% from the bid, and that a further 27.2% of estimates were within the 0 - 10% range.

In order to establish the accuracy levels actually being achieved by price forecasters in a typical South African building environment, a total of 243 project estimates produced by 30 quantity surveying firms in Cape Town in the period 1982 to 1992 were analysed (Pearl, 1992).

It was found that virtually all the firms had difficulty in providing information on projects put out to tender more than 5 years prior to the investigation. In addition, most of the firms, although appearing to be supportive of the research, struggled to find the required details for comparatively recent contracts. Several of the firms providing data appeared to do so on a selective basis. A possible reason for this, confirmed by 3 responding firms, could be the practitioners' reluctance to divulge details of estimates not close to the tendered sum. There would therefore appear to be grounds for suggesting that the estimating performance actually achieved is inferior to that reflected in this paper.

Whilst 98% of the survey respondents anticipate that their estimates are within 10% of the tender, the results of the empirical study indicate that only 76% of the estimates fall within this category. Additionally, the mean nett absolute accuracy actually achieved is outside the 0 - 10% range; being 11.84% of the lowest tender. These statistics indicate that there is a distinct disparity between what estimators perceive they achieve in terms of the accuracy of their forecasts, and actual performance. A further notable aspect of the empirical survey is that the average consistency achieved (CV value) is a very poor 49.85%, as compared with the international norm of between 12% and 19%.

Of the 30 firms contributing to the study, only 6 submitted details on more than 14 projects. As previously noted, this is partly due to the lack of adequate records, but more significantly a reflection of the composition of quantity surveying practices - the available work being distributed amongst a large number of small firms. This distribution pattern clearly has serious implications for the widespread availability of project data.

The projects estimated by one participating firm are of specific interest in identifying whether or not estimates produced on a number of jobs of a similar nature produce better results than non-repetitive forecasts. This situation can be equated with a condition providing details of estimates on jobs where data is freely available (jobs of a similar nature), and that where very little appropriate data is obtainable (non-repetitive projects).

As shown in Figure 2, the price forecasting performance on the typically repetitive projects is clearly superior to that for the balance of the sample.

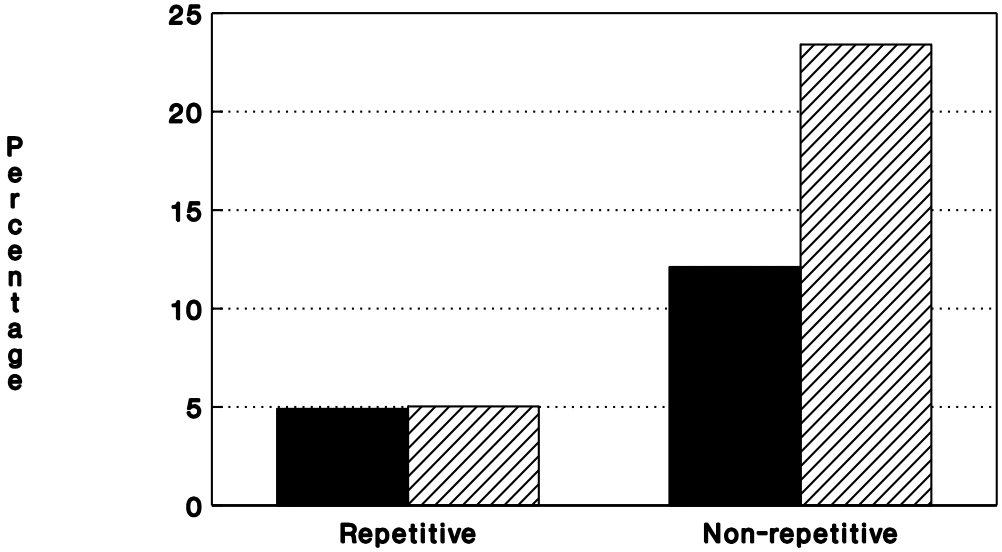


FIGURE 2 ESTIMATES ON REPETITIVE PROJECTS
(Source: Pearl, 1992)

An important feature of the results shown above, is that several factors otherwise considered to be detrimental to the consistent provision of accurate forecasts are evident in the sample of repetitive project type, whilst some normal indicators of likely good estimating performance apply to the remaining jobs.

This serves to confirm the opinion that forecasts presented by a specific estimator on typically similar projects are likely to be consistently more accurate than other estimates. The reasons for this would appear to be linked to factors not specifically contingent upon the project or type of building, but rather to influences such as effective data, and an `expert' knowledge of all conditions relating to such contracts.

The main difference between the construction price forecasting environment in South Africa and that of the U.K. appears to be the availability of price data

upon which estimates can be based. Whilst it would be simplistic to suggest that the vast difference in estimating performance can be ascribed to this factor alone, the indications are that this plays a most important role in the ability of the consultant to perform effectively.

POSSIBLE SOLUTIONS TO THE PROBLEM

It is clear that the most satisfactory means of resolving the difficulties described is to provide a universally accessible data bank for the South African construction industry. However, the demise of the Elemental Building Data service in 1984, and the suggestions by consultants that they prefer to use individual unit rates from projects that they have personally dealt with, would indicate that such a service may be given little support. Should there be support however, the stated reluctance of South African quantity surveyors to pay for such information would most probably mean that the service would best be provided by research units within the universities.

"Laboratory tests" described in the literature establish that there is a strong link between the role played by the availability of historical cost data and estimating expertise. The availability of data is particularly important to the inexpert estimator in the early stages of design price forecasting. Whilst a distinction should be made between *expert* and *experienced* price forecasters, the limited opportunities for consultants in the many small firms practising in South Africa to provide project estimates is probably a contributing factor in the poor performance observed. It is suggested that specialised courses aimed at improving the price forecasting skills of local practitioners could contribute meaningfully toward an improvement in performance, whilst also providing a forum for highlighting the importance of establishing new sources of price information for the industry as a whole.

The local studies conducted reveal that the most popular forecasting techniques used are the superficial area method (rate per square metre), approximate quantities, and elemental estimates. Virtually no other systems are utilised. Whilst adoption of other techniques may also require substantial databases to be accessible, consideration should be given their possible application. In assessing possible alternative methods of predicting construction prices, Ogunlana and Thorpe (1990)

identify certain important considerations which, although they may have a constraining influence on the rapid implementation of probabilistic estimating systems, could support the extended use of *range estimating*. Although not universally regarded as a pure estimating system, it is becoming increasingly recognised as a risk / decision assessment procedure which is a valuable adjunct to traditional estimating models. Other models, such as resource-based estimating techniques may also be preferable to the deterministic traditional techniques generally used at present.

CONCLUSION

In general, the pre-tender estimates produced by South African price forecasters are: (i) less accurate than that perceived by quantity surveyors themselves and fail to meet the expectations of architects and clients, and (ii) less accurate and more inconsistent than their overseas colleagues.

A major factor contributing to the poor performance being achieved is the dearth of cost / price data which is available to the many small consulting firms. In addressing this issue, specific attention needs to be given to developing facilities which can provide both the necessary information and enhance the skills of local price forecasters.

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