THE SIGNIFICANCE OF PRICE MODELLING IN PROJECT PROCUREMENT SYSTEM

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Summary

The world-wide operation of current, traditional price-modelling systems is examined and the extent to which they incorporate the production process is analysed in terms of the characteristics of realistic price models. Attention is focused on current international research and the authors comment on the competence of these recent developments to exhibit the integration of construction planning into pre-tender price modelling.

Introduction

Traditional cost models employed in forecasting building and construction prices are not processed-biased, therefore they

* do not represent the realities of on-site operations and

* cannot communicate the essence of the problems being modelled.

The world-wide operation of current price-modelling systems is characterised by a three-dimensional approach: historical determinism, inexplicability and unrelatedness. Furthermore, as depicted in Fig.1, these current systems take no account of risk and uncertainty, they make no attempt to explain the systems they purport to represent and they separate the design and construction processes.

Fig. 1 The existing paradigm in price modelling (Bowen and Edwards, 1985)
Realistic price models (Beeston, 1987) need to take into account, in some systematic and logically transparent manner, the economic implications of project procurement. Moreover, the cost-interdependencies between any sub-divisions of the project should be modelled during the early stages of procurement planning (Marston, 1985).

Construction-related expertise is an essential element of the planning and pre-tender phases of construction projects. Design decision-making is aided by models which have been developed to incorporate the expertise of construction planners in building and engineering projects, for example:

- a Construction Project Simulator (CPS) developed at the University of Reading by Bennett and Ormerod (1984): a stochastic simulation-based construction planning model capable of explicitly identifying and incorporating the important characteristics of variability and interference. Project information is arranged hierarchically based on the construction operations and hierarchical bar charts are utilised.

- Computer-aided Simulation for Project Appraisal and Review (CASPAR) developed at the University of Manchester Institute of Science and Technology by Thomson and Willmer (1985): a network-based system for the appraisal of engineering projects, using stochastic simulation for the assessment of risk associated with strategic development decisions (essentially a modification of the PERT approach).

- Intelligent Construction Time and Cost Analysis (TIME) developed at the University of Reading by Gray (1986) to predict and compare overall construction time when alternative forms of construction are proposed, utilising expert construction planning knowledge in the selection of activities, establishment of precedence, estimating activity durations and generating bar charts.

- Strategic Planning of Construction Projects (ELSIE) developed by the University of Salford and the Royal Institution of Chartered Surveyors (Brandon et al., 1988) and which utilises the expert knowledge of construction planners and quantity surveyors in the strategic planning and generation of reports for commercial building projects in four modules: Budget, Procurement, Time and Development.

- Project Management, Cost Control and Reporting System (POEM) developed by Howes (1992): a project management tool designed to assist in the planning, financial control, monitoring and reporting on building projects, with the generation of bar charts.

Any system which purports to generate design-to-cost advice during the pre-tender phase of a project should do so pro-actively (Bowen et al., 1993) and, although the foregoing examples of expert system-based models generally provide links between design decisions and the construction process in building or engineering projects, there are several significant restrictions which limit their practical application (adapted from Marston and Skitmore, 1990):

- The "model" contained within the computer is incomplete and a substantial volume of supplementary human input is required for the creation of comprehensive operational plans.

- All significant variables require the definition of probability distribution, which usually involves subjective assessment.

- The format of the output from these models is not "user friendly" as it is often in an unfamiliar format.

- Management control during the construction phase is not represented.

The integration of construction planning into the pre-tender price/cost modelling process remains the essence of the problem (Bowen et al., 1993).
User-satisfaction with construction price forecasts

Much has been written on the merits of price advice associated with construction projects and the various
techniques applied to evaluate various design and/or specification alternatives in economic terms. The literature
abounds with discussion on price-forecasting techniques such as 'elemental estimating' and the 'approximate
quantities method' (e.g., Seeley, 1983; Ashworth, 1991; Ferry and Brandon, 1991) which concentrate on the
principles and technical aspects while ignoring the extent to which the needs and expectations of the users of
price advice are met.

Despite the importance of the client's brief as a means of establishing the client's needs and expectations in
respect of a project, the cost control consultant very often does not attend briefing meetings (Procter et al.,
1993).

A comprehensive brief is rare and there is often no explicit information on building size, budget limit, quality
specification and, in respect of commercial investment projects, no statement of profitability requirements.

According to Procter et al., (1993) the issues of significance associated with the provision of price advice are
the

* extent to which the users are not always informed of the availability of the various forms of price data,
which results in barriers to communication between the client and the design consultants.

* forms of price advice which are most required at the various stages of the design process viz.
  - inception (budget price forecasts)
  - appraisal (budget price forecasts and viability studies)
  - design concept (price forecasts, comparative price forecasts, detailed
    price plans)
  - design development (detailed price plans)
  - documentation (expenditure forecasts and financial reports).

* usefulness of the various forms of price advice. Forecasts of initial project price are considered by clients and design consultants to be the most useful.

* explanation of a specific form of price advice to clients and designers, by the cost control consultants. Price advice is seldom explained to the users of this information.

* satisfaction of the users / recipients. Feedback mechanisms should be introduced to establish the levels
  of satisfaction, with pro-active inter- action between the providers and the users of the price advice to
  ensure that maximum benefit is obtained by the latter.

Clearly, quality pre-tender price advice is considered highly desirable by clients and design consultants. Every
attempt should therefore be made to create models capable of providing meaningful price advice.

A selective overview of international price modelling research, practice and processes

The purpose of this overview is to present a selection of current international directions and developments in
construction price modelling, with a view to

* illustrating the various research thrusts under way internationally in an endeavour to produce more
  meaningful price models and

* demonstrating the extent to which the problems associated with price modelling are being addressed.

Australia

Chan (1993) advocates the concept of Value Management (a structured, systematic, flexible, team-orientated
approach) in achieving the best available value for money on behalf of the client, maintaining that traditional
forms of cost control often involve piecemeal cost-cutting measures where the process has been to "cost the design" (after the design is complete), rather than to "design to cost", which provides a way of looking at designs in their entirety, taking into account the whole life cycle of the building or product. The Pareto Principle applies insofar as 80% of the total cost of a building concerns only 20% of the items required.

England

Denton (1993) contests the view that project management forms of construction procurement are more expensive to clients, along with the risk that likely price variance is greater. In preparing price forecasts, quantity surveyors use historical price data, not based on final construction costs, but on costs offered by successful tenders. The Building Cost Information Service provides data which is supplied by the industry on a selective basis, has little or no accuracy and is therefore not acceptable. The establishment of a financial database from which definitive conclusions can be drawn, will assist in delivering true value and professional service to clients (Denton, 1993).

Ruddock (1993) contends that pre-tender estimates may comprise Building Cost Information Service unit rate estimates, priced approximate bills of quantities based on crude outline sketches, with additions to cover undesigned or unmeasured work. After the addition of "standard" or "historic" adjustments, usually a percentage addition to cover preliminaries and contingencies, the client is presented with a single figure underwritten by a host of assumptions and qualifications.

Such price allowances are educated guesswork and perceived project risk is usually unquantified. Almost all clients are favourably disposed to risk assessment and the quantity surveying profession should take the initiative in adopting risk management practices.

France

Bobroff (1993) describes the implementation of some new and specific French forms and market procedures (turnkey projects, assembly activities, design and build procedures, total cost approaches, performancial exigencies methods) and states that to initiate all these procedures, some companies regroup into 'designer-planner-investor' teams, viz. a policy which favours a more complete approach with procedural aids to assist the client in defining product goals and project development linked to a selected financial arrangement which including operating and maintenance costs, combined with a variety of solution-options. Clients often elect to limit risk by linking the foregoing procedures to a form of lump-sum contract. A priority is to re-establish links between pre-contract price evaluation and communication of this information to the on-site team in charge of project execution, which involves cost transparencies, mastering of risk and quality management.

The Netherlands

Deimans and Templemans Plat (1993) state that cost information applied at the briefing stage is usually based on a construction expenditure rate per square metre or per cubic metre. At design concept stage, price prediction is based on the areas specified for the various types of space; at detail design stage, elements or clustered elements are priced by the architect and later, when working drawings are available, the contractor calculates a total price for the project. Although cost information is available on different levels of aggregation, corresponding to the various design stages, the respective databases are not interactive and the collection of adequate data poses a problem. The completion of a comprehensive cost model is a main thrust of future research.

South Africa

Stevens (1992) identified an integrated system for evaluating the cost-effectiveness and investment performance potential of commercial property investments, contending that current financial assessment procedures fail to accommodate the distinctive wealth maximisation investment objectives demanded by property investors. While Life Cycle Cost analysis is recognised as an appropriate method for analysing the cost-effectiveness of initial design decisions as it accommodates the long-term view with respect to the total cost of building ownership, a major failing is the inability of this system to afford investors the opportunity of ascertaining the effects of the economic relationship between initial capital investment and future income benefits.
Pearl (1992) examined the proficiency level of price forecasting by South African quantity surveyors, ascertained the most significant factors influencing such performance, and established that pre-tender price forecasts produced by quantity surveyors in South Africa are consistently inaccurate and do not meet the expectations of either clients or architects. The most important factors which influence the accuracy of price forecasts are identified as the personal expertise of the estimator, use of historical price data, availability of design information, market conditions prevailing at the date of the price estimate, project type and complexity.

Yugoslavia

Marinic and Vukovic (1993) state that the construction of residential buildings, secondary infrastructures and the preparation of unoccupied sites are founded on a previously fixed technical-technological plan, within the boundaries of given market conditions. The investor chooses the contractor according to the price and time schedule and the builder's business references. Sub-contractors are employed and market conditions, which have a significant effect on price levels, are built into the bidding price along with the market conditions which occur while the contract is underway, primarily the input prices which the contractor cannot control.

None of the foregoing (current) research thrusts appear to satisfy the requirement of integrating the production process into the price modelling environment

Conclusion

It is apparent that the essence of the problem remains the integration of construction planning into the pre-tender price/cost modelling process.

Despite meaningful progress in model developments, modellers need to address the inherent and, to date, unsolved problems of historical determinism, inexplicability and unrelatedness.

References


