

CHAPTER FOUR

PRACTICE OF APPROXIMATE ESTIMATING IN LOCAL ORGANIZATIONS



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4.1 INTRODUCTION

This chapter explores approximate estimating techniques in use and computer applications in approximate estimating in local organizations in Sri Lanka. A questionnaire survey was carried out between organizations and individual practices to grasp the essence of the practice. Previous research findings are stated and compared with current survey findings. Finally conclusions are given on different aspects of the practice of approximate estimating techniques in organizations in Sri Lanka.

4.2 PREVIOUS RESEARCH STUDIES



Perera (1989) has presented following information with respect to design process. These information are evaluated below in juxtaposition with approximate estimating techniques.

1. Most clients consult designers after deciding on required floor area, number of storeys and some aspect of specification. This occurs at the Briefing stage. It indicates the possibility that clients may have an idea of costs of building projects. Therefore, design team render their service from Sketch plan stage.
2. Entire design team is formed at detail design stage
3. Most design decisions are taken by Project director in private sector. In state sector all design team members participate in the decision making process.



4. Designing to the cost is followed. This could be a reality in case clients come to designers at Sketch plan stage with set cost limits.
5. Design is developed without referring to the cost of the design.
6. Seven Architects have been using cost per unit floor area method and two Quantity Surveyor have been using Elemental cost estimates.

Above research findings appeal to following requirements:

- There should be a way to check the cost limit set by the client. Establishing realistic first estimate is crucial.
- Since the full design team interacts at Detail design stage, design cost control at Briefing stage and Sketch plan stage may hardly be achieved. Risk of exceeding the cost limit is commonly seen. This results in design changes wasting time and resources at later stages.
- Accuracy of approximate estimates is not considered promptly.
- Up to the Detail design stage cost information is used to forecast overall cost. At detail design stage cost information are used for design decision making.



Jayalath (1991) proposes following to improve the quality of the approximate estimating practice in local organizations:

1. Introducing a single estimating technique which can forecast consistently from early stages of design.
2. Taking measures to establish the design team from the earliest possible time.
3. Creating and maintaining cost database for informed judgments.
4. Making aware the clients as to reliability and accuracy of cost forecasting of various preliminary estimating techniques.

Wijesuriya (1991) states that no cost control procedure is adopted during the design process in many firms. Preliminary cost estimate is produced and this is not checked until the stage at which Bill of Quantities is prepared and priced. This practice shows that client is unaware of the probable cost of the project until the bill of quantities is priced.

Tilakaratne (1991) states that the management of construction cost information in the local construction industry is very poor. The bill of quantities is the extensively used source of cost information. The cost data are collected in different formats. These formats are not compatible. Re-work is necessary to use these cost data in practice. Use of computer technology is limited to project documentation.

The research findings of Tilakaratne (1991) and Wijesuriya (1991) reveal the following:

1. The preliminary cost estimating techniques used in practice do not facilitate continuous use of cost information with design development. Estimating techniques used in practice cannot accommodate design information developed at different design stages. Consequently, the preliminary cost estimating techniques in practice cannot meet the purposes and principles of cost control described in chapter two.
2. Cost and design databases should be created, maintained and updated to produce reasonably accurate cost estimates. Existing practice in cost information management is very unorganized.
3. Information technology is not applied to obtain optimum benefits in the context of preliminary estimating, cost information management and cost control techniques.
4. Bill of quantities is the commonly used cost information source. Since different practices use different BOQ formats, cost information cannot be readily referred even at very later stage of the design process.



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4.3 SURVEY ON APPROXIMATE ESTIMATE TECHNIQUES

4.3.1 Rationale of the questionnaire survey

Questionnaire survey was executed to collect data on practice of current approximate estimating techniques. The questionnaire was designed to have two sections. Section A collects information on professional category, experience and type of the organization. Section B is aimed at finding types of design stage estimating techniques in current use, level of use of Information technology in approximate estimating and finally, exploring the practicability in use of approximate quantities estimating system at Briefing stage.

Table 4.1 Research Sample: number and rate of response by category

Type of Organization	Questionnaires issued	Responses	% Responses
Design and Build	4(11)	4(13.33)	100
Multidisciplinary Practices	7(19)	6(20)	86
Client organization	3(8)	2(6.67)	67
Architectural Practices	3(8)	2(6.67)	67
Property Developers	3(8)	3(10)	100
Quantity Surveying Practices	7(19)	6(20)	86
Project Management	1(3)	1(3.33)	100
Individual Practices	9(24)	6(20)	67
	37	30	81

Note: Figures in brackets indicate the corresponding percentage relative to total questionnaires issued (37=100%), or relative to total response (30=100%), as applicable to that column.

The sample was selected from organizations which provide pre contract services for building construction. All of above organizations either carry out or administer design and estimating

work at different levels. 37 practices were selected and issued questionnaire but only 30 practices responded. Response rate is as tabulated above.

4.3.2 Results of sample survey

Results of the research survey are discussed in this section. In certain tables no of respondents exceed the sample total of thirty. This occurs in cases where one respondent can select more than one method simultaneously. Absolute number of respondents in such situations are tabulated in data records of the Survey.

4.3.2.1 Experience of respondents

The respondents were asked to comment on their experience.

Results:

Table 4.2 –Experience of the respondents

Experience	No of respondents	Percentage
Experience less than 3 years	8	27%
Experience less than 6 years	3	10%
Experience less than 10 years	16	53%
Experience more than 10years	3	10%
Total	30	100%

Comments:

According to the table 53% of the respondents belong to less than 10 years but more than 6 years experience group. 10% of respondent belong to more than 10 years category. Accordingly, majority of responses likely to present experienced judgment.

4.3.2.2 Use of approximate estimating techniques without preset cost limit

This question is aimed at collecting information in current practice in approximate estimating techniques in organizations in Sri Lanka. Here, the responses given are tabulated in table 4.3.

Results:

Table 4.3-Design stages and approximate estimating practice

Stages Techniques	Briefing stage (Inception to Feasibility)	Sketch plans (Outline proposal to scheme design)	Working drawings (Detail design to Tender action)
A. Preliminary Approximate Estimating Techniques			
A/1. Unit method	18(60%)	2(7%)	2(7%)
A/2. Superficial(cost/m ²) method	21(70%)	11(37%)	3(10%)
A/3. Cube method	2(7%)	1(3%)	0
A/4. Storey Enclosure method	1(3%)	1(3%)	0
B. Later Stage Approximate Estimating Techniques			
B/1. Approximate quantities	2(7%)	24(80%)	2(7%)
B/2. Elemental estimating	3(10%)	6(20%)	3(10%)
B/3. Cost per /m ² method with appropriate parts taken from approximate quantities	3(10%)	19(63%)	6(20%)
B/4. Pricing an accurate Bill of Quantities	0	1(3%)	27(90%)
B/5. Analytical estimating	1(3%)	0	5(17%)

Comments:

1. According to the Table 4.3, 70% of the respondent use cost /m² method at Briefing stage. Unit method was used by 60%. These are the commonly used techniques at the Briefing stage. At Briefing stage perhaps only the information available will be useable floor area form client and likely budget he can allocate. This has resulted in very simple, inflexible but quick approximate estimating techniques to be used at Briefing stage. Perera (1989) states that clients reach consultants at sketch plan stage. Accordingly, some understanding on design feasibility and financial feasibility, which should be addressed at Briefing stage remains with clients. At Briefing stage single estimating techniques such as cost /m², cost per unit etc. are the methods which can be used to obtain construction cost estimates in traditional practice. These single estimating techniques are the widely applied techniques in traditional practice whether the client comes with the budget or not. This justifies the higher percentages for cost per m² and cost per unit methods.
2. At Sketch plan stage , sketch plans or preliminary working drawings, specification notes and external services and external works etc. are available. This explains the reason why approximate quantities estimating system and cost per m² method with appropriate parts taken from approximate quantities are used at this stage. According to the survey 80% of the respondents use approximate quantities estimating system at Sketch plan stage. 63% of the respondents use cost per m² method with appropriate parts taken from approximate quantities.
3. At working drawing stage 90% of the respondents price bill of quantities to obtain a purview of probable tender figure. Priced BOQ is used to compare the priced bids submitted by the bidders. Bill of quantities is a cost model which provides the mechanism for cost control of construction projects in addition to its capability of predicting cost at working drawing stage.
4. Consistent Use of elemental estimating method is not evidenced. 20% of the respondents use elemental estimating method at Sketch plan stage.
5. Analytical estimating is used by 17% of the respondents. Analytical estimating is used generally by contractors to estimate construction cost which is adjudicated to a tender figure.

4.3.2.3 Use of approximate estimating techniques with preset cost limit

This question is formulated to investigate the approach of cost estimators when cost limits are set by clients. Alphabetic symbols were assigned to cost limits as follows:

'a= cost limit = Rs500m ; b = cost limit = Rs 250m

c= cost limit = Rs100m ; d = cost limit = Rs 50m

Results :

Table 4.4- Design stages and approximate estimating practice with pre -set cost limits

Stages Techniques	Briefing stage (Inception to feasibility)				Sketch design (Outline proposal to scheme design)				Working drawings (Detail design to tender action)			
	a	b	c	d	a	b	c	d	a	b	c	d
A. Preliminary Approximate Estimating Techniques												
A/1. Unit method	53	53	53	53	3	3	7	3	3	3	3	0
A/2. Superficial (cost/m ²) method	60	63	60	67	23	23	30	27	13	13	10	10
A/3. Cube method	0	0	3	3	3	3	0	0	0	0	0	3
A/4. Storey Enclosure method	3	0	3	3	7	7	0	0	0	0	0	0
B. Later Stage Approximate Estimating Techniques												
B/1. Approximate quantities	7	7	10	10	60	57	63	63	3	3	0	3
B/2. Elemental estimating	10	10	7	7	17	17	10	10	0	0	0	3
B/3. Cost per /m ² method with appropriate parts taken from approximate quantities	7	7	10	10	57	53	50	57	13	13	7	7
B/4. Pricing an accurate Bill of Quantities	0	0	0	0	0	0	3	3	77	77	70	73
B/5. Analytical estimating	0	0	0	0	0	0	3	3	13	10	7	7

Comments:

1. Briefing stage

53% of respondents use unit method at Briefing stage. 63% (average) of respondents use cost/m² method at Briefing stage. The responses are not significantly different from the responses received for respective stages when no client set cost limit is available. For example 60% of the respondents use unit method at Briefing stage as shown in the Table 4.3. The percentage decreases to 53% when cost limit is known. 70% of the respondents use cost/m² method at Briefing stage as shown in the Table 4.3. This percentage decreases to 63% (average) when cost limit is set in advance. The reason for this marginal variation has to be studied, as author perceives, with a larger sample followed by structured interview.

Application of other methods at Briefing stage is very low being less than 10%.

2. Sketch plan stage

61% (average) of the respondents use approximate quantities estimating method at Sketch plan stage. The corresponding figure in Table 4.3 when cost limit is not known is 80%. 54% (average) of the respondents uses cost /m² method with appropriate parts taken from approximate quantities at sketch plan stage. The corresponding percentage in Table 4.3 is 63%. Variations in the use of both methods, when cost limit is known and not known, are not significant. Cost /m² method is adopted by 26% (average) of the respondents. Corresponding percentage in Table 4.3 is 37%. Number of respondents decreases by 11% when cost limit is known in advance.

Elemental estimating method is used by 13% (average) of the respondents. The corresponding percentage in Table 4.3 is 20%. Number of respondents decreases by 7% when cost limit is known.

It is suggested to reason these variations with separate survey followed by structured interview.

Application of other methods at Sketch plan stage is less than 10%.

3. Working drawing stage

Pricing an accurate bill of quantities at Working drawing stage was adopted by 74% (average) of the respondents. The corresponding percentage in the Table 4.3 is 90%. Number of respondents decrease by 16% when the cost limit is known.

Cost /m2 method with appropriate parts taken from approximate quantities method is adopted by 10% (average) of the respondents. The corresponding percentage in the table 4.3 is 20%. Number of respondents decrease by 10% when cost limit is known.

Cost /m2 method is used by 12% (average) of the respondents. The corresponding percentage in Table 4.3 is 10%.

The application of other methods at Working drawing stage is less than 10%.

4.3.2.4 Application of alternative estimating techniques in approximate estimating

This question is related to alternative estimating methods which can be used to produce approximate estimates. Respondents were asked to respond against 4 different methods.

Results:



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Table 4.5- Alternative approximate estimating methods against design stages

Stages \ Technique	Briefing stage	Sketch plan stage	Working drawing stage
Empirical methods	2(7%)	1(4%)	2(7%)
Regression analysis	0	0	0
Simulation	0	0	0
Heuristics	0	0	0

Comment:

The responses in the Table 4.5 show that the application of the Empirical methods, regression analysis, simulation and heuristics is very lower. Response rate is less than 10% for all methods as shown in the table.

4.3.2.5 Application of Knowledge based expert system

This question is related to application of Knowledge Based Expert Systems (KBES) in approximate estimating to produce estimates. Four KBES techniques were presented for response. Presented techniques include Rule based system, case based system, Neural network based systems, Genetic algorithm based system, Model based system.

Comments:

No response received from respondents for this question.

4.3.2.6 Information processing methods in approximate estimating



This question is formulated to explore the information processing methods with respect to approximate estimating techniques.

Results:

Table 4.6 – Information processing systems

Information processing method	No of respondents	Percentage
Database approach	5	17%
File processing approach	21	70%
Both approaches	3	10%

Comments:

File processing approach is resorted to by 70% of the respondents. Data base approach is resorted to by 17% of the respondents. Both approaches are used by 10% of the respondents. The high use of the conventional file processing approach can be explained by the fact that most organizations maintain files for each activity. Estimating in this sense is an activity for which separate files are created. These files are manipulated independent of other activities. This explains the lower level use of database management packages.

4.3.2.7 Type of database structures in practice

This question is related to application of database structures to accomplish database approach queried in question 7.

Results:

Table 4.7- database structures

Database structure	No of users	Percentage
Hierarchical database structure	0	0
Network database structure	0	0
Relational database structure	4	13%
Object oriented database structure	4	13%

Comments:

4 respondents use relational database structure (RDBMS) in approximate estimating activities. 4 respondents use object oriented data base structure (OODBMS). The depth and the breath of the use of database structures cannot be expressed and concluded upon without separately researching into this area. The survey results may be considered as an indication received from some respondents as to their awareness of the potential of database management packages in approximate estimating area. The author considers the necessity of

a research on its own into this area for a critical analysis. Such is not the objective of this research.

4.3.2.8 Type of software applications

This question queries types of software and their applications in approximate estimating. Here the responses were post coded as follows:

Code 1- Spreadsheet application

Code 2- Database management software

Code 3- Customised software

Code 4- CAD software

Code 5- Spread sheet and Database software

Code 6- Spread sheet and CAD software

Results:

Table 4.8 - Software types and applications in approximate estimating

Type of software	Code	Frequency	Percentage
Spreadsheet software users	1	18	60%
Database software users	2	0	
Customized software	3	1	3%
CAD software	4	0	
Spreadsheet and database software	5	10	33%
Spreadsheet and CAD software	6	1	3%

Comments:

The spreadsheet software application is adopted by 60% of the respondents. This is justified by the fact that 80% of the respondents use file processing approach. Most of the approximate estimating functions are executed using Microsoft Excel software. Latest versions possess

added and enhanced database capability. Number of spread sheet files are linked in particular application area (approximate estimating) to obtain the output.

Both spreadsheet and database software are used by 33% of the respondents. Ms Access is the database software in use. The use of database software per se is not revealed. This shows that use of database software is preferred only with spreadsheet software. The database software are less popular. This may be due to lack of understanding about database systems in organizations and its potential in managing large amount of data.

4.3.2.9 Identification of constraints in informative estimating techniques

This question is related to the identification of constraints which confine the use of approximate quantities estimating technique at very early stage of the design process. Here, the responses were post coded as follows:

Code 1- Project information related constraints

Code 2- Time related constraints

Code 3- Information technology related constraints

Code 4- Combination of 1 and 2 above

Code 5- More consideration on technical aspects over cost and design relationship factors

Code 6- Combination of 1 and 3 above

Code 7- Combination of 2 and 3

Code 8- Miscellaneous



Results:

Table 4.9-Information constraints of approximating estimating techniques

Constraints	Code	No of respondents	Percentage
Project information related constraints	1	19	63%
Time related constraints	2	0	
Information technology related constraints	3	0	
Combination of 1 and 2 above	4	3	10%
More consideration on technical aspects over cost and design relationship factors	5	1	3%
Combination of 1 and 3 above	6	3	10%
Combination of 2 and 3	7	0	
Miscellaneous	8	1	3%

Comments:

1. The main constraint which bars the use of approximate quantities estimating techniques, as perceived by 63% of respondents, is lack of the project information at very early stage of a project. In the Briefing stage it is only the client's brief which provides very basic information of a project. Database comprising design and cost information is not available to users. Requirement seems to be a database for historical information.
2. Lack of project information and time constraints are perceived by 10% of the respondents as the barrier for early stage use of the approximate quantities estimating technique. In addition to lack of project information the time bars to use techniques which need additional time to operate. This reveals the problem of speed in existing techniques. This indicates a definite barrier even if the project information are made available to cost advisors at the early stage. This result can be extended to use of other techniques such as elemental cost planning, pricing bill of quantities at early stages of the design process.

3. The inadequate application of Information technology and the insufficient time are considered by 10% of the respondents as constraints to use approximate quantities estimating technique in the early stage of the design process. This response indicates the necessity of application of Information technology at required level to overcome the difficulties which manual approaches suffer.
4. Some respondents (3.33%) propose the cost is not taken in its real token at initial stages. This bars the application and development of suitable and reliable cost estimating techniques with the result of justifying to project clients, budgets with substantial deviations.

4.3.2.10 Proposals of respondents

The final question of the questionnaire is related to the proposals which would overcome the constraints stated in the question no10. Question was post coded as follows:

Code 1- Application of Database management systems

Code 2- Developing a methodology for improved briefing.

Code 3-Introducing quantity generation system from briefing information

Code 4- Setting realistic duration for early stage estimating

Code 5- Combination of 1,2 and 3

Code 6- Combination of 1 and 2

Code 7- Miscellaneous

Results :

Table 4.10-Proposals to overcome information constraints at early stages

Proposal	Code	No of respondents	Percentage
Application of database management systems	1	6	20%
Developing a methodology for improved briefing.	2	5	17%
Introducing quantity generation system from past projects	3	0	
Setting realistic duration for early stage estimating	4	0	
Combination of 1,2 and 3	5	9	30%
Combination of 1 and 2	6	2	6%
Miscellaneous	7	4	13%

Comments :



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1. 30% of the respondents proposed that application of the database management software, improving and properly structuring the brief and introducing quantity generation facility can create a system with which approximate quantities estimating system can be applied at very early stages. Respondents did not comment on any system which is in current practice.
2. Application of database management software to overcome the difficulty in the use of approximate quantities technique at briefing stage was proposed by 20% of the respondents. This answer seems to indicate that computer software application is a strategy to overcome certain difficulties of existing system.
3. The responses to this question in overall constitute the fact that capability of computers, quantity generation technique which refers to quantity generation from

past cases, and properly developed client brief are vital components of an approximate estimating model which can perform at early stages.

4.4 SUMMARY OF RESULTS OF THE SURVEY

1. The practice of approximate estimating techniques is confined to a greater extent to traditional methods. At very early stage of the design process (Briefing stage) “cost/m² method” and Unit method are used to predict construction costs. At later stage of the design process (Sketch plan stage and Working drawing stage) approximate quantities method , cost per m² method with appropriate parts taken from approximate quantities and pricing bill of quantities are extensively used. No evidence received to prove that initial information on cost limit influences the choice of the approximate estimating techniques.
2. The estimating techniques such as empirical methods, regression models, simulation models, heuristics are not in the practice. Knowledge Based Expert Systems (KBES) are not applied in approximate estimating practice. The survey findings corroborate that cost advisors prefer to continue traditional estimating techniques as stated above. The client and design team require estimates at different stages of the design process. The method of approximate estimating, accuracy of the methods and compatibility of estimating methods with iterative design process are not sufficiently addressed local in practice.
3. The application of Information technology (IT) in approximate estimating is very low. The major application is use of MS Excel (60% of the respondents) for storing estimating data, manipulating data and retrieving estimating data. Thus, files created for estimating purposes are managed by files processing system. According to the survey results 70% of the respondents use file processing system. Therefore, application of IT in approximate estimating practice is limited to Spreadsheet applications and conventional file processing system.

Database approach is resorted to by only 17% of the respondents. It is found that the word “database” is loosely used in the construction sector. Therefore, the response as

to the database approach shall not be taken to mean proper comprehension by the respondents as to its potential. Specially, the Relational Database Management System (RDBMS) is claimed to have an excellent theoretical rigor over the other database structures. It can be concluded that approximate estimating practice is not at a stage to reap the full potential of database approach, and RDBMS in particular.

4. The major barrier to use approximate quantities estimating method at Briefing stage, as reasoned by 60% of the respondents, is lack of project information in hand at this stage. Inadequate application of Information Technology and lack of project information availability at Briefing stage are the reasons as perceived by 10% of the respondents. The responses indicate the proposition that if project information are made available at Briefing stage it is possible to use informative approximate estimating techniques at very early stages (Briefing stage). Information Technology (IT) can manipulate large amount of information accurately and with speed. Thus it can be said that making available required information at very early stage and optimizing IT application is a device to use informative approximate estimating techniques at very early stages (Brief). The survey results expand this idea proposing, application of database management techniques, incorporating quantity generation facility and structuring the Brief of client as major steps towards the use of later stage approximate estimating techniques (informative techniques) at early stage of the design process.
5. Previous researches reveal the fact that approximate estimating techniques are used to predict construction cost with no emphasis on cost control. Cost and design data are not managed efficiently. Approximate estimating techniques which can manipulate cost and design data consistently from the outset are vital in this respect.