A MARKUP DETERMINATION FOR BUILDING CONTRACTORS IN GHANA

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ABSTRACT

As builders' estimated costs are similar the main variable in bids is the markup. But deciding on the right markup to add to an estimate is not an easy task for a contractor. The markup must be small enough to ensure a good chance of winning the contract, yet big enough to realize a reasonable profit.

Studies have identified some thirty-six factors that affect markup decision in Ghana. Optimum markup determination entails the evaluation of these factors, and in Ghana building contractors are found to consider and evaluate the factors subjectively when they set markup for projects.

This research sought to identify the most important factors needed for the markup determination in the competitive bidding environment and provided a suitable model for computing the optimum markup.

The research comprised a questionnaire survey, supplemented with interviews, among all class D1 and a random sample of class D2 building construction firms in Ghana with the aim of identifying problems associated with the markup decision and the importance that the contractors attached to the factors that affect the markup decision.

The research revealed that project cash flow, risk involved in investment and competition are the most important factors that affect markup decision and the FaRM Pricing Model is a suitable tool for the determination of the optimum markup by Ghanaian contractors.

(Keywords: markup, competitive bidding, construction, Ghana)

DEDICATION

To my father and mother, the Late Mr. Peter Aduasah and Madam Theresa Amoah, the two people who gave meaning to my life.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

A construction firm may secure the right to provide services in a job through either a direct negotiation with the client or the client's representative, or competitive bidding. This study is concerned with the competitive bidding situation in Ghana.

Most clients in Ghana use the competitive bidding system to select a contractor to execute a building project. In most cases the client's agency advertises in trade and local newspapers its intention of selecting a lowest responsible bidder for constructing a project that is described in drawings and specifications. A contractor who is qualified to bid studies the bidding documents and decides either to bid or not to bid. A contractor who is interested in performing the job will independently prepare a bid price and submit it in a sealed envelope to the client or the client's representative prior to a designated time of bid opening. During bid opening, envelopes are opened, bids are announced and the apparent lowest bidder is declared. The evaluation process is performed and the job, usually, is awarded to the lowest evaluated bidder.

A submitted bid is an offer. When the bid is accepted by the client, it is binding. The bid price comprises an estimate of the direct cost, indirect cost and a markup. The estimated direct cost is the sum of labour, material and equipment costs that are assumed to occur in the execution of the project drawings and specifications. The indirect cost is the sum of all costs which are traceable to the project but which are not traceable to a single activity. This account is designated as job overhead. The markup is a percentage of the estimated total cost which a contractor adds to the estimated direct and indirect

costs to account for head office overhead cost, profit and contingencies (Clough, 1975). The size of the markup for a contractor varies from one bid to another, depending on a multiplicity of internal and external factors that are encountered in each markup decision. The very existence of a construction firm depends on its ability to assign an appropriate markup (Morse, 1977) which produces enough jobs and significant profits. Therefore, it is a must that each contractor develops a strategy for determining this markup, which allows the company to achieve its objectives under different bidding situations.

The markup should ideally consider:

1. A "risk-free" return on the contractor's investment in the project commensurate with the return available on other risk-free investment opportunities.
2. A "premium" to compensate the contractor for the uncertainties involved in the project ("contingencies" are often considered to include this compensation).
3. The risk-return preferences of the firm's equityholders, and not that of the management.
4. The competitive environment in which the contract is awarded.
5. A "reasonable" compensation for the human resources and skills to be utilized in the project, such as business, financial and managerial expertise, professional experience and technical know-how.
6. Other difficult, if not impossible, to quantify factors such as potential improved competitive position and opportunity to acquire new and valuable experience.
7. An allowance for the recovery of an "appropriate share" of the head office overhead expenses if contractually excluded from being directly charged to the client.

8. An adequate allowance for the marginal tax expenditures that the contractor may incur under the various sales and income tax laws applicable to the project or the firm.

The determination of the right amount of markup is an essential task of all contractors. However, how to determine this amount is not an easy task.

1.2 STATEMENT OF THE PROBLEM

In the Ghanaian construction industry there is an intense competition for the limited number of construction projects. Contractors need to use a more rational way to determine their markups because the awarding system depends basically on the lowest bidder criterion.

There is therefore the need to determine the markup that will help a contractor be the lowest bidder and at the same time maximize his/her profit for that particular project.

An item for "adjustment allowance" in the Grand Summary of Bill of Quantities is inserted by consultants for the convenience of bidders in making last minute adjustments to their Bid Price without the necessity of altering the unit rates and prices within the actual bills themselves. To enable contractors make the best use of this provision it has become necessary to establish the Minimum Acceptable Price (MAP) for the project below which the contractor should not accept the project, and that minimum feasible price is determined with the optimum markup.

The emphasis on contract pricing under this lowest bidder criterion must therefore be on the minimum acceptable price that depends on the optimum markup.

1.3 AIMS AND OBJECTIVES

The main aim of this study is to provide a tool to assist Ghanaian building contractors to establish optimum markup for construction projects.

Specific objectives are:

- To determine the relative importance that classes D1 and D2 building contractors attach to the factors that affect project markup determination.
- To identify the most important factors needed to determine the markup.
- To investigate the rate of return the building contractors require from their projects.
- To use the selected factors to establish a fair and reasonable markup that satisfies the required rate of return of the contractor from the particular (or at least the general risk-class of) project at hand.
- To determine whether there is any significant difference between classes D1 and D2 building contractors in assessing markup factors.

Based on the statement of the problem and the aims and objectives set for the study, the following hypotheses have been put forward as basis for investigation:

1. The project cash flow and the risk involved in the investment of the contractor are the main factors of consideration in establishing the optimum markup.
2. Classes D1 and D2 building contractors vary significantly in their evaluation of the various factors that are considered in the markup determination.
3. Ghanaian building contractors do not consider time value of money in markup determination.

1.4 JUSTIFICATION OF RESEARCH

Contract pricing decision, in contrast to design and other engineering decisions, must be made in the face of insufficient information about future construction processes that are stochastic, dynamic, interrelated, lagged, sometimes untested, and often difficult to predict.

According to Dun and Bradstreet [1986] the major causes of business failures among contractors are incompetence and lack of managerial experience. Although incompetence may refer to technical as well as managerial inabilities, the history of business failures in the construction industry indicates that lack of managerial skills is a far greater contributor than lack of technical skills.

These managerial problems apparently exist because most construction firms are managed by businessmen and family members. These managers have little education and training in construction, economics, management or finance. Therefore, their business skills are limited to what they may eventually acquire in dealing with real world situations. Such a trial-and-error managerial training may prove quite expensive.

This research will contribute to the body of knowledge of construction professionals in improving their managerial competence. Managers will achieve a better understanding of the effects of cash flow and the project's risk on the bid price and will have an analytical tool to aid their decision-making. This should substantially reduce the chances of neglecting or underestimating the effects of risk and thereby reduce the number of business failures in construction.

The research will identify the most important factors that affect markup and facilitate the determination of the optimum markup that satisfies the required rate of return of the contractor from a project. This will lead to the establishment of the

minimum acceptable price for the project, below which the contractor should not accept the project. Contractors can then make more intelligent contract pricing decisions to improve their competitiveness.

This will help in no small way to improve efficiency in the Ghanaian construction industry.

1.5 RESEARCH METHODOLOGY

Literature review was chosen as the initial method of preliminary information gathering. This was followed by a survey using a structured questionnaire. Interviews were conducted with some firms, which agreed to such interviews, to complement the points that may not have been adequately examined by the questionnaire. A critical desktop evaluation of the responses was carried out in order to establish the best model for the optimum markup decision.

1.6 FRAMEWORK OF RESEARCH

The study is organized in seven chapters, including this one.

Chapter Two compares a pricing method that seeks to satisfy the required rate of return of the contractor with the more traditional pricing practices used in construction.

Chapter Three gives an overview of studies addressing the competitive bidding strategy, which involves markup selection/determination, and reviews four studies specifically aimed at developing a more systematic method of computing a markup.

Chapter Four discusses the various aspects of risk and uncertainty in construction and the methods of incorporating risk into capital investment decisions. It then demonstrates how the rate of return by contractors for each particular project can be estimated systematically.

Chapter Five depicts the research methodology utilized in the research and how data was collected.

In chapter Six analyses of responses obtained from questionnaire survey conducted among building construction firms is carried out. The results of the responses are contained in this chapter. A general discussion of the results of the survey is carried out to simulate meaningful inferences.

Chapter Seven concludes the study by summarizing findings and proposals. It also outlines areas of interest for further research.

Four appendices containing details of the questionnaire used for the survey, summary of the categorization of the building contractors, the mathematics of the recommended model and an illustration of a computation of a markup using the model are presented at the end of the report.

1.7 SUMMARY OF MAIN CONCLUSIONS

The research drew the following major conclusions:

1) Project cash flow, risk involved in investment and competition are considered to be the most important factors in determining markup.

The FaRM Pricing Model, which follows a net present value approach and employs an expected-value cash-flow schedule with the uncertainties involved in the project considered in the determination of the required rate of return, is therefore considered the most suitable model for determining the optimum markup.

2) There is no significant difference in markup policies of building contractors in classes D1 and D2.

3) Though some management of the construction firms are involved in the markup decision-making, there are some participation by private consultants because some contractors do not employ qualified personnel as permanent members of staff to undertake the markup decision.

4) The method of recovery of head office overheads varies from one firm to the other. Head office overheads could be recovered either through the markup or charged as a cost item.

5) Building contractors in Ghana do not use mathematical or statistical models to determine markup. Majority of them use subjective judgement in markup decisions. Analytical tools are therefore needed for the markup decision-making.

6) There is no fixed rate of return that contractors require from their projects. Each project should therefore be assessed to establish the required rate of return that maximizes the wealth of the equityholders of the firm.

7) Building contractors in Ghana do not use cost and value curves in forecasting cash flow at the pre-tender stage. Where cash flow is undertaken, cost and value are estimated from the contract documents. As a result, forecasting of cash flows is not undertaken in situations where detailed contract documents and/or time are not

available. Education is required among a majority of the contractors on the importance of cost and value curves in forecasting cash flows.

8) The building contractors do appreciate the effect of time on the value of money.

CHAPTER TWO

PRICING PRACTICES

2.1 INTRODUCTION

Construction is a peculiar industry in the sense that its final product, in most cases, is neither standardised nor mass-produced. Each project is a unique product that is conceived and priced well in advance of its actual construction. Therefore, pricing in the construction industry is a rather "crude art" based on the professional expertise, experience and subjective judgement of the estimator or the quantity surveyor. (1)

This chapter compares a pricing method that seeks to satisfy the required rate of return of the contractor with the more traditional pricing practices used in construction, within the framework of basic price-setting models used in free-market economies. Since any pricing decision model strives to achieve a broader objective of the enterprise, a logical first step is to define the "objective of the firm".

2.2 OBJECTIVE OF THE FIRM

There are several goals of the firm. A partial listing that has been mentioned over the years includes:

1. Maximisation of profits.
2. Maximisation of sales.
3. Achieving a 'satisfactory' level of profits.
4. Achieving a target market share.
5. Achieving 'internal peace', or no ulcers for management as this objective is often called.
6. Maximisation of managerial perks and salaries.

All the above indicate that firms should maximise profit and minimise risk which is the first rule of the "game" to stay in business. In real life, a project with high profit potential is characterised by a high degree of risk and therefore management should weigh the return against risk and select the set of projects which maximises the value of the shareholder's wealth.

According to the theory of company finance the foremost inclusive objective of the firm is one of "maximising equityholders' wealth". J.C. Van Horne (1979) describes this objective best where he states:

> "... we assume that the objective of the firm is to maximise its value to its shareholders. Value is represented by the market price of the company's common stock, which in turn is a reflection of the firm's investment, financing and dividend decisions."

2.3 PRICE SETTING MODELS USED IN FREE-MARKET ECONOMIES

Pricing decision, an important task in any organisation, is theoretically a function of the objective of the firm. Yet economists have not been able to develop a general analytical model which can directly link the pricing decision to the broader objective of the firm. This is due to the interrelation and the complexities of the many factors involved in pricing. Pricing models used in practice tend to concentrate on one factor such as cost, competition, … etc., at the expense of the others.

The pricing models used in free-market economies are classified as follows:

1. **Cost-oriented Pricing:**

   Costs set the floor for the price that a company can charge for its product. The company wants to charge a price that both covers all its total costs and delivers a fair rate of return for its effort and risk.

Cost-based approaches to pricing include markup (cost-plus) pricing and target pricing.

- **Markup (Cost-plus) pricing:**

  This is a pricing method that adds a markup to the cost of the product.

  It is mostly used in pricing "non-routine" and "difficult-to-cost-in-advance" products such as construction facilities.

- **Target Pricing:**

  This is another cost-oriented pricing approach that determines the price at which the firm will break even, or make the target profit it is seeking. Prices are therefore set such that they would satisfy the required rate of return of the firm.

2. Demand-oriented Pricing:

This method uses the customer's perception of value, not the firm's cost structure, to set pricing.

The customer's perceived value is estimated, and then a price is set that would leave the customer with a slightly higher perceived value-to-price ratio than with any competing offer.

A modification of this method is the price discrimination.

- **Price Discrimination:**

  The firm may discriminate in its pricing policy on the basis of the customer, the product version, the place, or the time.

3. Competition-oriented Pricing:

The firm sets prices not directly on the basis of its own costs or demand, but on the basis of the prices that competitors charge for similar products.

There are two major variations of competition-based pricing – going rate pricing and sealed-bid pricing.

- **Going-rate Pricing:**

  The firm strives to charge its customers the average prices set by the industry.

- **Sealed (Competitive)-bid Pricing:**

  The firm faces the dilemma of setting the price at a level that will both enable the firm to win the contract and leave a minimum spread between the firm's low bid and the second-low bidder, so that it can presumably realise the highest possible profit under the circumstances.

The firm cannot, however, bid a price below a certain "Minimum Acceptable Price" (MAP) without damaging its financial position; i.e. diminishing the equityholders' wealth.

2.4 CONVENTIONAL PRACTICES USED IN CONSTRUCTION

Construction contracts are awarded in many ways. These methods can be classified into two general categories as below:

A. Negotiated Contracts:

Negotiated contracts can be of the following types:

- **Lump sum (Firm-fixed-price):**

  The completely-known, well-defined and accurately-documented construction project will be built in exchange for a fixed sum of money.

- **Unit-price / Schedule of Rates:**

  Payments will be based on the actual quantities of work put in place and unit prices stipulated in the contract.

- **Cost-plus-fee:**

  The contractor will be compensated for the incurred costs plus a "reward" for the effort. This type of contract can have many forms, among them:

  - Cost-plus-percentage-of-cost
  - Cost-plus-sliding-scale-percentage-of-cost
  - Cost-plus-fixed-fee
  - Cost-plus-fixed-fee-with-guaranteed-maximum
  - Incentive-contracts

B. Competitive-Bid Contracts:

A contract procured by competition will involve tenderers submitting quotations based upon documentation common to all.

Competitive-bid contracts can also be of the following types:

- **Lump-sum**
- **Unit-price**
- **Cost-plus-fee**

A comparison of Price Setting Models used in Free-Market Economies and Conventional Pricing Practices used in Construction, neglecting minor differences in the terminology used in marketing and construction, reveals significant similarities. "Demand-oriented Pricing" and "Going-rate Pricing" are not included in the

Conventional Pricing Practices used in Construction because they are not directly applicable to pricing of construction contracts.

Target Pricing, which has been ignored in construction, is the pricing model that seems suitable for the present competitive bidding situation in Ghana.

The remainder of this chapter serves to justify this position and offer a perspective of the general direction of this dissertation.

2.5 SHORTFALLS OF CONVENTIONAL PRACTICES USED IN CONSTRUCTION

According to Dun and Bradstreet, lack of financial and managerial skills are two of the major causes of business failures among contractors in the construction industry.

Because of these managerial problems and, hence, neglect of the target-pricing approach, a good number of contractors have long assumed that any cedi beyond the "estimated total cost" of a project is a cedi of profit. The definition of "estimated total cost" is far from universal. For example, the "appropriate" treatment of the head office overheads has been a major source of controversy in this area. (See section 3.4.6.1 "Head Office Overheads"). There are indications that in some cases the "estimated total cost" has even been perceived as the "actual cost" of the project, overlooking the uncertainty inherent in the expectation of a future event.

In the case of negotiated contracts, which are priced on a cost-oriented basis, this has led to negotiating prices that have not generally satisfied the required rate of return of the contractor, thereby diminishing the value of the firm to the equityholders.

In the case of competitive-bid contracts, the competition has cut prices to sometimes disastrous levels. This has been mainly due to a failure to include all cost items, "Return-On-Investment" (ROI) in particular, in the "estimated total cost".

2.6 TARGET PRICING: A NEW PRICING APPROACH FOR CONSTRUCTION CONTRACTS

Although Target Pricing is new to the pricing practices used in construction, it has long been used in other sectors of the economy. This is a cost-oriented pricing technique that attempts to ensure an adequate return on the investment of the firm.

Target pricing can be used for both negotiated contracts and competitive-bid contracts. Most, if not all, bidding strategies will still be valid if the minimum acceptable price (the resulting price of the model) is substituted for the estimated cost in the desired bidding model. This will reconcile "cost-oriented" and "competition-oriented" pricing models to ensure that prices set by the free-market competition do satisfy the return required by the equityholders of the firm.

However, when the construction industry is operating at low price levels, the prudent contractor is well advised to bid at the minimum acceptable price levels, or else face the risk of losing more of the jobs he/she bids for.

2.7 SUMMARY

The foremost inclusive objective of the firm is "maximising equityholders' wealth".

Cost-oriented, demand-oriented and competition-oriented models are the three basic pricing methods employed in free-market economies. Although construction contracts are awarded on either a negotiated or competitive-bid basis, there exists a parallel between these and the more general pricing models outlined in section 2.3.

Conventional pricing methods employed in construction are major causes of the economic problems of the industry. The Target Pricing method seeks to satisfy the required rate of return of the equityholders of the firm and is more in line with the objective of the firm than are the conventional pricing methods.

Reference

1. Farid, F and Boyer, L.T (1981), Construction Pricing Practices and Objective of the Firm, Proceedings of the CIB (W-65) International Symposium on Organization and Management of Construction, Dublin, Ireland, July 1981.

CHAPTER THREE

REVIEW OF EXISTING LITERATURE

3.1 INTRODUCTION

Chapter Two examined the Pricing practices used in construction within the broader framework of price setting models used in free-market economies and conventional pricing practices. It was concluded that a major portion of business failures in the construction industry is the result of poor pricing policies.

Clients, contractors, consultants and academicians have recognized this problem. Several studies have been undertaken, especially in the United States of America (USA), to develop better price setting models for construction contracts. This chapter will give an overview of the studies (both quantitative and qualitative) in addressing the competitive bidding strategy, which involves markup selection, and will review four studies specifically aimed at developing a more systematic method of computing a markup.

Many quantitative studies based on statistical decisions and the game theory have been conducted in the construction industry in an attempt to replace the mental model with a formal model which contractors can use in determining the most desirable markup. Friedman [1956] built his model on the assumption that in a competitive bidding situation firms submit bids with the objective of maximizing expectation values of profits to be realized. Employing the same argument, Park [1962], Casey and Shaffer [1964], Shaffer [1965], Broemser [1968], Gates [1971], Morin and Clough [1972], Wade and Harris [1976] and Carr [1982] developed their strategic models. Benjamin [1969] and Neufille et al [1977], on the other hand, introduced strategic models with the intention of maximizing the expectation value of

a contractor's utility value rather than monetary value. The most controversial issue that exists among these models is the assumption of dependency/independence among contractors letting when the joint probability of winning is calculated. (1)

Gates [1983] introduced a qualitative approach based on the Delphi technique, designated as the expert subjective pragmatic estimate (ESPE) as a solution to the markup problem. Recently Ahmed and Minkharah [1988] using the qualitative approach determined the factors affecting contractors' bidding strategy. The study investigated the level of importance of each factor on the contractor's decision to bid and on the size of the markup. Shash and Abdul-Hadi [1992] and Tanga [1998] have done similar work in Saudi Arabia and Ghana respectively.

Four studies specifically aimed at developing a more systematic method of computing a markup are Wages of Risk, Cash Flow-Markup Models and Fair and Reasonable Markup (FaRM) Pricing Model.

The first study, Wages of Risk, was conducted by J.M. Deponai [1980] at the U.S. Army "Construction Engineering Research Laboratory" (CERL).

The second and third research projects, closely related to each other, are the works of J.W. Fondahl [1972] and R.R. Bacarreza [1973] conducted at the "Construction Institute", Stanford University.

The fourth research, which is also related to the third, was conducted by F. Farid [1981] at the U.S. Army Construction Engineering Research Laboratory in Champaign, Illinois.

3.2 DEPONAI'S "WAGES OF RISK"

In 1964, the U.S. Department of Defence introduced the "Weighted Guidelines Method" for determining the "Profit Objective" on negotiated government contracts. This profit policy was subsequently interpreted in Engineer Regulation (ER) 1180-1-1 (Engineer Contract Instructions [ECI], paragraph 3-808), outlining procedures to be followed in determining "Fair and Reasonable Profit" for Cost-Reimbursement type construction contracts. In 1976, the US "Department of Defense (DOD) Profit '76 Study Team" made major changes to the profit policies of the Department of Defense. The U.S. Army Construction Engineering Research Laboratory was subsequently asked to develop an improved procedure for determining profit objective on Corps of Engineers' contracts. The result, Wages of Risk (Deponai [1980]), will be transferred to the field as Section ECI 3-808.2 of the proposed changes to ER 1180-1-1. (2)

3.2.1 Wages of Risk - An Interpretation of Weighted Guidelines Method

Table 3.1 summarizes Deponai's proposed changes to Engineer Regulation (ER) 1180-1-1. Each of the first five factors in Table 3.1 are assigned an "appropriate weight" from zero to one, based on the circumstances of the contract at hand. These "weights" are multiplied by the "predetermined rates" in order to determine a "value" for the contribution of each factor to the "profit objective". Conversely, for the sixth factor, an "appropriate rate" is assigned and is multiplied by 0.4, the "predetermined weight", in order to compute the "value" of the "Base Incentive" factor's share of the overall markup percentage. The summation of these values prescribes the "Profit Objective" in terms of a markup percentage.

Assuming a (6-20) per cent range for the "Base Incentive" rate, the "Profit Objective" varies from a minimum of 2.5 percent to a maximum of 20 per cent, approximately.

This approach is an improvement over the conventional practice of using a subjective markup percentage, mainly because it recognizes the importance of the degree of investment and risk associated with construction contracts. Notice how terms such as investment, type of contract, difficulty of work and duration of work appear in Table 3.1.

3.2.2 Wages of Risk - Limitations

The main shortcoming of this method is the implied assumption of 12 per cent ceiling for markup. Deponai justifies this arbitrary ceiling as follows:

> "An arbitrary 'ceiling rate' of 30 per cent (annual rate) as assumed as an appropriate Return on Investment (ROI) for the most risky construction jobs. Dividing this ROI ceiling rate by an average turnover of 2.5 for the construction industry yields a markup ceiling of 12 per cent [30/2.5] for the 'average' construction industry".

This "average" construction company viewpoint does not consider the investment requirement and risk complexion of the particular project at hand. Neither does it consider the effect of the prospective project on the existing projects portfolio of the firm. Instead, it assumes both an average project and an average contractor.

Moreover, the distribution of this 12 per cent "fair and reasonable" profit among different profit factors and its subsequent transformation into predetermined "rates" assigned to each factor in Table 3.1 is in effect arbitrary.

The approach also fails to consider the effects of other important profit factors such as income taxes, inflation, … etc.

Table 3.1 Weighted Profit Factor Guidelines for use in Construction Contracts and Modifications

	Factor	Rates (%)			
		Before Fact	After Fact*	Weight (0.0-1.0)	Value (%)
1	Relative Difficulty of Work	2.6	1.3		
2	Contractor Participation**	1.2	1.2		
3	Type of Contract+	2	0		
4	Duration of Work	1.4	1.4		
5	Fixed Asset Investment	4.5	4.5		
6	Base Incentive++			0.4	
	PROFIT OBJECTIVE:				

* This column is used if contract price is settled after the work is performed; otherwise the "Before Fact" column is used.

** Factor 2 considers the degree of subcontracting. Its assigned weight linearly varies from 0.0, where main contractor performs 20% or less the money value of the job, to 1.0, where all the work is performed by the main contractor.

+ The weight for this factor normally changes from 0.0 for a cost-plus-fixed-fee contracts to 1.0 for a firm-fixed-price (lump-sum) contract.

++ Deponai suggests using the Treasury bill rate as a "convenient and reasonable indicator of … risk-free market opportunities". The 0.4 weight is based on the assumption of a turnover (volume/assets) rate of 2.5.

3.3 FONDAHL AND BACARREZA'S "CASH FLOW-MARKUP MODEL"

Two technical reports by Fondahl and Bacarreza [1972] and Bacarreza [1973] propose the consideration of a construction project as a capital investment opportunity. Applying the principles of capital budgeting, they propose techniques for determining an appropriate "Markup" to be used in bidding for construction contracts. (3) (4)

The Fair and Reasonable Markup (FaRM) Pricing Model, as discussed in Section 3.4, is based on the same conceptual framework. Hence, the analytical details of how the markup can be related to the cash-flow schedule are deferred until Section 3.4, where the basic present value framework for determining the fair and reasonable markup is presented.

3.3.1 Construction Contract Markup Related to Forecasted Cash Flow

In this earlier work, Fondahl and Bacarreza [1972] illustrate how a manual or computerized "Cash Flow-Markup" model can be developed.

The model may not be suitable for every construction company. In fact, it may prove more efficient and economical to develop a custom-made model (either manual or computerized) in accordance with the specific accounting, control, and computer systems employed by the company. Such a model should be viewed as only a part of the overall "Management Information System" (MIS) of the firm.

The model lacks consistency with respect to the precision exercised in different parts. For example, approximate cost curves are used to estimate the cash-flow schedule while daily compounding is employed to calculate the present value of cash flows.

3.3.2 Construction Project Markup Decision Under Conditions of Uncertainty

Bacarreza [1973] subsequently expands the scope of the earlier report and studies the effects of incorporating risk into the cash-flow-markup model. He develops a set of probability density functions of Net Present Values (NPV), given different markups, and argues that "The decision criterion is then to choose a markup M2 such that the expected utility of the NPV, given that markup, is equal to the utility of obtaining a zero NPV with absolute certainty, i.e.:

$$E\{U(NPV|M2)\} = U(O).$$"

Bacarreza further states that "This approach, though very satisfactory from a theoretical point of view, is very difficult to apply in most real world situations. Major problems are the construction of the utility function (especially multi-party utility function), and the question of whose utility function to use (i.e., management, equityholders, … etc.)."

To remedy the difficulties involved he suggests that "If the projects are of the same type and, roughly, of the same size, the markup decision criterion is to choose a markup M2 such that the expected NPV, given that markup, is not less than zero. That is:

$$E(NPV|M2) \geq O.$$

Since the markup calculations are based on the use of the company's minimum attractive rate of return (RRR), this criterion applied over a series of projects should result in the realization of at least that required rate of return. However, this criterion must be coupled with one that provides against the risk of events such as financial ruin".

Bacarreza's position on the difficulties involved in the construction of utility function, at least at the present state-of-the-art, is plausible. But, there appears to be

no advantage to the stochastic model if the remedy is to find a markup that yields at least a zero expected NPV for the project. Infact, the same result can be obtained by employing the expected values of cash-flows in a deterministic model and finding a Fair and Reasonable Markup (FaRM) which will yield a zero NPV for the project.

Bacarreza discount the estimated cash flows at the "minimum attractive rate of return" (RRR). But a sizeable portion of the RRR is a premium for the risk involved in the estimated cash-flow schedule of the project (i.e. the fact that cash-flow figures are random variables whose exact values are not known until the project is completed). Hence, the appropriate discount rate for a stochastic model, in which the randomness of variables involved is explicitly considered, must be the "Risk-Free-Rate" [See Mao (1969) and Van Horne (1976)].

For these considerations there was the need for a pricing model that could employ an expected-value cash-flow schedule and consider the uncertainties involved in the development of the RRR.

3.4 FARID'S "FAIR AND REASONABLE MARKUP (FaRM) PRICING MODEL"

To have a valid conceptual framework and all the tools necessary to properly apply capital budgeting techniques in pricing of construction contracts, Foad Farid [1981] developed the FaRM Pricing Model following a Net Present Value (NPV) approach and employing an expected-value cash-flow schedule. The uncertainties involved are considered in the determination of the required rate of return. (5)

3.4.1 Definition of FaRM

A "Markup" which is considered as "Fair and Reasonable" (FaRM) was defined as:

> The FaRM would be viewed as the smallest markup which satisfies the Required-Rate-of-Return (RRR) of the contractor for the particular (or at least the general risk-class of) project at hand,

where

> The Required Rate of Return (RRR) is the return investors expect the firm to earn on its projects. This is the return required to maintain the present market price of a share of common stock of the firm.

3.4.2 FaRM Pricing Model: Information Required

In addition to the RRR, various taxes and inflation, the project's "Cumulative-total-cost Curve", commonly known as the "S curve", is needed as input to the FaRM Pricing Model.

A typical Modified-Cumulative-Total-Estimated-Cost Curve is shown in Fig. 3.1. The term "modified" is to signify that the S curve is modified to be more suitable to the FaRM Pricing Model. The horizontal axis shows typical end-of-periods. The vertical axis is modified to show cumulative cost as a percentage of the total-estimated-cost of the project. The word "estimated" signifies that this curve depicts only the contractor's best estimate of the project's actual cost.

This curve provides sufficient information for determining the FaRM for most types of construction contracts. Most contractors are better prepared, and more comfortable, to estimate cost on a percentage basis rather than absolute terms, at the

End-of-month	% of Total-Estimated-Cost of Project
0	0
1	3.3
2	21.9
3	46.4
4	80.3
5	96
6	100

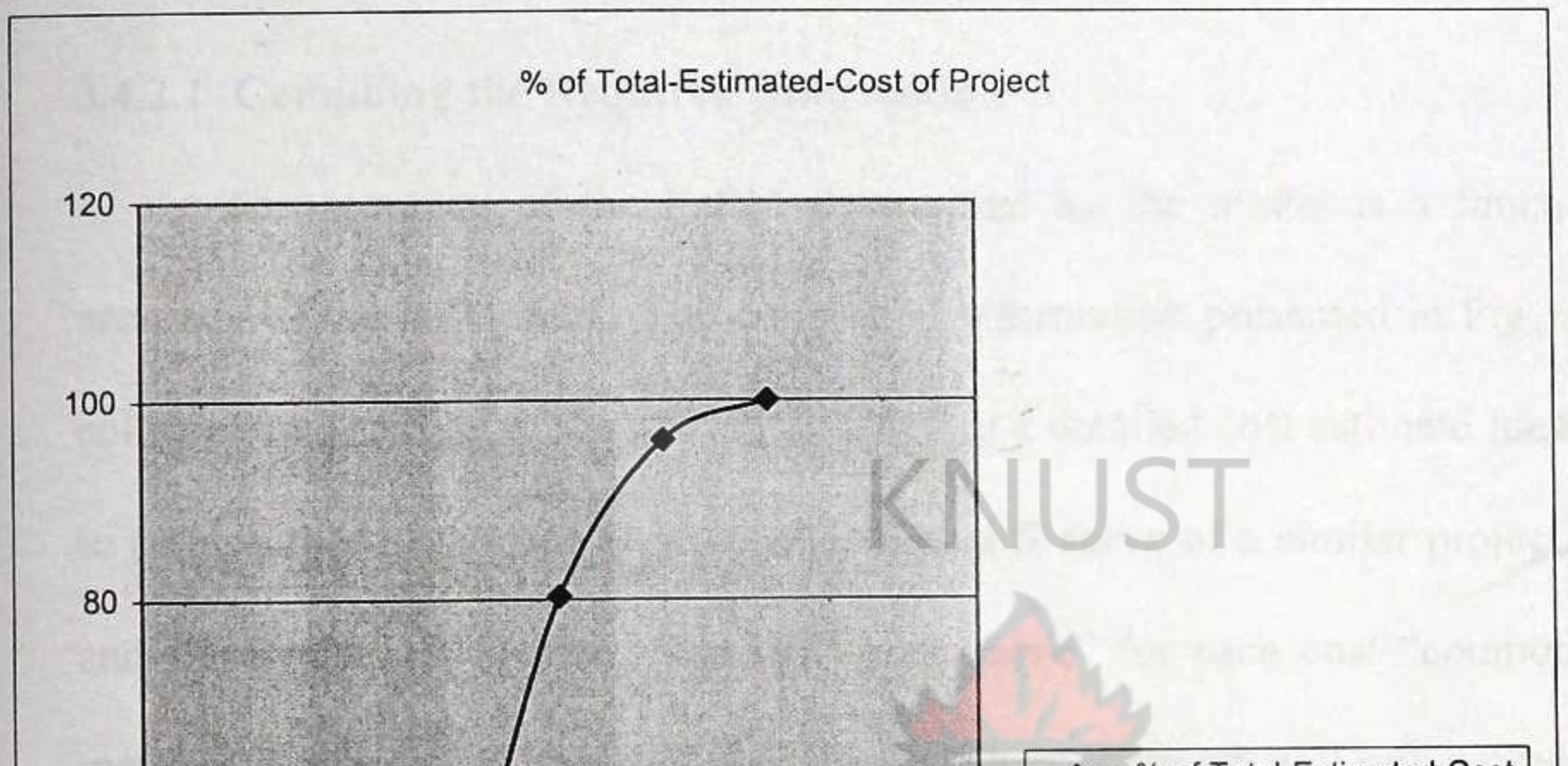

Fig. 3.1 - A Typical Modified-Cumulative-Total-Estimated-Cost Curve

busy time period before bidding on (or negotiating) a contract when only a limited amount of information is available.

Other information required as input to the model include billing, payment and retention policies that are specified in the contract.

3.4.2.1 Compiling the Required Information

The accuracy of the FaRM determined by the model is a function of the accuracy of the input data. The condensed information presented in Fig. 3.1 can be collected in a variety of ways from conducting a detailed cost estimate for the project to using either a standard S curve or an actual S curve of a similar project. Fondahl and Bacarreza [1972] use a standard "cost curve" for each cost "component" (i.e., material, equipment, … etc.) of the project. Their approach will prove useful in some cases where the availability of data, or time to process them, is very limited.

Contractors, after careful consideration of the specific circumstances of the project at hand, are in the best position to decide how this information should be collected.

3.4.3 FaRM Pricing Model: Cash-Flow Schedule

3.4.3.1 Translating Incurred Costs into Cash Outflows

Cash-flow analysis is primarily concerned with the amount and timing of the actual funds transferred rather than costs incurred. At the same time, the cumulative total cost is a pool of costs encompassing every cost component, i.e., material, equipment, labour, and subcontract. Although these costs are technically incurred throughout the period, the actual timing of payments varies considerably. For

example, casual labour is paid daily or weekly whereas indirect labour costs are paid on a monthly basis. Furthermore, there exists a significant variation in the terms of materials and equipment acquisition. There are cases where contractors can delay payments for several months. On the other hand, sometimes contractors prefer to purchase, and even to make a down-payment on, certain types of materials well in advance of what the schedule indicates, in order to ensure the availability of some critical items or to get ahead of inflation. One possible solution might be to use a weighted average lead/lag time for those cases where the contractor has compiled a detailed cost breakdown and can reasonably estimate the lead/lag from the time each cost item is incurred to the time it is actually paid for.

To circumvent these difficulties, it is assumed that management requires the company to have available at the end of each time period sufficient funds for the projected total incurred cost of the following period.

3.4.3.2 Billing Policy Factor

Sometimes contractors discover that they cannot include all the incurred costs during certain periods in the interim valuations for those periods. Examples include cost of mobilization, haul roads, installing plants, and in some cases materials delivered to the site but not yet used in any completed work item.

On the other hand, there are frequent cases where contractors can and do submit valuations in excess of their actual incurred costs - the so-called front-end loading.

The "billing factor" is included to take care of both situations. In the case of front-end loading the billing factor would have a value larger than 1.0 initially.

3.4.3.3 Payments Time-lag

Construction contracts typically provide that interim valuations are made at the end of each month. The consultant prepares a payment certificate and together with the valuation forwards the documents to the owner/client. The client has an obligation to honour the certificate within the period for honouring of certificates so stated in the contract.

Clients are often slow in making payments, for a variety of reasons. Processing, verifying and making arrangements for payments often take longer than anticipated.

For these reasons time should be allowed from the time a valuation is made to the time the actual payment is made.

3.4.4 FaRM: A Function of RRR and Cash-Flow Schedule

When the Cumulative-Cash-Flow Schedule for a project is prepared the difference between cash inflow and cash outflow is the **markup** and **the time the client takes to honour a payment certificate**. As a result cash outflows and cash inflows cannot be combined into net cash flows because cash inflows should be "marked up" by the FaRM which is unknown at this point.

If the required return of the contractor is neglected, both cash outflows and cash inflows invariably add to 100 per cent.

However, the summation of Present Values (PV) of before-FaRM payments ($\sum PV[S_j]$) is less than the same figure for costs ($\sum PV[C_j]$), because of the time-lag involved between expenditures and corresponding payments.

Marking up the cash inflows by the FaRM (m_f), and setting the "Net Present Value" (NPV) of the project equal to zero, according to the definition of the FaRM;

$$NPV = (1 + m_f) \sum PV[S_j] + \sum PV[C_j] = 0 \quad \text{....(3a)}$$

or,

$$m_f = -\{ \sum PV[C_j] / \sum PV[S_j] \} - 1 \quad \text{....(3b)}$$

Eq. 3b indicates that the FaRM is a function of the ratio of the present value of cash outflows (costs) to the present value of cash inflows (payments). Therefore, all cash flows can be expressed on either an absolute or relative (e.g. percentage of total cost) basis.

3.4.5 FaRM Pricing Model: Minimum Acceptance Price (MAP)

The illustration below shows how the contractor's "Minimum Acceptable Price" (MAP) for a project can be determined once the FaRM is known.

MAP Related to FaRM

a	Total Cost of Project	A
b	FaRM @ x %	B
c	Contract Price before bond premium	C = A + B
d	Cost of bond	D
e	Minimum Acceptable Price (MAP)	E = C + D

A contract bond is required for almost every construction contract except a few cost-plus fee type projects. The cost of bond is generally determined by the contract price.

The firm cannot accept the project at a price below this MAP without damaging its financial position. Bidding strategies should be based on the MAP rather than the conventional total estimated cost of the project. (6)

3.4.6 FaRM Pricing Model: Further Discussion

Some issues, which are often major sources of misunderstanding, confusion, or controversy, are the focus of this section.

3.4.6.1 Head Office Overheads

Head Office overhead expenses are those costs that are incurred in support of the overall operation of the company but cannot generally be charged to any particular project.

Fondahl [1972], Bacarreza [1973], Park [1979], Cook [1991] and Amoa-Mensah [1995] have advocated the position that head office overhead expenses are not directly billable and therefore, should be recovered through markup. Clough [1975] and Harris and McCaffer [1977] suggests that head office overheads should either be added as a separate cost item or, alternatively, the markup percentage should include an allowance for the recovery of "an appropriate share" of these expenses. Roy Pilcher [1992] is of the opinion that the markup should not include head office overheads.

As the definition of the FaRM strongly suggests, every item of cost to the contractor must be included in the pool of the total estimated cost of the project.

However, in certain types of construction contracts, such as cost-plus-fee type projects, contractors often are not allowed to directly charge the head office expenses in interim valuations.

To circumvent this restriction and to accommodate those who suggest that markup should include an appropriate share of the head office overheads, a revised form of the FaRM Pricing Model is used.

3.4.6.2 Interest Costs During Construction

Ashley [1977], Riggs [1977] and Thuesen [1977], among others, have included a separate item of "interest costs", on an assumed loan used in financing the job, in their economic studies of projects. Other labels which have been used include "Interest During Construction" and "Allowance for Funds used During Construction".

It is true that, in certain cases, contractors may be able to finance an entire project through a bank loan at a fixed interest rate. Equally true is the resulting temptation to include this interest cost in the cash-outflow stream of the project.

This argument, however, overlooks the fact that the bank loan could not have been obtained without the contractor's underlying equity capital base. Lending institutions are obligated to make sure that the contractor has adequate income capacity to service debts before extending credit.

Thus, the bank, along with the firm's other creditors, may have claim to the total assets of the contractor, not just the revenues generated by this particular project, if financial difficulties arise.

The contractor, on the other hand, must repay both the principal and interest to the bank regardless of what happens to the project.

The differences in the risk characteristics of the financing and investment decisions make it imperative that they are treated separately even though these two decisions are, in fact, related. Mao [1969] and Johnson [1977], among others, express the same opinion.

It will be realized that the RRR is to recover these costs.

3.4.6.3 Return on Long-Term Investment of Contractor

Another source of persistent controversy in the construction industry is the contractor's compensation for equipment utilized on the job. This is most troublesome on jobs where the contractor owns the equipment. It centres on the question of whether or not the contractor should be allowed to charge a use rate (similar to a rental rate) for equipment.

Equally troublesome, though less common, is the more general question of whether the contractor should be compensated for his long-term investments (fixed assets, such as land, buildings, plant, equipment, … etc.) through appropriate cost items or markup ("profit").

The FaRM Pricing Model only considers the short-term (i.e. working capital) investment of the contractor as pictured by the cash-flow schedule of the project.

The implicit assumption is that the appropriate "reward" for the contractor's investment in any long-term asset utilized in the project is included in the direct cost of the associated activity, project overhead, or unallowable costs.

3.5 SUMMARY

The "Weighted Profit Factor Guidelines" proposed in J.M. Deponai's Wages of Risk is an improvement over the conventional practice of using subjective markup percentage. However, the approach imposes an arbitrary ceiling on markup and arbitrarily distributes this markup among different "Profit Factors".

Fondahl and Bacarreza [1972] in the first report, "Construction Contract Markup Related to Forecasted Cash Flow", offer a "non-computer" and also an "interactive computer" version of the "Cash Flow-Markup" model. These models are rather inflexible and inconsistent.

Bacarreza [1973] in the second report, "The Construction Project Markup Decision Under Conditions of Uncertainty" studies the markup under the conditions of risk. Because of the difficulties involved in the interpretation of the results, and even more importantly, because of the current lack of meaningfully data to be employed in the model, there is little additional information to be learned by pursuing a stochastic approach instead of a deterministic method. Furthermore, using the RRR as the discount rate for a stochastic model is tantamount to double counting the risk, because the RRR includes a premium for the uncertainties involved in the cash flows. In fact, the appropriate discount rate for such a model must be the "Risk-free Rate".

The Fair and Reasonable Markup (FaRM) Pricing Model by Farid [1981] is based on reasonable, adequate, and easily accessible information, quantitative in nature and yields a Minimum Acceptable Price. It directly relates to the "maximizing equityholders' wealth" objective of the firm and systematically considers the interrelations of the factors of markup and incorporates them into the model through the Required Rate of Return and the Cash-flow Schedule of the project.

The FaRM Pricing Model seems suitable to solving the problem at hand. It is therefore the intention of this dissertation to look for evidence to support or challenge the propositions of Farid, F., in his "Fair and Reasonable Markup (FaRM) Pricing Model: A Present Value Approach to Pricing of Construction Contracts".

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CHAPTER FOUR

RISK AND REQUIRED RETURN

4.1 INTRODUCTION

The process of determining required return involves the calculation of the appropriate level of return to compensate the firm for the risk undertaken. If a firm is considering a high-risk proposal, it should get a high return. A low-risk proposal would offer a lower return in most situations. (1)

In construction the probability of winning a particular contract is a function of the markup employed. But, according to the FaRM Pricing Model, the markup itself depends on the rate of return (RRR).

A survey conducted by Gareis [1979] in USA disclosed that 70 per cent of construction firms use either the "firm's historical" or "management determined target" rates of return. This chapter demonstrates how this rate of return required by contractors for each particular project can be estimated systematically.

4.2 RISK AND UNCERTAINTY IN CONSTRUCTION

Erikson [1979] offers a "working definition of risk" in construction as:

> "Exposure to possible economic loss arising from involvement in the construction process".

This definition indicates that risk is perceived as some variability measure of the outcomes of a proposed economic activity. Often, the variance (or standard deviation) of possible outcomes is used as the index for measuring risk.

4.2.1 Sources of Uncertainty

Park [1979] explains that risks in construction are "brought about by nature, by shortcomings in the contractor's own organization, or by outside influences". He gives the following list of twelve major risks that contractors normally face:

1. Weather
2. Unexpected job conditions
3. Personnel problems
4. Errors (in cost estimating, scheduling, ... etc.)
5. Delays
6. Financial difficulties
7. Strikes
8. Faulty materials
9. Faulty workmanship
10. Operational problems
11. Inadequate drawings or specifications
12. Disaster.

Erikson [1979] classifies risks in the construction process as "contractual risk" and "construction risk".

Contractual risk is primarily caused by "lack of contract clarity, absence of perfect communication between the parties involved, and problems of timeliness in contract administration". Contractual risk can be reduced by "improving contract clarity and contract administration", at little additional cost.

Construction risk is "inherent in the work itself" and can only be reduced marginally. Factors responsible for this class of risk include "weather, differing site conditions, acts of God, resource availability, ... etc."

Farid [1981] considers "total risk", in the FaRM Pricing Model, as consisting of "systematic risk" and "unsystematic risk". This classification is very crucial for Portfolio Theory and Capital Market Theory.

4.2.1.1 Systematic Risk

This is alternatively referred to as "non-diversifiable" or "unavoidable" risk. It is related to the "overall market risk" and cannot be diversified away. Factors of particular interest to the construction industry include unanticipated increases in inflation or interest rates, labour shortages and economic downturn or recession.

4.2.1.2 Unsystematic Risk

This is alternatively called "diversifiable" or "avoidable" risk. It cannot be described by the overall market movement and is unique to the particular company or project. That is, unsystematic risk is independent of any economic, political, social or any other factor that affects the market in a systematic manner. This is the part of risk that can be diversified away. Sources of this class of risk in construction include weather, unexpected job conditions, strikes and particularly financial difficulties.

4.3 METHODS OF INCORPORATING RISK INTO CAPITAL INVESTMENT DECISIONS

In any economic undertaking, risk is an ever-present fact which must be managed and accounted for, but cannot be eliminated completely. However, risk can often be reduced by prudent application of risk analysis techniques.

Traditionally, contractors, as well as other businessmen, have subjectively included an allowance for the perceived risk of the project in their final bid prices.

More often than not, this "contingency" item is included in the markup which is intended to cover both profit and contingency.

More formal methods of risk analysis include Dual Risk-Return (DRR), Certainty Equivalent (CE) and Risk-Adjusted Discount-Rate (RADR) methods.

4.3.1 Dual Risk-Return Methods

With this method some measures of risk and "return" of the investment in question are often quantified and submitted to the management. Their decision will be based on the expected value or standard deviation (or variance) of the distribution of possible returns. The project is evaluated in isolation without any explicit consideration of either systematic risk or the impact of the project on the total risk-return complexion of the company. The decision depends entirely upon the perception of the management with regard to investors' trade-off between return and risk.

There is no direct link between the "maximization of equityholders' wealth" objective of the firm and the DRR methods. Therefore, these methods are less than desirable.

Examples of these methods include the use of expected value-variance (standard deviation) decisions and simulation techniques.

4.3.2 Certainty Equivalent Method

The Certainty Equivalent (CE) method incorporates risk into Discounted Cash Flow (DCF) techniques by making adjustments to the numerator of the DCF equation.

The CE method accounts for risk by multiplying the risky net cash flow for each period by a corresponding "certainty equivalent adjustment factor". The result is

the "certainty equivalent net cash flow" which can then be used in DCF equations. The appropriate discount rate here is the risk-free rate, because the uncertainty has been incorporated into the certainty equivalent net cash flows.

The major problem with the CE method is the question of how the certainty equivalent adjustment factors can be determined.

4.3.3 Risk-Adjusted Discount Rate Methods

The Risk-Adjusted Discount-Rate (RADR) method also incorporates risk into DCF techniques by making adjustments to the denominator of the DCF equation.

The RADR must include:

1. An allowance for the time value of money (i.e., risk-free rate)
2. An allowance for the uncertainties involved in the cash-flow stream of the project.

That is, adjustments for risk and time are combined into a single factor.

Many financial managers prefer RADR methods because of their familiarity, practicality and convenience. It is also considerably easier and less troublesome to determine the RADR from the market and other available information than to compute the certainty equivalent adjustment factors. The RADR method was therefore selected with the FaRM Pricing Model.

4.4 DETERMINATION OF APPROPRIATE DISCOUNT RATE

Risk-adjusted discount rate methods have been known and practised for quite some time. However, the question of how the appropriate discount rate (i.e. the RRR) can be determined has persistently created controversy, confusion and misunderstanding.

In the early years, it was argued that the final decision should be left to "management preferences". Later on, the "Weighted Average Cost of Capital" found widespread acceptance.

With the advent of the Portfolio Theory, first introduced by Markowitz [1952], and subsequently the Capital Market Theory, developed by Sharpe [1964] and Lintner [1965], a new surge of interest was created, making this a fast growing area of finance.

4.4.1 Firm in Market Context

This is the "Weighted Average Cost of Capital" (WACC) approach which implies that investment opportunities are inevitably financed out of a pool of funds raised in a variety of forms such as equity capital, preferred stock, long-term debt, ... etc.

The name, Firm in Market Context, signifies three points. First, the approach is concerned with the risk-return complexion of the firm as a whole and not the individual assets. Second, the value of the firm is what creditors and investors at the market place perceive externally, not the internal viewpoint of the management. Third, the advent of the capital market theory does not necessarily mean the demise of the classic WACC approach. (2)

The major underlying assumptions of the WACC approach include:

1. The new project and the existing projects of the firm are completely homogenous with respect to risk.
2. The unsystematic risk of the new project does not provide any diversification benefit to the firm, if indeed this risk is of any significance at all.

As far as construction projects are concerned, these assumptions do not appear to create any problem. In those cases where the presence of these assumptions seems questionable, the use of the WACC approach is inappropriate.

4.4.1.1 Firm's Capital Structure (Sources of Funds)

Business enterprises normally finance their capital investment projects by internal sources, external sources, or both.

The internally generated portion generally comes from the following sources:

1. Depreciation charges,
2. Retained earnings,
3. Decreased working capital.

The externally generated portion is normally raised by issuing some combination of the following securities:

1. Debt securities (bonds, ... etc.),
2. Preferred stocks,
3. Common stocks.

Other means of financing, such as leasing, convertible securities and other options, are used in the market place. The different methods of financing can be conveniently classified into the three major sources of financing - equity, debt and preferred stock.

In order to compute an overall WACC, the costs of the individual components of the capital structure must be determined first.

4.4.1.2 Cost of Debt

The approach for determining the effective cost of debt, as well as any other fixed income security, is to solve for that discount rate (k_d) which sets the net present value of all cash outflows (interest and principal payments) plus cash inflows (proceeds) equal to zero.

Mathematically,

$$NPV(k_d,m) = P_N - I_t\,(PVIFA_{kd,m}) - P_m\,(PVIF_{kd,m}) = 0 \qquad .....(4a)$$

where,

P_N = net proceeds of the debt issue

I_t = fixed interest cost (including handling) per period

m = number of years to maturity

P_m = maturity (par of redemption) value of the debt security including any handling cost

k_d = cost of debt financing

$PVIF_{kd,m}$ = present value interest factor for a single amount discounted at k_d% for m periods.

$PVIFA_{kd,m}$ = present value interest factor for an annuity when interest is discounted annually at k_d% for m periods.

The effective cost of debt is estimated by solving Eq. 4a for k_d, the Internal Rate of Return (IRR) for the cash flow stream of the debt instrument.

4.4.1.3 Cost of Preferred Stock

Preferred stock is a hybrid between debt and common stock securities. It is considered a fixed-income security because it carries fixed periodic dividend payments.

The appropriate formula for calculating the cost of preferred stock is a perpetuity formula because this type of security does not have a maturity date. Hence,

$$k_p = D_p / P_N \quad \text{.....(4b)}$$

where,

k_p = cost of preferred stock financing

D_p = stated annual dividend

P_N = net proceeds of the new preferred stock issue

4.4.1.4 Cost of Equity

The cost of equity capital is theoretically defined as the minimum rate of return the corporation must earn on the equity-financed portion of its capital structure to keep the market price of the firm's stock unchanged.

Two models will be reviewed here. The first model is based on the Capital Market Theory. The other is based on investors' perceived value of the future stream of dividends that they hope to receive eventually.

4.4.1.4.1 Cost of Equity - Capital Market Theory (CMT) Model

The capital market theory implies that the expected return for the proportion of equity capital in the overall pool of financing, **e,** can be expressed as

$$k_e = i + [\, E(R_m) - i \,] \beta_e \quad \text{..... (4c)}$$

where,

k_e = cost of equity capital

i = the risk-free rate of return

$E(R_m)$ = the expected value of return of the market portfolio

β_e = systematic risk index of security e.

The strength of the capital market theory lies in the fact that all the factors in Eq. 4c, except beta, are market parameters which are independent of the particular security, e, and are freely accessible. Therefore, the task of estimating the cost of equity capital is simply reduced to one of measuring the systematic risk index, beta, of the company.

4.4.1.4.2 Cost of Equity - Stream of Dividends Model

This model defines the cost of equity capital (k_e) as the discount rate that equates the present market price of the stock (P_o) with the present value of the expected future stream of dividends per share (D_js). This valuation concept is based on the premise that dividends are all that investors hope to receive, collectively. Mathematically,

$$P_o = \sum_{j=1}^{\infty} D_j / (1 + k_e)^j \quad \text{..... (4d)}$$

where j is the end of time periods. k_e is the IRR for investing in a share of common stock of the corporation as perceived by investors.

Gordon has shown that if dividends per share are to grow at a constant rate (g) indefinitely, and providing g is less than k_e, then k_e can be expressed as:

$$k_e = (D_1 / P_o) + g \quad \text{..... (4e)}$$

where D_1 = dividend per share expected at the end of year 1.

The problem is how to determine the appropriate growth rate, g, which is supposed to be perpetual. One possible solution is to use the past trends in earnings per share as proxy for future growth. If it is felt that such an assumption is unrealistic, the option is to use the internal estimates of the expected future growth in dividends per share.

4.4.1.5 Weighted Average Cost of Capital (WACC)

The WACC stipulates that the cost of the individual sources of financing must be weighted by their corresponding proportions in the overall pool of financing, so that an average cost of capital can be determined. Mathematically,

$$k_c = \sum_{h=1}^{H} W_h k_h \qquad \text{.....(4f)}$$

where,

W_h = the appropriate weight

k_h = the corresponding cost of the h^{th} source of financing

H = number of different sources of financing to be employed

k_c = WACC.

For example, if the firm is to employ only one class of debt with weight of b and at the cost of k_b, one class of preferred stock (p at k_p), and one class of equity (e at k_e), Eq. 4f will be reduced to:

$$k_c = bk_b + pk_p + ek_e$$

where $b + p + e = 1$

The major unresolved issue is the question of how to determine the appropriate weights. Most authors, like Weston [1978] and Van Horne [1980], seem to favour weights based on the market values of different sources of financing. In recent years however, the trend has been toward advocating weights based on, in a sense, book values.

4.5 SUMMARY

Systematic risk is related to the overall market risk and cannot be diversified away. Unsystematic risk cannot be described by the overall market movement and is unique to the particular company or project.

Dual risk-return, certainty equivalent, and risk-adjusted-discount-rate (RADR) are three alternative methods of incorporating uncertainty into capital investment decisions.

The firm-in-market context is a RADR method adopted by the FaRM Pricing Model. This approach stipulates that the cost of the individual sources of financing must be weighted by their corresponding proportions in the overall pool of financing, so that an average cost of capital can be determined.

An accurate required rate of return (RRR) is needed to compute an optimum markup.

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CHAPTER FIVE

RESEARCH METHODOLOGY AND DATA COLLECTION

5.1 RESEARCH STRATEGIES / APPROACH

This research has taken the form of a literature review and a survey using questionnaire approach.

Generally, three types of review with different purposes are identified. These include:

- Integrative review - which aims at summarizing past research by drawing overall conclusions from separate studies that are believed to address related or identical hypothesis.
- Theoretical review - which is the attempt to present the theories offered to explain a particular phenomenon and to draw a comparison between them with regard to their 'breadth, internal consistency and the nature of their predictions'.
- Mathematical review - which is intended to examine the measured methods and operational definitions that have been applied to a problem area.

The approach in this research is the integrative literature review that has been observed to suit the aims and objectives. (See chapters two, three and four).

To determine the approach to the methodology of the research, it is important to define the fundamental question in order that the research can be planned to follow logical steps from which conclusions can be drawn. The question that this research is seeking to explore is:

What is the optimum markup for each project that establishes the minimum acceptable price for the project below which the contractor should not accept the project and to relate this to the lowest bid selection criterion currently in use in the construction industry. How does the implementation of this system influence contract pricing decisions?

Following this reasoning it was decided to carry out the research in three phases as follows:

Firstly to undertake a literature search from industry and academic journals worldwide to address this markup decision.

Secondly to design a postal questionnaire using a modification of the questionnaire originally prepared for a markup study at the University of Cincinnati by Ahmed and Minkharah [1988], to survey a substantial cross section of Ghanaian building contractors. This industry wide survey will provide data and opinions relating to the importance that building contractors attach to the factors that affect the markup decision.

And finally, to analyze the results of the questionnaire statistically, use the results to form the basis for recommending a suitable model for the markup decision and make recommendations for further research.

5.2 DATA COLLECTION

The primary source of data for this research is in the form of a postal questionnaire, designed to gather a large volume of data from the top management of

classes D1 and D2 building contractors in all the ten regions of Ghana, within the limited time and financial constraints. The primary function of the survey is to collect information that can be analyzed to produce conclusions about the area of markup decision. In order to evaluate the survey method to be adopted, it is important to consider the purpose to which the information is going to be put, the relative cost of different methods and also the time frame within which a response is required.

5.2.1 Sampling

The questionnaires were sent to all class D1 building contractors and randomly selected sample contractors from class D2. The samples were selected from the 1998 classified building contractors' list prepared by the Ministry of Works and Housing. (See Appendix 2). The procedures that were followed to ensure the randomness of the class D2 sample are as follows:

1. A list which had all the classified contractors whose registration was valid as at September 1998 was sequentially numbered.
2. Random numbers were selected from a statistical table according to a preset criteria (i.e. begin from right to left, top to bottom, take one row and leave the other, etc.).
3. The random numbers selected were then compared with the number on the list, and accordingly certain contractors were selected.

There were 96 class D1 contractors and 446 class D2 contractors.

Sample sizes were determined using the following formula: (Kish, 1965) (1)

$$n = n^1/(1 + n^1/N)$$

where,

n = sample size

n^1 = S^2/V^2

N = total population

V = the standard error of sampling distribution = 0.05

S = the maximum standard deviation of the population elements.

(Total error = 0.1 at a confidence level of 95%)

S^2 = P(1 - P) = 0.5 (1 - 0.5) = 0.25

P = the proportion of population elements that belong to the defined class.

Considering only class D1 contractors and substituting N = 96 a sample size of 49 is calculated. However, for both classes D1 and D2 N = 542 and a new sample size of 84 is introduced.

It was assumed that the commercial sensitivity of the required information would discourage many contractors from participating in the study. A response rate of 30% was therefore assumed. The total sample size had to be increased to about 250 to accommodate the anticipated shortfall in response. To be able to get statistically acceptable response from the class D1 contractors it became imperative to reach all the 96 building contractors in the class D1 category. Due to time and financial constraints only 104 contractors were reached in the class D2 category. Thus 96 class D1 contractors and 104 class D2 contractors received copies of the questionnaire. 52 responses were received from the class D1 contractors and 34 responses from the class D2 contractors. The response rate from the class D1 contractors was therefore 54% and that of class D2 contractors 33%.

5.2.2 Developing the Questionnaire

The questionnaire originally prepared by Ahmed and Minkharah [1988] was used after it was modified to suit the bidding environment in Ghana.

To be able to achieve the objectives of the study the questionnaire, with closed-ended questions, is divided into two parts (Appendix 1). The first part contains seven questions that reflect the firm's policy regarding bidding decision-making. The contractors were asked to indicate their classification, those responsible for the determination of the markup, the method in use for the determination of the markup and how head office overheads are recovered. The questionnaire also sought to establish how cash flow was forecast at the pre-tender stage, the rate of return that contractors require from their projects, and whether the contractors appreciate time value of money. The second part of the questionnaire contains questions about the importance level of 36 potential factors affecting the decision on the size of markup to be assigned. In this part, a scale from 1 to 7 is used to measure the level of effect of each factor on the underlying decisions, where '1' means low level of effect and '7' means high effect. The respondents were asked to check a number on the scale that reflects their assessment regarding the different factors.

5.2.3 Distribution of Questionnaire

Most of the questionnaires were sent by post to the contractors through their respective addresses that were supplied by the Ministry of Works and Housing, Accra. Some of these were subsequently followed up by personal visits. A good number were also distributed personally. In order to get high response stamped addressed envelopes for the return of the answered questionnaire were added to the questionnaire sent by post. The contractors were also asked to remain anonymous.

Reference

1. Kish, L (1965), Survey Sampling, John Wiley & Sons Inc., New York.

CHAPTER SIX

SURVEY RESULTS AND DISCUSSION

6.1 ANALYSIS OF RESPONSE

A total of 200 questionnaires were sent to various classes D1 and D2 building construction firms in Ghana. Of these, 86 were completed and returned, giving 43 per cent response rate.

Five of the respondents failed to complete the questionnaire fully. These responses were rejected and not considered for any analysis.

Table 6.1 shows the survey response levels. The class D1 category recorded 54.2 per cent response rate and the class D2 32.7 per cent.

Table 6.1 Survey Response Levels

class	issued	returned	percentage returned
D1	96	52	54.2
D2	104	34	32.7
Total	200	86	43.0

Though the response levels were encouraging and above average some reasons could be attributed to not having full or a higher response. The timing of the survey, commencing just before the Christmas holidays with most managers going on holidays, could be a contributory factor. Also the volume of questionnaires from graduate and undergraduate finalists to these firms at this particular time should be another contributory factor since the firms could be saddled with volumes of such questionnaires from these students, not only from the researcher's university, but also

from other institutions within Ghana. The completion of all such questionnaires could be boring or time consuming for many of these organizations.

6.2 RESULTS ANALYSIS AND DISCUSSION

Questions 1 to 8 (Appendix 1) were analyzed one after the other and discussed. The discussion assesses the current issues of evaluating the optimum markup and relates any implications of the findings to the adoption of a suitable markup model for the Ghanaian building industry.

6.2.1 Markup Decision

Table 6.2 below shows the response to question 2.

Table 6.2 Contractor Classification and Markup Decision

DECISION MAKERS	class D1		class D2		Overall
	number of responses	Percentage Response	number of responses	percentage response	percentage response
Management only	7	13.5	4	11.8	12.8
In-house estimating department only	4	7.7	1	2.9	5.8
Private consultants only	6	11.5	4	11.8	11.6
Management + In-house estimating department	27	51.9	13	38.2	46.5
Management + Private consultants	6	11.5	11	32.4	19.8
Others	2	3.9	1	2.9	3.5
Total	52	100	34	100	100

The survey shows that only 11.5 per cent of the responding class D1 contractors and 11.8 per cent of the class D2 contractors depend solely on private consultants to

decide on markups. For the overall view 11.6 per cent of the firms that responded use private consultants only. This shows that some management of the construction firms is involved in the markup decision.

In the class D1 category 51.9 per cent of the firms indicated that markups are decided by management and in-house estimating department. For class D2 only 38.2 per cent indicated likewise and 32.4 per cent indicated markup decision by management and private consultants. This seems to suggest some level of adjudication process before tenders are finalized. However, private consultants play a significant role in determining the markup for class D2 contractors. The class D1 contractors have the capacity for markup decision.

It appears, from the analysis, that private consultants are not only engaged by some building construction firms to prepare bid estimates but to decide markups as well. This is a worrying observation since these private consultants (who are mostly private individuals) are not only outsiders who may not have any in-depth knowledge of the firm's characteristics, but may also not have the ample time required to prepare a complete, detailed and thorough analysis for a particular bidding situation.

The responsibility for determining a markup is that of management, at the adjudication meeting. The markup for a contractor varies from one bid to another, depending on a multiplicity of internal and external factors that are encountered in each markup decision. The very existence of a construction firm depends on its ability to assign an appropriate markup (Morse, 1977) which produces enough jobs and significant profits.

Markup decision must therefore be made by management of the construction firm, committed to the policies of the firm, and not by outsiders. There is the need,

therefore, for the contractors to employ qualified personnel as permanent members of staff to undertake this very important markup decision.

6.2.2 Recovery of Head Office Overheads

Table 6.3 shows the response to question 3.

Table 6.3 Contractor Classification and Recovery of Head Office Overheads

MODE OF RECOVERY	class D1		class D2		Overall
	number of responses	Percentage Response	number of responses	percentage response	percentage response
Included in markup	26	50	27	79.4	61.6
Charged as cost item	14	26.9	0	0	16.3
Either included in markup or charged as cost item	12	23.1	7	20.6	22.1
Other means	0	0	0	0	0
Total	52	100	34	100	100

The analysis shows that 50 per cent of the class D1 contractors include head office overheads in markup, 26.9 per cent charge it as a cost item and 23.1 per cent do either depending on the project. For the class D2 contractors 79.4 per cent include head office overheads in markup and 20.6 per cent either included in markup or charged as a cost item but none indicating recovery through cost item.

Costs such as head office overhead and job related contingencies are some examples of indirect costs. These costs must be recovered by some way or another. This study revealed that about 61.6 per cent of the firms include head office overhead in markup, 16.3 per cent charge it as a cost item and 22.1 per cent do either depending on the project.

The results show that the method of recovery of office overhead and indirect costs in general vary from one firm to the other. This is in agreement with existing literature. Cook [1991] and Amoa-Mensah [1995] have advocated the position that head office overhead expenses should be recovered through markup. Clough [1975] and Harris and McCaffer [1977] suggests that head office overheads should either be added as a separate cost item or included in markup. Roy Pilcher [1992] is of the opinion that the markup should not include head office overheads.

A suitable markup model must, therefore, be flexible enough to accommodate the various methods of recovering head office overheads.

6.2.3 Method Used in the Determination of Markup

This survey revealed that mathematical or statistical models for determining markup are rarely used in the Ghanaian building industry. Table 6.4 below shows the response to question 4. Of the 34 class D2 contractors that responded, 70.6 per cent use pure subjective judgement and 29.4 per cent estimating to determine suitable markup. For the class D1 firms whilst 48.1 per cent use estimating 46.1 per cent use subjective judgement.

Table 6.4 Contractor Classification and Method of Markup Determination

METHOD	Class D1		class D2		Overall
	Number of Responses	percentage response	Number of Responses	percentage Response	percentage response
Mathematical or Statistical Model	3	5.8	0	0	3.5
Pure Subjective Judgement	24	46.1	24	70.6	55.8
Estimating	25	48.1	10	29.4	40.7
Other Method	0	0	0	0	0
Total	52	100	34	100	100

The study shows that fewer than 6 per cent of Ghanaian top building contractors use some kind of mathematical or statistical model to aid them in their markup decisions. Out of the 52 responses from the class D1 contractors only 3 indicated some use of mathematical or statistical models. These 3 firms might be multi-national companies. Ahmed and Minkharah [1988] found that fewer than 10 per cent of American top contractors use some kind of mathematical or statistical models to aid them in determining the proper markup while the majority use subjective judgement.

There is a 50-50 chance of using pure subjective judgement and estimating in markup decisions by class D1 contractors and subjective judgement dominates in class D2 category. This seems to suggest that majority of building contractors do not take a critical look at their markup determination. In this competitive era there is the need to change this perception.

6.2.4 Required Rate of Return (RRR)

The results to question 5 are shown in Table 6.5.

From the analysis, as shown in Table 6.5, both classes D1 and D2 contractors preferred first a rate of return more than 5% above the bank's interest rate and the least the Bank of Ghana 91-day Treasury bill rate. For the overall view 48.8 per cent of the firms preferred more than 5% above the bank's interest rate followed by the other rates of return in the following order: 18.6 per cent for 2-5% above the bank's interest rate; 15.1 per cent for the bank's interest rate; 10.5 per cent for other rate; 4.7 per cent for up to 2% above the bank's interest rate and 2.3 per cent for Bank of Ghana 91-day Treasury bill rate.

Table 6.5 Contractor Classification and Required Rate of Return

RATE OF RETURN	Class D1		class D2		Overall
	Number of Responses	Percentage Response	number of responses	percentage response	percentage response
Commercial bank's interest rate	8	15.4	5	14.7	15.1
Up to 2% above the bank's interest rate	3	5.8	1	2.9	4.7
2 - 5 % above the bank's interest rate	10	19.2	6	17.7	18.6
More than 5% above the bank's interest rate	23	44.2	19	55.9	48.8
Bank of Ghana 91-day Treasury bill rate	2	3.9	0	0	2.3
Other rate	6	11.5	3	8.8	10.5
Total	52	100	34	100	100

The preference of the bank's interest rate to up to 2% above the bank's interest rate by all the contractors seems anomalous. At least there is uniformity in the rating of these rates of return by the two classes of contractors.

Contracting is full of decision making that is affected by the existence of risk and uncertainty. The price for the risks undertaken by a contractor is the return on his/her investment. Generally, the higher the risk the higher the return.

The variance of the responses to question 5 indicates that there is no fixed rate of return that contractors require from their projects. Each project must be analyzed taking into consideration the mode of financing the project and the risks associated with that particular project.

6.2.5 Cash Flow Forecasting

The purpose of question 6 was to find out whether the contractors use cost and value curves in forecasting cash flow at the pre-tender stage. Table 6.6 shows the response to question 6.

Table 6.6 Contractor Classification and Cash Flow Forecasting

MODE OF FORECASTING	Class D1		class D2		Overall
	number of Responses	Percentage Response	number of responses	percentage response	percentage response
Estimating value and cost from contract documents	35	67.4	24	70.6	68.6
Use of standard S-curves	2	3.8	1	2.9	3.5
No forecasting	13	25	8	23.6	24.4
Other means	2	3.8	1	2.9	3.5
Total	52	100	34	100	100

From the analysis less than 4 per cent of the respondent companies use standard S-curves in forecasting cash flow. As much as 67.4 per cent of the class D1 contractors and 70.6 per cent of the class D2 contractors estimate value and cost from contract documents. This seems to suggest non-availability of cost curves. The analysis also reveals that about 25 per cent of the firms surveyed do not consider cash flow at the tender stage.

The survey shows that where cash flow forecasting is undertaken the building contractors estimate value and cost from contract documents (68.6 per cent overall response). Only 3.5 per cent use standard S-curves.

A contractor, who decides to bid on a project, needs to prepare cost estimate for the project. The contractor must study the bidding documents and estimate the direct and indirect costs of the project. Many a time the contractor's estimators have very limited time and inadequate contract drawings, at the tender stage, to enable detailed cost estimate for the project to be prepared. McKay [1971] has indicated that it is possible to bypass the detailed cost estimating and use either a standard S-curve or an actual S-curve of a similar project. McKay demonstrated that this approach of using standard curves did not lead to loss of reliability in the eventual cash flow forecast.

This survey has revealed that the classes D1 and D2 building contractors do not depend on cost and value curves for projects undertaken for cash flow forecasting and should be encouraged to do so. These curves can be used where detailed drawings and/or time are not available. The situation of no forecasting of cash flow (25 per cent for class D1 and 23.6 per cent for class D2) is not healthy for the growth of the building industry and the contractors need be educated on the relevance of cash flow to markup determination.

6.2.6 Time Value of Money Consideration

Unlike the other questions, participating firms could tick as many factors as possible to question 7 and the responses are shown in Table 6.7 above.

Table 6.7 Contractor Classification and Factors Considered in Taking Financial Decisions at Pre-tender Stage

FACTOR OF COST / INCOME	class D1		class D2		Overall
	Number of response	Percentage Response	number of responses	percentage response	percentage response
Rate of interest	28	28	6	13.1	23.3
The timing of cost and income	36	36	27	58.7	43.1
Inflation	32	32	11	23.9	29.5
None	4	4	2	4.3	4.1
Total	100	100	46	100	100

Only 4.1 per cent of the responding firms do not consider interest, inflation and timing of cost and income when taking financial decisions at pre-tender stage. The effect of interest on financial decisions was acknowledged by 23.3 per cent of the respondents, 43.1 per cent on the effect of time on value of money and 29.5 per cent on inflation.

From the analysis less than 5 per cent of the respondent firms do not consider time value of money. There is therefore enough evidence to show that classes D1 and D2 building contractors appreciate the effect of time on the value of money. As a result the null hypothesis that Ghanaian building contractors do not consider time value of money in markup determination is rejected.

This seems to suggest that these classes of building contractors appreciate discounted cash flow (DCF) technique in capital investment and financial decisions.

6.2.7 Factors Affecting Project Markup Determination

Tables 6.8 and 6.9 embody 36 factors that are thought to influence the markup decision. These factors were ranked in accordance to their importance to classes D1 and D2 building contractors in Ghana.

The relative importance indices for the various factors were measured using the following formula:

$$\text{Relative Importance Index} = \Sigma w / (S \times N)$$

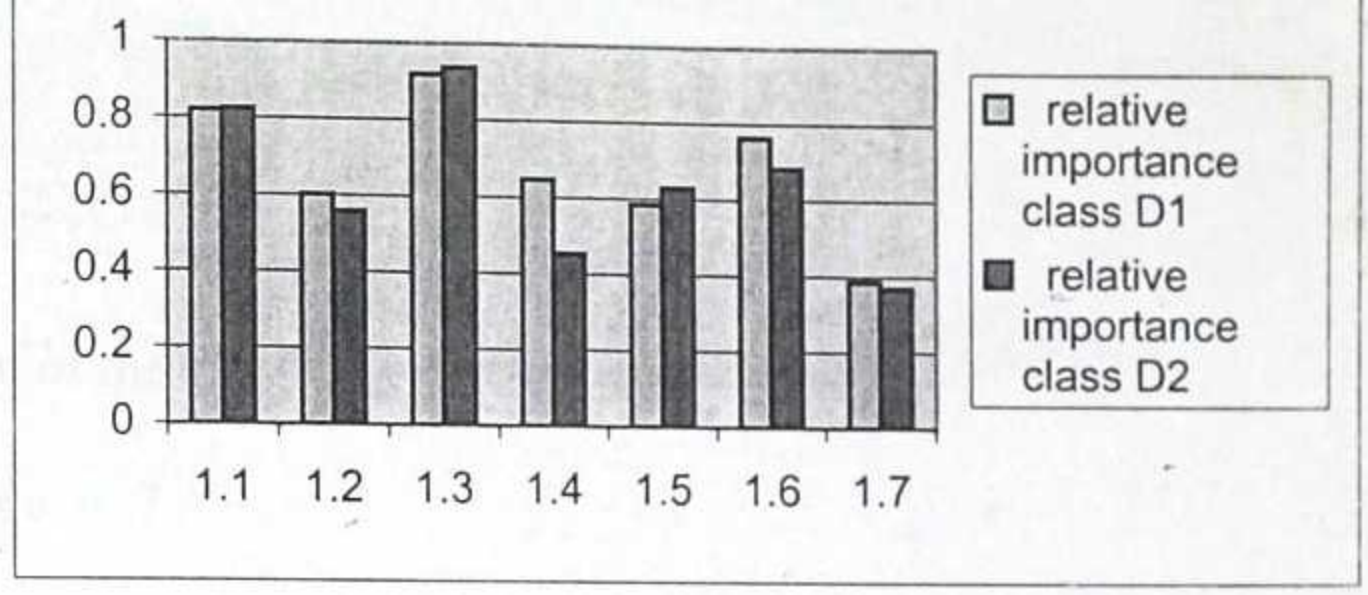
Table 6.8 Factors Affecting Project Markup Determination - class D1

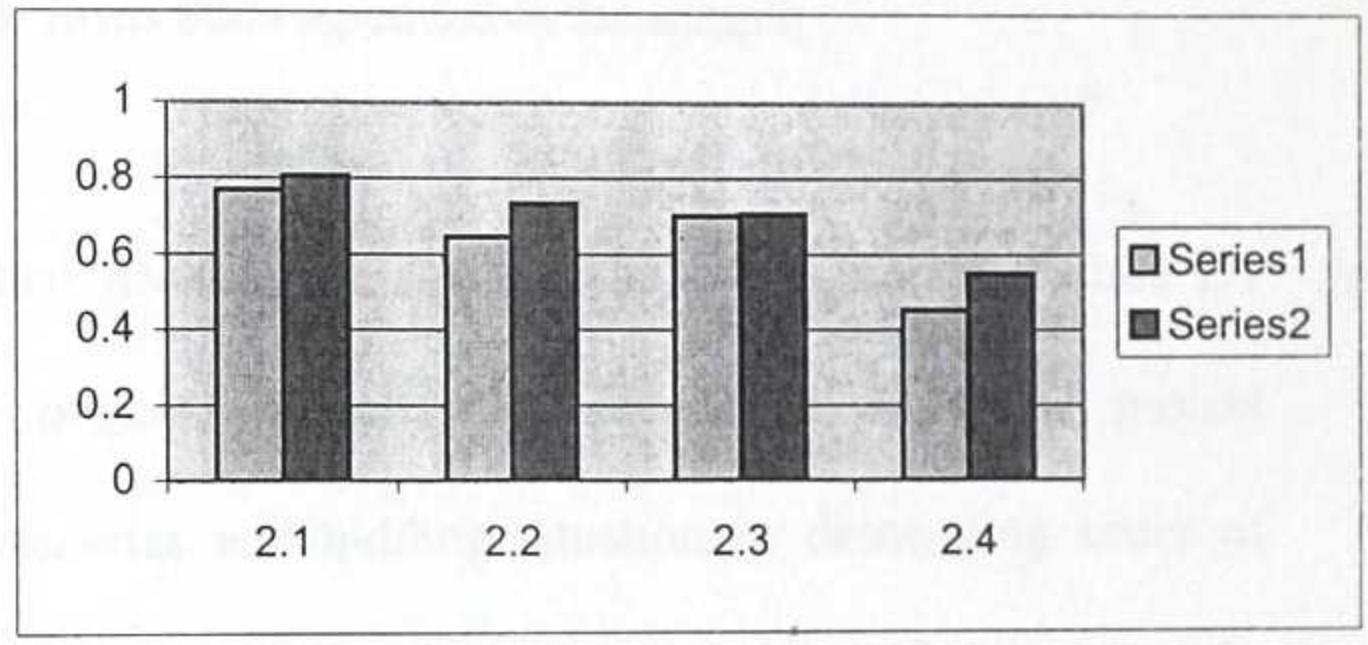
CODE	FACTOR	SCORE							WEIGHTING	RELATIVE IMPORTANCE INDEX	RANK
		1	2	3	4	5	6	7			
1	**PROJECT CHARACTERISTICS**									0.675	
1.1	Size of Contract	1	1	0	4	18	7	21	298	0.819	6
1.2	Duration	3	2	19	7	6	8	7	219	0.602	20
1.3	Project Cash Flow	0	1	0	2	4	11	34	334	0.918	1
1.4	Type of Equipment Required	1	2	11	8	19	6	5	236	0.648	17
1.5	Location of Project	1	14	9	6	6	9	7	213	0.585	21
1.6	Owner / Client	4	4	3	3	6	9	23	278	0.764	8
1.7	Job Start Time	10	20	7	9	3	2	1	141	0.387	35
2	**PROJECT DOCUMENTS**									0.642	
2.1	Type of Contract	1	2	4	3	16	11	15	280	0.769	7
2.2	Design Quality	5	6	6	7	3	18	7	235	0.646	18
2.3	Client's Special Requirements	3	1	5	10	10	16	7	255	0.701	12
2.4	Designers	7	16	11	6	6	3	3	165	0.453	32
3	**COMPANY CHARACTERISTICS**									0.637	
3.1	Availability of Required Cash	2	1	0	17	7	9	16	273	0.75	9
3.2	Uncertainty in Cost Estimate	2	2	3	20	11	7	7	241	0.662	14
3.3	Confidence in Work Force	15	5	5	9	7	6	5	182	0.5	29
3.4	Strength in Industry	4	4	9	17	14	3	1	202	0.555	24
3.5	Availability of Qualified Staff	2	3	5	18	8	10	6	237	0.651	16
3.6	Need for Work	1	1	1	6	9	13	21	300	0.824	5
3.7	Experience in Such Projects	1	1	4	9	23	4	10	260	0.714	11
3.8	Establishing Long Relationships with Clients	0	13	2	8	16	8	5	227	0.624	19
3.9	Past Profit in Similar Jobs	4	1	4	6	26	8	3	241	0.662	14
3.10	Current Work Load	1	4	3	7	13	7	17	272	0.747	10
3.11	Reliability of Subcontractors	7	10	7	7	3	17	1	200	0.549	25
3.12	Portion subcontracted to Others	5	8	12	4	7	16	0	204	0.56	23
3.13	Public Exposure	5	21	6	5	5	5	5	175	0.481	31
4	**BIDDING SITUATION**									0.532	
4.1	Required Bond Capacity	14	2	8	7	11	5	5	190	0.522	28
4.2	Competition	1	0	0	3	10	22	16	307	0.843	3
4.3	Time Allowed for Submitting Bids	8	3	18	4	9	4	6	195	0.536	26
4.4	Time of Bidding (Season)	20	6	6	6	8	4	2	152	0.418	34
4.5	Bidding Document Price	25	6	4	2	8	5	2	141	0.387	35
4.6	Pre-qualification Requirements	17	4	8	7	5	2	9	177	0.486	30
5	**ECONOMIC SITUATION**									0.653	
5.1	Risk Involved in Investment	2	0	2	2	6	16	24	310	0.852	2
5.2	Availability of Equipment	0	3	6	7	22	10	4	250	0.687	13
5.3	Overall Economy (Availability of Work)	1	2	2	3	9	10	25	303	0.832	4
5.4	Quality of Available Labour	1	8	20	10	6	2	5	194	0.533	27
5.5	Availability of Labour	3	5	9	18	10	3	4	208	0.571	22
5.6	Governmental Division Requirements	17	11	3	5	7	5	4	161	0.442	33

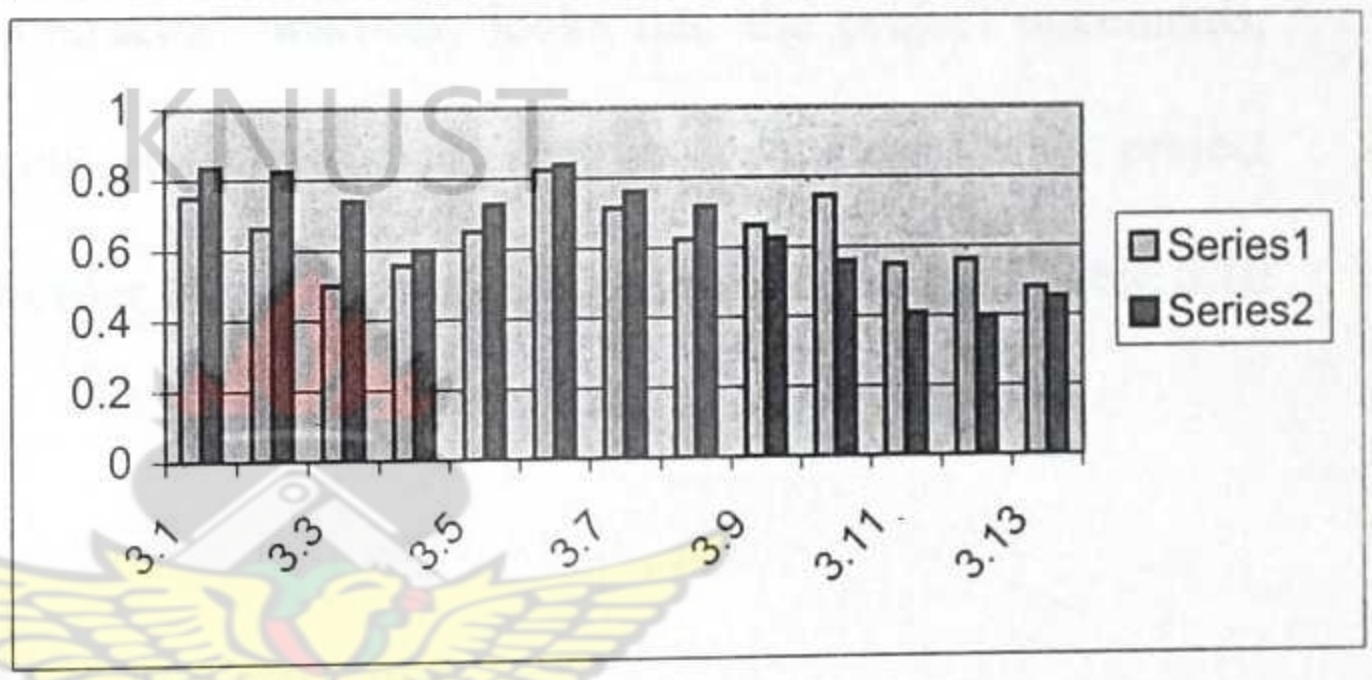
Table 6.9 Factors Affecting Project Markup Determination - class D2

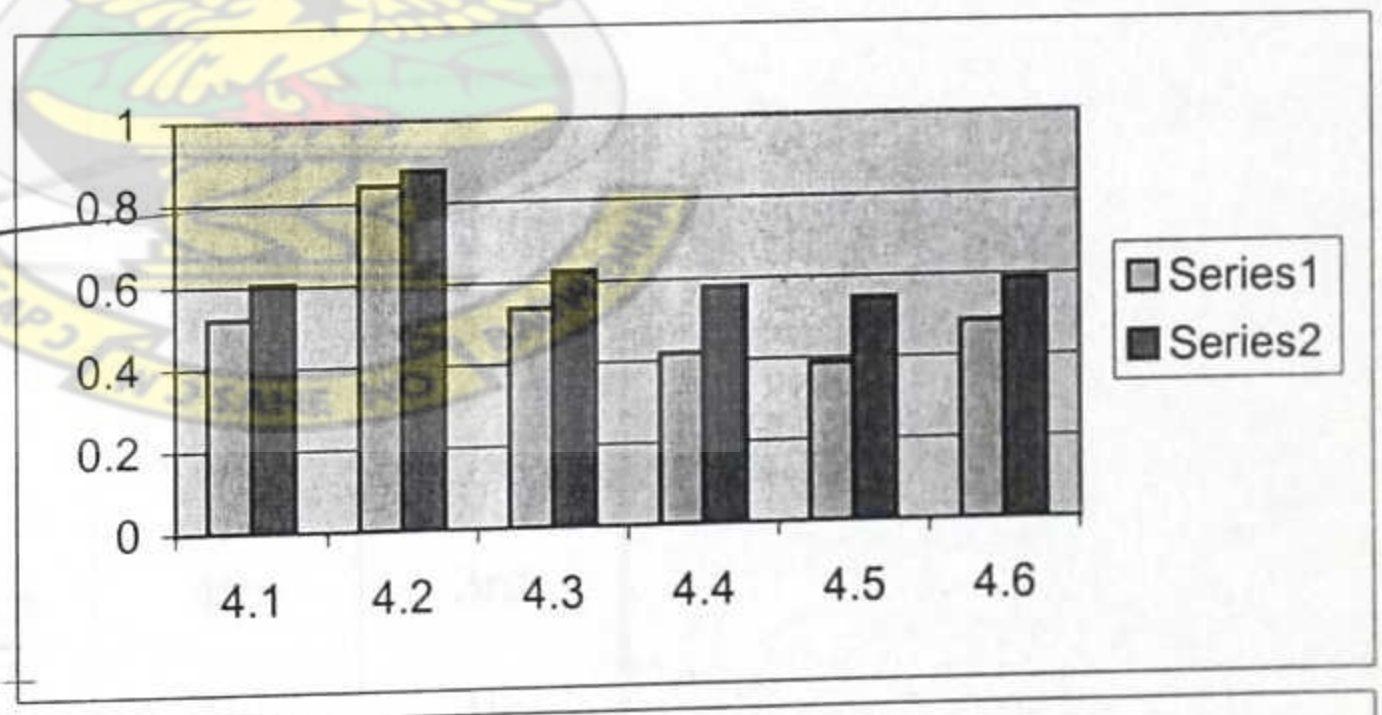
ODE	FACTOR	SCORE							WEIGHTING	RELATIVE IMPORTANCE INDEX	RANK
		1	2	3	4	5	6	7			
1	**PROJECT CHARACTERISTICS**									0.637	
1.1	Size of Contract	1	1	0	3	3	16	10	196	0.824	6
1.2	Duration	2	2	15	3	4	6	2	133	0.559	28
1.3	Project Cash Flow	0	0	0	1	3	6	24	223	0.937	1
1.4	Type of Equipment Required	13	0	6	4	7	2	2	108	0.454	32
1.5	Location of Project	1	1	4	16	3	7	2	150	0.63	18
1.6	Owner / Client	3	2	0	3	15	8	3	163	0.685	16
1.7	Job Start Time	4	18	3	6	3	0	0	88	0.37	36
2	**PROJECT DOCUMENTS**									0.7	
2.1	Type of Contract	1	1	1	2	3	19	7	192	0.807	8
2.2	Design Quality	2	4	3	4	2	3	16	175	0.735	12
2.3	Client's Special Requirements	2	0	1	4	20	2	5	168	0.706	15
2.4	Designers	2	4	6	14	4	1	3	131	0.55	30
3	**COMPANY CHARACTERISTICS**									0.653	
3.1	Availability of Required Cash	1	0	0	3	3	18	9	199	0.836	5
3.2	Uncertainty in Cost Estimate	0	1	0	5	9	4	15	196	0.824	6
3.3	Confidence in Work Force	1	2	1	6	4	16	4	176	0.739	11
3.4	Strength in Industry	0	3	4	16	7	3	1	142	0.597	25
3.5	Availability of Qualified Staff	0	1	3	2	18	6	4	173	0.727	13
3.6	Need for Work	1	0	1	3	6	7	16	200	0.84	4
3.7	Experience in Such Projects	1	1	1	6	5	14	6	181	0.761	10
3.8	Establishing Long Relationships with Clients	0	1	1	1	24	7	0	171	0.718	14
3.9	Past Profit in Similar Jobs	2	0	2	16	8	5	1	149	0.626	21
3.10	Current Work Load	1	3	14	4	6	4	2	133	0.559	28
3.11	Reliability of Subcontractors	2	19	4	4	1	4	0	97	0.408	34
3.12	Portion subcontracted to Others	2	18	6	3	3	2	0	95	0.399	35
3.13	Public Exposure	3	16	3	3	4	3	2	108	0.454	32
4	**BIDDING SITUATION**									0.637	
4.1	Required Bond Capacity	0	0	17	3	6	5	3	144	0.605	24
4.2	Competition	1	0	0	1	8	4	20	209	0.878	2
4.3	Time Allowed for Submitting Bids	4	2	1	4	19	1	3	149	0.626	21
4.4	Time of Bidding (Season)	5	3	3	2	17	3	1	138	0.58	27
4.5	Bidding Document Price	7	2	3	2	18	2	0	130	0.546	31
4.6	Pre-qualification Requirements	2	2	4	17	4	1	4	140	0.588	26
5	**ECONOMIC SITUATION**									0.692	
5.1	Risk Involved in Investment	1	0	1	2	1	16	13	204	0.857	3
5.2	Availability of Equipment	0	1	2	18	5	6	2	155	0.651	17
5.3	Overall Economy (Availability of Work)	1	1	1	2	7	18	4	185	0.777	9
5.4	Quality of Available Labour	0	5	4	6	17	0	2	145	0.609	23
5.5	Availability of Labour	1	3	5	2	20	1	2	150	0.63	18
5.6	Governmental Division Requirements	3	5	2	5	4	14	1	150	0.63	18

factor	relative importance	
	class D1	class D2
1.1	0.819	0.824
1.2	0.602	0.559
1.3	0.918	0.937
1.4	0.648	0.454
1.5	0.585	0.63
1.6	0.764	0.685
1.7	0.387	0.37
2.1	0.769	0.807
2.2	0.646	0.735
2.3	0.701	0.706
2.4	0.453	0.55
3.1	0.75	0.836
3,2	0.662	0.824
3.3	0.5	0.739
3.4	0.555	0.597
3.5	0.651	0.727
3.6	0.824	0.84
3.7	0.714	0.761
3.8	0.624	0.718
3.9	0.662	0.626
3.10	0.747	0.559
3.11	0.549	0.408
3.12	0.56	0.399
3.13	0.481	0.454
4.1	0.522	0.605
4.2	0.843	0.878
4.3	0.536	0.626
4.4	0.418	0.58
4.5	0.387	0.546
4.6	0.486	0.588
5.1	0.852	0.857
5.2	0.687	0.651
5.3	0.832	0.777
5.4	0.533	0.609
5.5	0.571	0.63
5.6	0.442	0.63









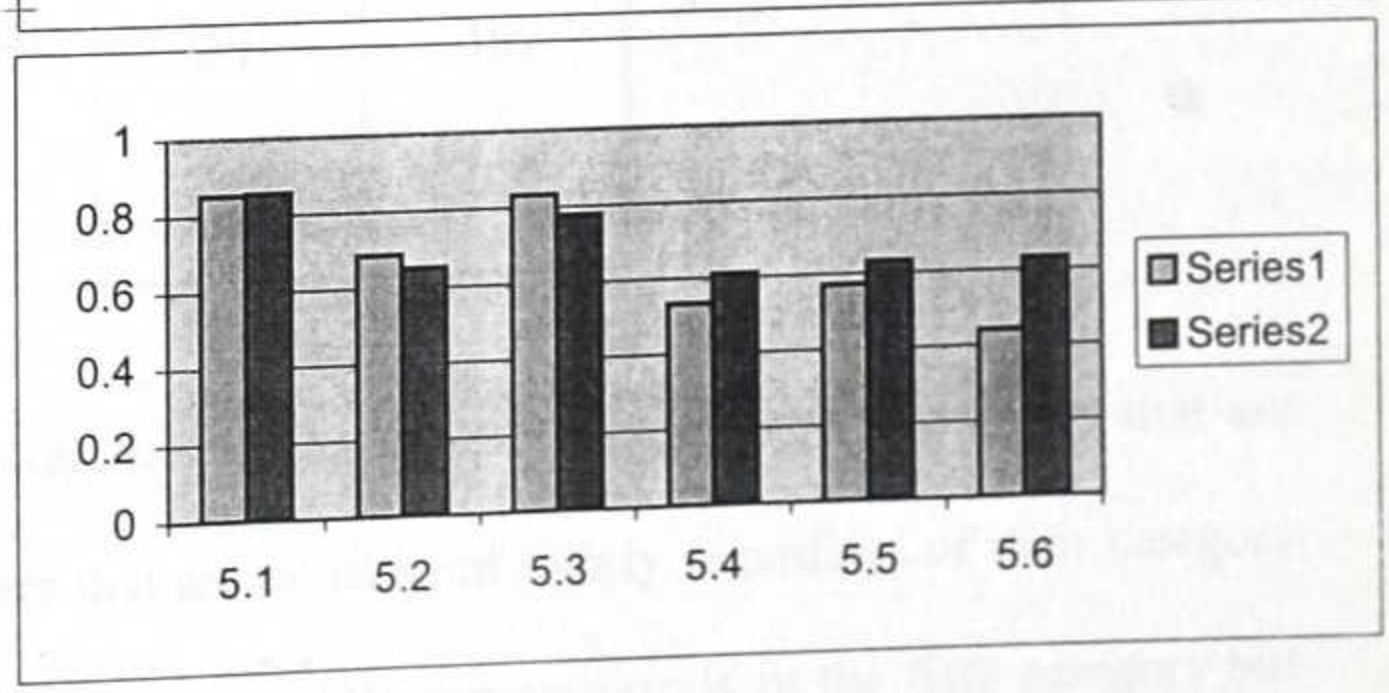


Figure 6.1
Relative importance indices

where,

Σw = the summation of the weighting given to each factor

S = maximum score = 7

N = total number of firms that responded in the sample

The results indicate that when deciding on the markup for a project a class D1 contractor looks into the project characteristics, economic situation, project documents, company characteristics and bidding situation in descending order of importance. The class D2 contractor, however, looks into the project documents, economic situation, company characteristics, bidding situation and project characteristics in descending order of importance. This is illustrated with Table 6.10 below.

Table 6.10 Rank Order of Broad Categories

CATEGORY	RANK	
	class D1	Class D2
Project Characteristics	1st	5th
Project Documents	3rd	1st
Company Characteristics	4th	3rd
Bidding Situation	5th	4th
Economic Situation	2nd	2nd

Despite the broad categories' order of importance, there are factors that are considered heavily and others that are considered lightly regardless of their category position. For example, considering class D1, competition is in the fifth category but ranked third in importance among the 36 factors. Considering also class D2, project

cash flow is in the fifth category but ranked first among the 36 factors. The last columns of Tables 6.8 and 6.9 present the rank order of the 36 factors for classes D1 D2 respectively.

Studying the relative importance indices and the ranks of the 36 factors across the two contractor classes reveals that some factors such as size of contract, project cash flow, job start time, strength in industry, need for work, experience in such projects, public exposure, competition and risk involved in investment have almost the same importance indices and very close rank orders across the two groups. (See also Figure 6.1)

It is evident that project characteristics is the most important category and bidding situation is the least important category for class D1 contractors whenever they decide on the markup. However, for class D2 contractors, project documents is the most important category and project characteristics the least important category whenever they decide on markup.

The three top ranked factors by the class D1 contractors are project cash flow, risk involved in investment and competition. Similarly the three top ranked factors by the class D2 contractors are project cash flow, competition and risk involved in investment.

These three factors were among the nine selected factors that had almost the same importance indices and very close rank orders across the two groups. These three factors **(project cash flow, risk involved in investment and competition)** are considered to be the most important factors in determining markup. This corroborates well with Farid, F [1981] findings that fair and reasonable markup, that results in a minimum acceptable price, is a function of the required rate of return and the cash flow schedule of the project.

The project cash flow is the highest ranked factor in the markup decision. The substantial emphasis that is given by the contractors to project cash flow may reflect their need for cash. Monthly cash inflow will help a contractor to meet his/her financial obligations. Also the monthly inflow will increase cash availability to a contractor giving him/her an economic leverage to compete for other projects. In the Ghanaian construction industry the major client (the government) delays in honouring payment certificates. This, coupled with the difficulties in getting financial assistance from the banking institutions, underscores the importance of cash flows to contractors in making decisions on markup.

Firm price contracts are mostly used in competitive bidding in Ghana. These contracts transfer most of the construction risks to the contractor. The high ranking of risk involved in investment indicates that contractors do recognize contractual and construction risks in the determination of a markup for a project.

The notable high priority that is given to competition factor by the contractors is evidence that work is not available, there is need for work and current workload is low. Contractors therefore underprice their bids to win contracts.

With project cash flow and risk involved in investment ranked first and second respectively, and therefore being the most important factors needed to determine the markup, the hypothesis that the project cash flow and the risk involved in the investment of the contractor are the main factors of consideration in establishing the optimum markup is accepted.

6.2.8 The Effect of Contractor Size on Markup Decision

To study the rank correlation between the class D1 and class D2 building contractors the Spearman rank correlation coefficient, R, between the two classes was measured using the formula:

$$R = 1 - \{ 6 \Sigma d_i^2 / [n (n^2 - 1)] \}$$

$$-1.0 \leq R \leq 1.0$$

where,

n = total number of paired ranks

x_i = rank of factor i by class D1 contractors

y_i = rank of factor i by class D2 contractors

d_i = difference between the ranks

Table 6.11 below shows the calculation of R.

A correlation coefficient of 0.76 was measured. This indicates that a monotonically increasing relationship exists between the rankings of the factors affecting markup by the two classes of building contractors.

A further test was made to find out whether or not the correlation found (using the Spearman rank correlation coefficient) justifies a conclusion that there is a non zero correlation between the rankings by the two classes of contractors.

Table 6.11 Determination of Rank Correlation

CODE	FACTOR	RANK class D1	RANK class D2	d_i	d_i^2
1.1	Size of Contract	6	6	0	0
1.2	Duration	20	28	-8	64
1.3	Project Cash Flow	1	1	0	0
1.4	Type of Equipment Required	17	32	-15	225
1.5	Location of Project	21	18	3	9
1.6	Owner / Client	8	16	-8	64
1.7	Job Start Time	35	36	-1	1
2.1	Type of Contract	7	8	-1	1
2.2	Design Quality	18	12	6	36
2.3	Client's Special Requirements	12	15	-3	9
2.4	Designers	32	30	2	4
3.1	Availability of Required Cash	9	5	4	16
3.2	Uncertainty in Cost Estimate	14	6	8	64
3.3	Confidence in Work Force	29	11	18	324
3.4	Strength in Industry	24	25	-1	1
3.5	Availability of Qualified Staff	16	13	3	9
3.6	Need for Work	5	4	1	1
3.7	Experience in Such Projects	11	10	1	1
3.8	Establishing Long Relationships with Clients	19	14	5	25
3.9	Past Profit in Similar Jobs	14	21	-7	49
3.10	Current Work Load	10	28	-18	324
3.11	Reliability of Subcontractors	25	34	-9	81
3.12	Portion subcontracted to Others	23	35	-12	144
3.13	Public Exposure	31	32	-1	1
4.1	Required Bond Capacity	28	24	4	16
4.2	Competition	3	2	1	1
4.3	Time Allowed for Submitting Bids	26	21	5	25
4.4	Time of Bidding (Season)	34	27	7	49
4.5	Bidding Document Price	35	31	4	16
4.6	Pre-qualification Requirements	30	26	4	16
5.1	Risk Involved in Investment	2	3	-1	1
5.2	Availability of Equipment	13	17	-4	16
5.3	Overall Economy (Availability of Work)	4	9	-5	25
5.4	Quality of Available Labour	27	23	4	16
5.5	Availability of Labour	22	18	4	16
5.6	Governmental Division Requirements	33	18	15	225
					1875

$$R = 1 - \{ 6 \Sigma d_i^2 / [n (n^2 - 1)] \}$$

$$= 1 - \{ (6 \times 1875) / [36 (36^2 - 1)] \}$$

$$= 1 - (11250 / 46620)$$

$$= 1 - 0.241 = 0.759$$

Statistically, if the two rankings are independent and if n is 10 or more, the sampling distribution of R can be approximated by a normal probability distribution with mean

$$\mu_R = 0$$

and standard deviation

$$\sigma_R = \sqrt{ \{ 1 / (n - 1) \} }$$

With $\alpha = 0.05$, the decision rule will be to reject the null hypothesis that the two rankings are independent if the observed value of R is

greater than $\mu_R + 1.96 \sigma_R$

or less than $\mu_R - 1.96 \sigma_R$ (1)

From the data, $\sigma_R = \sqrt{ \{ 1 / (36 - 1) \} } = 0.169$

$$\mu_R + 1.96 \sigma_R = 0 + (1.96 \times 0.169) = 0.33$$

$$\mu_R - 1.96 \sigma_R = 0 - (1.96 \times 0.169) = -0.33$$

Since the Spearman rank correlation coefficient shows a value of 0.76, the null hypothesis that classes D1 and D2 building contractors vary significantly in their evaluation of the various factors that are considered in the markup decision is rejected. It is therefore concluded that a significant rank correlation exists between classes D1 and D2 building contractors in prioritizing the factors that affect markup

determination. This result seems to be in conflict with the findings of Shash and Abdul-Hadi [1992] in "The effect of contractor size on markup size decision in Saudi Arabia". Shash and Abdul-Hadi examined the markup size decisions of small, medium and large contractors in Saudi Arabia using the same factors that were used for this survey (see Table 6.8). They reported that the importance of these factors varies as the contractors size changes.

The difference in the results might be due to the categorization of contractors for the two studies in Ghana and Saudi Arabia. Shash and Abdul-Hadi considered the number of permanent employees, the value of equipment owned and the business volume as the attributes for classifying the contractors in Saudi Arabia. They noted that the categorization of a contractor changes as a different classifying measure was utilized. When the number of permanent employees was used, many contractors who were considered large in the engineering sector were classified as small. The same phenomenon was observed when the value of equipment owned was used. Many building contractors were not placed in the proper category that reflected their apparent size. They decided to use business volume as the basis for categorization. The rationale behind this decision was that the other two attributes might introduce misleading categorization because as the type of the contractor changes, the classifying measures that best reflect its size changes. A good measure for building contractor size is the number of employees, while for an engineering type it is the value of equipment owned. Building construction is labour intensive and engineering construction machine intensive.

In Ghana quality of personnel, value of equipment owned and capital are the attributes considered for classifying building contractors. Sophisticated equipment is not generally required. More emphasis is therefore put on qualified personnel and

capital. There is the likelihood that, in the case of Shash and Abdul-Hadi, classes D1 and D2 building contractors in Ghana might have been in the same category in Saudi Arabia. This is an indication that categorization of contractors changes from one country to the other.

Though Shash and Abdul-Hadi concluded that the importance of the markup factors varies as the contractors size changes they found a relatively high association between the small and medium contractors and not much in common between the small and large contractors and medium and large contractors. There is therefore the need to repeat the study with classes D3 and D4 building contractors to be able to test whether differences do not exist between the four classes of building contractors with regard to the importance of the factors affecting the markup decision. Similar researches can also be conducted with civil engineering contractors and all contractors classified according to business volume.

6.3 SUMMARY

The survey achieved an encouraging response rate of 43 per cent. The results of the analyzed responses have shown the following observations.

Private consultants play a significant role in determining markup for class D2 building contractors. The class D1 contractors have the capacity for markup decision.

Though the method of recovery of head office overheads varies from one firm to the other, the majority of the contractors preferred including head office overheads in markup.

The building contractors in Ghana rarely use Mathematical or Statistical models for determining markup. Whereas the class D1 contractors use either pure

subjective judgement or estimating in markup decisions class D2 contractors depend on subjective judgement.

The rate of return required by the contractors varied. This indicates that there is no fixed rate of return that contractors require from their projects.

The contractors rarely use cost and value curves in forecasting cash flow at the pre-tender stage. Where cash flow forecasting is undertaken value and cost are estimated from the contract documents.

The contractors do appreciate the effect of time on the value of money.

The three top ranked factors affecting project markup decision by the class D1 contractors are project cash flow, risk involved in investment and competition in decreasing rank order. Similarly, the three top ranked factors by the class D2 contractors are cash flow, competition and risk involved in investment in decreasing rank order.

A very high rank correlation exist between the classes D1 and D2 building contractors in assessing factors that affect the markup decision.

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CHAPTER SEVEN

CONCLUSIONS AND RECOMMENDATIONS

7.1 INTRODUCTION

The search for the optimal markup has attracted intensive investigation over the years by both academics and construction companies. An attempt to explore the extent of the analysis that go into determining the feasible markup of building contractors in Ghana cannot fail to be a useful addition to that exercise.

The aim of the research as identified in chapter one included identification of the most important factors needed for the markup decision and the provision of a tool for establishing optimum markup for construction projects in Ghana.

Pricing practices were reviewed and it was realized that a major portion of business failures in the construction industry is the result of poor pricing policies. The Target Pricing method was found to be more in line with the objective of the firm, sought to satisfy the required rate of return of the equityholders of the firm and the minimum acceptable price is the resulting price of the model.

Some markup models were also reviewed. It was found that the Fair and Reasonable Markup (FaRM) Pricing Model by Farid uses the target pricing method and yields a minimum acceptable price. The study therefore looked for evidence to support or challenge the suitability of the FaRM Pricing Model.

The rate of return on a contractor's investment in a project is a major consideration of the markup and the probability of winning a particular contract is a function of the markup employed. In view of this, the method of estimating systematically the feasible rate of return for contractors for projects was reviewed. An

investigation was therefore made to find the rate of return the Ghanaian building contractors require from their projects.

7.2 CONCLUSIONS

Within the analytical framework put forward in this study in investigating the markup decision-making policies of classes D1 and D2 building contractors in Ghana, the following conclusions can be formulated in the light of the analysis made in the preceding chapters:

1) There is some level of adjudication process before tenders are finalized. Though some management of the construction firms are involved in the markup decision, there are some participation by private consultants because some contractors do not employ qualified personnel as permanent members of staff to undertake the markup decision.

2) The method of recovery of head office overheads varies from one firm to the other. Head office overheads could be recovered through markup or charged as a cost item. Markup can therefore either cater for or be devoid of head office overheads.

3) Building contractors in Ghana do not use mathematical or statistical models to determine markup. Majority of them use subjective judgement in markup decisions. Analytical tools are therefore needed for this all important markup decision.

4) There is no fixed rate of return that contractors require from their projects. Each project should be assessed to establish the required rate of return that maximizes the wealth of the equityholders of the firm.

5) Building contractors in Ghana do not use cost and value curves in forecasting cash flow at the pre-tender stage. Where cash flow forecasting is undertaken cost and value are estimated from the contract documents. As a result, forecasting of cash flows is not undertaken in situations where detailed contract documents and/or time are not available. This is an area where construction managers can play a leading role. Education is required among a majority of contractors on the importance of cost and value curves (S-curves) in forecasting cash flows.

6) The building contractors do appreciate the effect of time on the value of money in markup determination. The contractors therefore consider the construction projects as capital investment opportunities.

7) Project cash flow, risk involved in investment and competition are considered the most important factors in determining markup.

8) A significant rank correlation exists between classes D1 and D2 building contractors in Ghana in prioritizing the factors that affect markup determination. There is therefore not much difference in markup policies of the two classes of building contractors.

7.3 MAIN FINDINGS

The following form the major findings of the research studies:

- The optimum markup for construction projects, currently in Ghana, is a function of cash flow and the required rate of return. As a result the Fair and Reasonable Markup (FaRM) Pricing Model is very suitable in establishing the optimum markup for construction projects in the present competitive environment in the Ghanaian building industry.

The optimum markup can be calculated from the following equation:

$$(1 + m_f) \sum PV[S_j] + \sum PV[C_j] = 0$$

or,

$$m_f = - \{ \sum PV[C_j] / \sum PV[S_j] \} - 1$$

where,

m_f = optimum markup

$\sum PV[C_j]$ = present value of cash outflows (costs)

$\sum PV[S_j]$ = present value of cash inflows (payments)

rate of discount = RRR

(See Section 3.4.4 and Appendix 3)

- Building contractors should consider the determination of the required rate of return (RRR) as an area of competence. The RRR is project specific and its accuracy determines the accuracy of the markup.

7.3.1 The way forward

The way forward is the adoption of the Fair and Reasonable Markup (FaRM) Pricing Model by building contractors in Ghana as a tool to determine the optimum markup for their projects. This will enable them establish the minimum acceptable price (MAP) for each project below which they should not accept the project. They should improve their managerial and financial capabilities in determining accurately the rate of return they require from their projects.

(Appendix 4 illustrates the computation of the optimum markup using the model.)

7.4 RECOMMENDATIONS

From the foregoing analysis and conclusions the following recommendations are made for consideration.

1) The Fair and Reasonable Markup (FaRM) Pricing Model is a solution to the fundamental problem of seeking the optimum markup that will help a contractor be the lowest bidder and at the same time maximize profit for the project.

2) The building contractors should employ qualified personnel as permanent members of staff and institute training programmes to improve their management techniques.

3) Efforts should be made by the local contractors to internationalize by building stronger cooperative relationships with foreign companies and organizations in terms of technology and business developments to improve their competitiveness.

4) The contractors should improve their information technology base. They should adopt computer-aided systems to enhance estimating, project planning and control, cash flow forecasting, cost control, transportation planning and assignments, … etc.

5) Efforts should also be made by the contractors to improve productivity and quality to minimize cost. Individual in-house research is probably difficult but could have major benefits. Where individual research facilities cannot be established due to financial constraints, contractors can finance researches in the existing universities and research institutes.

6) Consultants should endeavour to provide more detailed, accurate and complete design information. This will reduce the associated project risks and enhance risk management considerably, and enable contractors establish more detailed and accurate bid estimates.

7) Considering the proliferation of construction firms in Ghana and the resulting competition for jobs, it would probably not be out of place to review existing regulations pertaining to the registration and categorization of contractors in the country. This should limit the number of firms in the industry considerably and make more jobs available to the well-qualified ones to increase their turnover levels and improve their profitability. Contractors will then be in the position to create their own quantity surveying/estimating departments.

8) The government should encourage the commercial banks to grant loans at reduced interest rates and introduce various types of tax incentives to give contractors access to capital at reasonable cost.

9) The contractors are also advised to enlist and trade on the Stock Exchange to be able to mop up capital to grow to be efficient and competitive.

10) A contractor's **markup policy** for projects is recommended as a pre-qualification requirement by clients and/or consultants. This action should, however, be a follow-up after a period of well planned and coordinated education programme for contractors and consultants in the form of pay seminars or short period construction management training schooling. Should this prove to be too expensive, then the Egan (1998) *"Rethinking Construction"* approach of sustainable chain of procurement commencing on a pilot scheme basis with selected contractors and consultants should form an ideal solution.

11) The department of Building Technology in the University of Science and Technology should organize education programmes for contractors and consultants to educate them on modern construction management practices and make research findings, including this one on markup determination, available to them. This will help the department to make money and at the same time contribute towards EDUCATION in the construction industry in Ghana.

7.5 FUTURE RESEARCH

The following are major related areas suggested for future research.

- A rigorous investigation of the Required Rate of Return (RRR) should be carried out and the sensitivity of the FaRM Pricing Model to changing RRR also investigated.

- The effect of income tax and other taxes on markup should be investigated.

- This research covered building contractors in classes D1 and D2. There is the need to repeat the study with classes D3 and D4 building contractors to be able to test whether differences do exist between the four categories of building contractors in the markup decision-making.

Similar researches can also be conducted with civil engineering contractors and all construction firms classified according to business volume.

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APPENDICES

APPENDIX 1

QUESTIONNAIRE TO CONTRACTORS

DATE: **DECEMBER, 1998**

PROJECT TOPIC: **A MARKUP DETERMINATION FOR BUILDING CONTRACTORS IN GHANA**

The essence of this questionnaire is to identify in order of priority the factors that building contractors in Ghana consider when determining what proportion of their net cost to allow for risks, profit and company overheads during preparation of tenders.

Mr. Peter Amoah of the Department of Building Technology, U.S.T., Kumasi with assistance from Dr. Edward Badu, a Senior Lecturer/Supervisor at the Department is conducting the research for academic purposes.

Your assistance in answering the questions set out below would be much appreciated.

Please do not leave any identification marks on the forms in order that the replies remain anonymous.

Thank you.

UNIVERSITY OF SCIENCE AND TECHNOLOGY
KUMASI, GHANA

DEPARTMENT OF BUILDING TECHNOLOGY
CONSTRUCTION MANAGEMENT PROGRAM

A MARKUP DETERMINATION FOR BUILDING CONTRACTORS IN GHANA

QUESTIONNAIRE

Title:.....

1. **Which class of Building Contractors do you belong to ?**
   D1 ☐ D2 ☐ D3 ☐ D4 ☐

2. **Who decides mostly on your company's overheads, risks and profit margin during adjudication stage in the estimating process ?**

   Management only ☐
   In-house estimating department only ☐
   Private Consultants only ☐
   Management + In-house Estimating Department ☐
   Management + Private Consultants ☐
   Other (Give details) ..... ☐

3. **How are Head Office overheads recovered ?**

   Included in markup ☐
   Charged as cost item ☐
   Either included in markup or charged as cost item depending on the Project ☐
   Other means (Please state) ..... ☐

4. **What method do you use in the determination of Markup ?**

   Mathematical or Statistical Model ☐
   Pure Subjective Judgement ☐
   Estimating ☐
   Other method (Please state) ..... ☐

5. **What rate of return do you require from your projects ?**

Commercial Bank's interest Rate ☐

Up to 2% above the Bank's interest Rate ☐

2-5% above the Bank's interest Rate ☐

More than 5% above the bank's interest Rate ☐

Bank of Ghana 91-day Treasury Bill Rate ☐

Other rate (Please state) ..... ☐

6. **How do you forecast Cash Flow before submission of bid ?**

Estimating value and cost from contract documents ☐

Use of Standard S-curves ☐

None (no forecasting) ☐

Other means (Please specify) ..... ☐

7. **What factors are taken into consideration when taking financial decisions at pre-tender stage ?**

Rate of interest ☐

The timing of cost and income ☐

Inflation ☐

None of the above ☐

8. The following is a list of factors affecting project **MARKUP** determination during preparation of tenders.

Using a **RANKING** scale of 1 to 7, where a rank of 1 means very little importance and 7 extremely important, rank the factors accordingly.

Note :
The **MARKUP** is the proportion of the contractor's net cost that he allows for his profit, risks and company overheads.

FACTORS	RANK						
	1	2	3	4	5	6	7
1 PROJECT CHARACTERISTICS							
1.1 Size of Contract							
1.2 Duration							
1.3 Project Cash Flow							
1.4 Type of equipment required							
1.5 Location of Project							
1.6 Owner/Client							
1.7 Job Start Time							
2 PROJECT DOCUMENTS							
2.1 Type of Contract							
2.2 Design Quality							
2.3 Client's Special Requirements							
2.4 Designers							
3 COMPANY CHARACTERISTICS							
3.1 Availability of Required Cash							
3.2 Uncertainty in Cost Estimate							
3.3 Confidence in Work Force							
3.4 Strength in Industry							
3.5 Availability of Qualified Staff							
3.6 Need for Work							
3.7 Experience in such Projects							
3.8 Establishing Long Relationship with Clients							
3.9 Past Profit in Similar Jobs							
3.10 Current Work Load							
3.11 Reliability of Sub-Contractors							
3.12 Portion Sub-Contracted to others							
3.13 Public Exposure							
4 BIDDING SITUATION							
4.1 Required Bond Capacity							
4.2 Competition							
4.3 Time Allowed for Submitting Bids							
4.4 Time of Bidding (Season)							
4.5 Bidding Document Price							
4.6 Prequalification Requirements							
5 ECONOMIC SITUATION							
5.1 Risk Involved in Investment							
5.2 Availability of Equipment							
5.3 Overall Economy (Availability of Work)							
5.4 Quality of Available Labour							
5.5 Availability of Labour							
5.6 Governmental Division Requirements							

Please send the completed questionnaire to:

Mr. Peter Amoah
P.O. Box AH 8831
Kumasi

Thank you for your cooperation

APPENDIX 2

CLASSIFICATION OF BUILDING CONTRACTORS - 1998

REGION / CLASS	Greater Accra	Northern	Upper East	Upper West	Ashanti	Western	Eastern	Volta	Brong Ahafo	Central Region	TOTAL
D1	64	4	0	0	5	5	2	6	1	9	96
D2	207	18	24	41	45	12	25	30	11	33	446
D3	1129	233	120	129	350	120	211	138	122	157	2709
D4	650	305	135	138	361	101	160	98	151	113	2212
TOTAL	2050	560	279	308	761	238	398	272	285	312	5463

APPENDIX 3

MATHEMATICS OF THE FaRM PRICING MODEL

The present value of cash outflows (expenditures) is equal to:

$$PV[C] = \sum_{j=0}^{N} C_j E_o (1 + r)^{-j}$$

The present value of cash inflows (payments) can be estimated as (see Table A.3):

$$PV[S] = \sum_{j=0}^{N^1} S_j S_o (1 + r)^{-j}$$

where S_o, the contract price before bond premium, can be described as:

$$S_o = (1+m_f) E_o$$

Setting the Net Present Value (NPV) of the project equal to zero (according to the definition of the FaRM),

$$NPV\ (r\%, N^1) = PV[S] + PV[C] = 0$$

or,

$$(1+m_f) E_0 \sum_{j=0}^{N1} S_j (1 + r)^{-j} + E_o \sum_{j=o}^{N} C_j (1+r)^{-j} = 0$$

Solving for m_f,

$$m_f = \frac{\frac{E_o}{E_o} - \sum_{j=o}^{N} c_j (1+r)^{-j}}{\sum_{j=o}^{N^1} S_j (1+r)^{-j}} - 1$$

TABLE A.3 MATHEMATICS OF FaRM PRICING MODEL

End-of-period j / Item	0	---	n + 1	---	J_o=j-(n+1)	---	j	---	N	---	N^1=N+(n+1)
a) Cum. Total Cost* c_j	Co	---	C_{n+1}	----	Cj_o	---	Cj	---	C_N		
b) Less: Unallowables	(U_o)	----	-----	----	(Uj_o)	---	---	---	(U_N)		
c) Cum Chargeable cost	Co - Uo	----	-----	----	$Cj_o - Uj_o$	---	---	---	$C_N - U_N$		
d) Billing Policy factor**	B_o	----	-----	----	Bj_o	---	---	----	B^o_N		
e) Cum. Billable cost (e = c.d)	Bo(Co-Uo)	----	------	----	$Bj_o(Cj_o - Bj_o)$	---	---	----	$B_N(C_N - U_N)$		
f) less Retainage @ 10%+	$(0.1\ e_o)$	-----	------	----	$(0.1\ ej_o)$	----	----	----	$(0.1\ e_N)$		
g) Cum. "Payments-Before-FaRM" Due	$0.9B_o(Co-Uo)$	-----	-----	----	$0.9Bj_o(Cj_o-Uj_o)$	----	----	----	$0.9B_N(C_N-U_N)$		
h) Cum. "Payments-Before-FaRM" Received Sj	----	----	0.9Bo(Co-Uo)	----	---	----	$0.9Bj_o(Cj_o-Uj_o)$	----	-----		$B^o_N(C_N-U_N)^{\#}$

*Assuming that management requires the company to have sufficient funds available at the end of each period for the total expenditures of the following period.

**This factor is a function of the billing policy specified in the contract. It accounts for the costs that are not immediately reimbursable, and other cases such as "front-end loading", etc.

+If a variable "Retainage Policy" is stipulated in the contract, it can be treated similar to billing policy.

++A payments-time-lag of n months is assumed. Contractor submits the progress billings at the end of month j, for the work performed during the month. The owner(s)/Engineers have n months to process, verify and arrange the payment. Therefore, the contractor usually receives the actual payment at the end of month (j + n).

#Assuming the entire retainage is released with the final payment.

o Normally, $B_N = 1$

Needless to say, E_o can be cancelled in this equation. It is for this reason that all the cash flows can be expressed on either an absolute or relative (e.g. percentage of total cost) basis. Hence:

$$m_f = \frac{-\sum_{j=o}^{N} C_j(1+r)^{-j}}{\sum_{j=o}^{N^1} S_j(1+r)^{-j}} - 1 \qquad \text{(A.3.1)}$$

where $(1+r)^{-j}$, the single-payment present value factor, can be substituted by the "functional format" of the standard notation endorsed by the Engineering Economy Division of the American Society for Engineering Education:

$$m_f = \frac{-\sum_{j=o}^{N} C_j.(P/F, r\%, j)}{\sum_{j=o}^{N^1} S_j.(P/F, r\%, j)} - 1 \qquad \text{(A.3.2)}^*$$

Moreover, C_j and S_j can be estimated from the following equations (See Table A.3)

$$\begin{cases} C_o = C_o \\ C_j = C_j - C_{j-1}, \quad \text{for} \quad j = 1, 2, \ldots, N \end{cases} \qquad \text{(A.3.3)}^*$$

and

$$S_j = S_j - S_{j-1} = 0.9\,[B_{j_o}(C_{j_o} - u_{j_o}) - B_{j_o-1}(C_{j_o-1} - U_{j_o-1})]$$

Substituting $j_o = j - (n+1)$,

$$\begin{cases} S_j = 0, & \text{for } j = 0, 1 \ldots, n \\ S_{n+1} = 0.9\,[B_o(C_o - U_o)], & \text{for } j = n+1 \\ S_j = 0.9\,[B_{j-(n+1)}[C_{j-(n+1)} - U_{j-(n+1)}] - B_{j-(n+2)}[C_{j-(n+2)} - U_{j-(n+2)}] & \\ \quad \text{for } j = (n+2), (n+3), \ldots, (N+n+1) & \end{cases}$$

(A.3.4)*

Equation A.3.2, A.3.3. and A.3.4 are the basic formulae of the FaRM Pricing Model which can be used in computerizing the model.

APPENDIX 4

ILLUSTRATION OF MARKUP DETERMINATION
(Using the FaRM Pricing Model)

Project:
GUEST HOUSE FOR GHANA WATER AND SEWERAGE CORPORATION (GWSC), KUMASI

1 **CONTRACTUAL REQUIREMENTS**

Contract duration = 6 months
Monthly Valuations
Retention 10%
Period for honouring certificates = 3 months

2 **OTHER CONSIDERATIONS BY CONTRACTOR**

Bank's lending rate (as at June, 1999) = 37% p.a.

Required Rate of Return (RRR) = 42% p.a. (or 3.5% per month)

PROJECT COST ESTIMATES

Total Estimated cost of Project = ¢ 375,000,000.00

	Activity (Item)	% of Total Cost	Cost ¢'000,000
1	Mobilization/Site preparation	0.8	3
2	Foundations	2.2	8
3	Siteworks	1.8	7
4	Metal work	6.8	26
5	Concrete	14.6	55
6	Mechanical systems	9.2	34
7	Blockwork	16.7	63
8	Electrical systems	7.5	28
9	Doors/windows	5.3	20
10	Air conditioning	7.2	27
11	Roofing	5.4	20
12	Finishing	5.7	21
13	Flooring	4.3	16
14	Wall Covering	2.2	8
	Total Direct Cost	89.7	336
	Project overheads	6.1	23
	Head Office overheads	4.2	16
	TOTAL COST OF PROJECT	100.0	375

Table A4.1: Modified Gantt Chart for GWSC Guest House

	ACTIVITY (ITEM)	END OF MONTH						% of Total Cost
		1	2	3	4	5	6	
1	Mobilization/Site Preparation	50	100					0.8
2	Foundations	35	100					2.2
3	Site works	25	50	75	100			1.8
4	Metalwork		50	100				6.8
5	Concrete		25	75	100			14.6
6	Mechanical Systems		30	60	100			9.2
7	Blockwork		25	60	95	100		16.7
8	Electrical System		10	20	65	90	100	7.5
9	Doors/Windows			30	80	90	100	5.3
10	Air Conditioning			10	65	100		7.2
11	Roofing				100			5.4
12	Finishing				50	100		5.7
13	Flooring					100		4.3
14	Wall Covering					55	100	2.2
								89.7
	Project overheads	15	30	50	70	85	100	6.1
	Head Office overheads	20	35	50	65	80	100	4.2
	Total Cost of Project							100.0

Note

The cumulative percentages of cost of each activity to be completed by the end of periods are shown in the corresponding cells

The cost of each activity as a percentage of the total estimated cost of the project is shown in the last column

Project overheads are those expenditures necessary for the ultimate completion of the project but not directly assignable to any particular activity.

Project overheads and head office overheads are included in the table because the concern is the total cost of the project to the contractor.

Table A4.2: Modified Cumulative Estimated - Cost Schedule for GWSC Guest House

	ACTIVITY (ITEM)	END OF MONTH						% of Total Cost
		1	2	3	4	5	6	
1	Mobilization/Site Preparation	0.4	0.8					0.8
2	Foundations	0.8	2.2					2.2
3	Site works	0.4	0.9	1.3	1.8			1.8
4	Metalwork		3.4	6.8				6.8
5	Concrete		3.6	10.9	14.6			14.6
6	Mechanical Systems		2.8	5.5	9.2			9.2
7	Blockwork		4.2	10	15.9	16.7		16.7
8	Electrical System		0.7	1.5	4.9	6.7	7.5	7.5
9	Doors/Windows			1.6	4.2	4.8	5.3	5.3
10	Air Conditioning			0.7	4.7	7.2		7.2
11	Roofing				5.4			5.4
12	Finishing				2.8	5.7		5.7
13	Flooring					4.3		4.3
14	Wall Covering					1.2	2.2	2.2
	PRIME COST (i.e. total direct cost of activities)	1.6	18.6	41.3	73.3	87.4	89.7	89.7
	Project overheads	0.9	1.8	3	4.3	5.2	6.1	6.1
	Head Office overheads	0.8	1.5	2.1	2.7	3.4	4.2	4.2
	Total Cost of Project	3.3	21.9	46.4	80.3	96.0	100	100.0

Note

Table A4.2 is a cost-oriented form of Table A4.1

End-of-month	% of Total-Estimated-Cost of Project
0	0
1	3.3
2	21.9
3	46.4
4	80.3
5	96
6	100

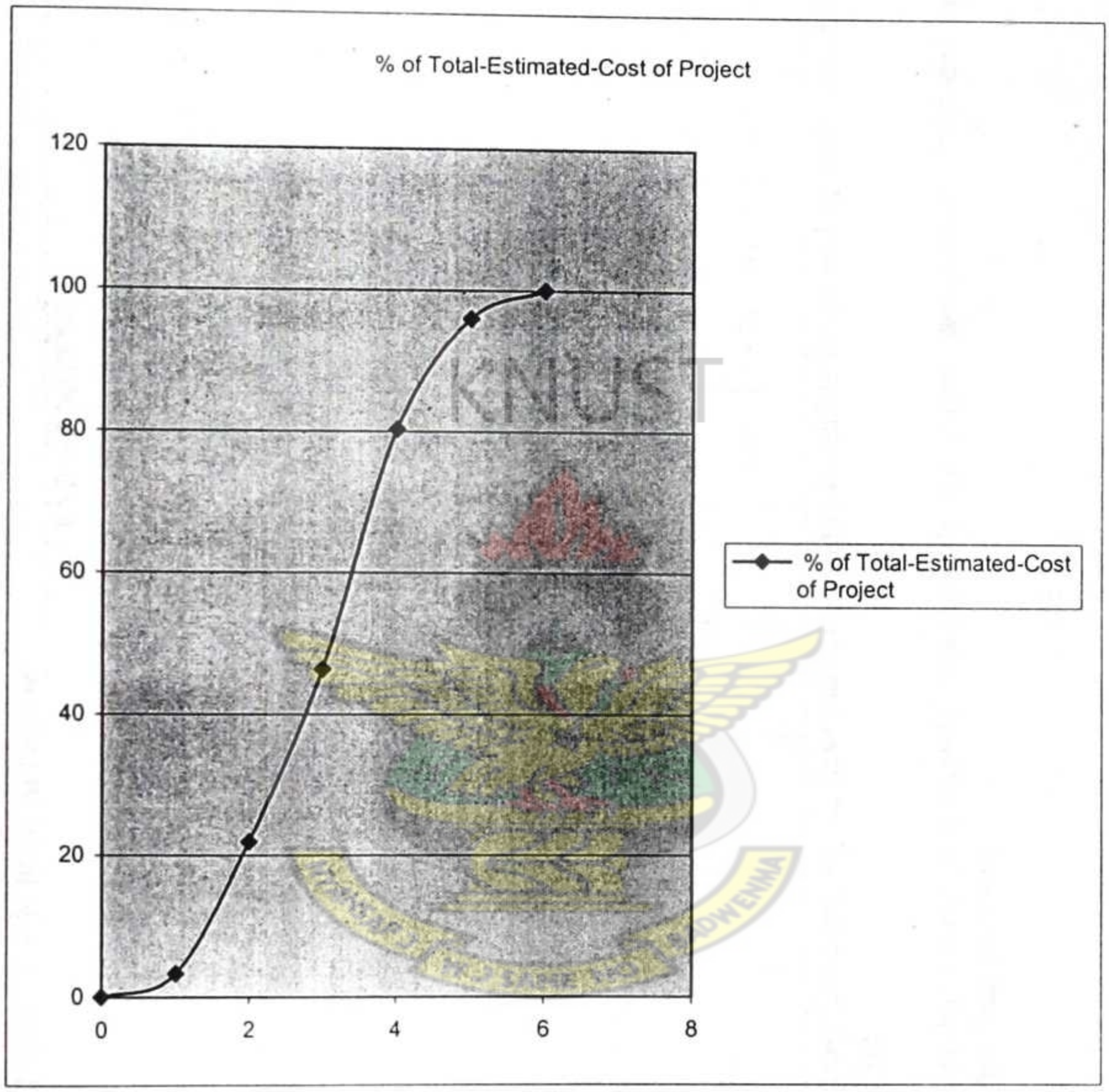

Fig. A4.1 - A Modified-Cumulative-Total-Estimated-Cost Curve (S-curve) for GWSC Guest House

A. USING FaRM PRICING MODEL TO COMPUTE MARKUP
(Head Office overheads charged as a cost item)

Table A4A.1 Modified - Cumulative - Cash-Flow Schedule

ITEM	END OF MONTH*										Percentage of total cost
	0	1	2	3	4	5	6	7	8	9	
(a) Cumulative total cost*	3.3	21.9	46.4	80.3	96.0	100.0					100.0
(b) Billing policy factor**	1.0	1.0	1.0	1.0	1.0	1.0					1.0
(c) Cumulative billable cost (c = a.b)	3.3	21.9	46.4	80.3	96.0	100.0					100.0
(d) **Less** Retention @ 10%	(0.33)	(2.19)	(4.64)	(8.03)	(9.60)	(10.0)					(10.0)
(e) Cumulative "Payments before markup" due	2.97	19.71	41.76	72.27	86.40	90.0					90.0
(f) Cumulative "Payments before markup" received	-	-	-	-	2.97	19.71	41.76	72.27	86.40	100.0+	100.0

*Assuming that management requires the company to have sufficient funds available at the end of each period for the total expenditures of the following period.

**This factor accounts for the costs that are not immediately reimbursable, and other cases such as "front-end loading", etc.
+Total retention is released with the final payment.

TABLE A4A.2 DETERMINATION OF OPTIMUM MARKUP

End of month j	PV Factor @ 3.5% P/F, 3.5%, j	Cash Outflows (Total cost for the following month) as % of Total Cost of Project, All Negative		Cash Inflows (Payments before markup received) as % of Total Cost of Project	
		$C_j = a_j - a_{j-1}$	$PV[C_j]$	$S_j = h_j - h_{j-1}$	$PV[S_j]$
(1)	(2)	(3)	(4)	(5)	(6)
0	1.000	3.30	3.30	-	-
1	0.966	18.60	17.97	-	-
2	0.934	24.50	22.88	-	-
3	0.902	33.90	30.58	-	-
4	0.871	15.70	13.67	2.97	2.59
5	0.842	4.00	3.37	16.74	14.10
6	0.814	-	-	22.05	17.95
7	0.786	-	-	30.51	23.98
8	0.759	-	-	14.13	10.72
9	0.734	-	-	13.60	9.98
	ΣC_j	-100.0	-91.77		
	ΣS_j			100.0	79.32

$$\text{NPV (3.5\%, 9 mo)} = (1+m_f)\,\Sigma PV[S_j] + \Sigma PV[C_j] = 0$$

$$m_f = -\{\Sigma PV[C_j] / \Sigma PV[S_j]\} - 1$$

$$= -(-91.77 / 79.32) - 1$$

$$= 1.157 - 1$$

$$= 0.157 \text{ or } 15.7\%$$

The **optimum markup** is 15.7%

With the receipt of the final payment, the contractor will realize a 15.7% markup, which would just satisfy its 3.5% per month RRR.

Determination of the Minimum Acceptable Price

Once the optimum markup is known the contractor's Minimum Acceptable Price (MAP) for the project can be determined.

Total cost of Project	¢375,000,000.00
Optimum markup @ 15.7%	58,875,000.00
Contract price before bond premium	¢433,875,000.00
Bond	869,500.00
Minimum Acceptable Price (MAP)	¢434,744,500.00

¢434,744,500 is the Contractor's Minimum Acceptable Price (MAP). The firm cannot accept the project at a price below this MAP without damaging its financial position.

B. USING FaRM PRICING MODEL TO COMPUTE MARKUP
(Head Office overheads included in markup)

Table A4B.1 Modified - Cumulative - Cash-Flow Schedule Revised

ITEM	END OF MONTH										Percentage of total cost
	0	1	2	3	4	5	6	7	8	9	
(a) Cumulative total cost	3.3	21.9	46.4	80.3	96.0	100.0					100.0
(b) **Less** Head Office Overheads, etc.	(0.8)	(1.5)	(2.1)	(2.7)	(3.4)	(4.2)					(4.2)
(c) Cumulative Chargeable Costs	2.5	20.4	44.3	77.6	92.6	95.8					95.8
(d) Billing policy factor	1.0	1.0	1.0	1.0	1.0	1.0					1.0
(e) Cumulative billable cost (e = c.d)	2.5	20.4	44.3	77.6	92.6	95.8					95.8
(f) **Less** Retention 10%	(0.25)	(2.04)	(4.43)	(7.76)	(9.26)	(9.58)					(9.58)
(g) Cumulative "Payments before markup" due	2.25	18.36	39.87	69.84	83.34	86.22					86.22
(h) Cumulative "Payments before markup" received	-	-	-	-	2.25	18.36	39.87	69.84	83.34	95.80	95.80

TABLE A4B.2 DETERMINATION OF OPTIMUM MARKUP (REVISED)

End of month j	PV Factor @ 3.5% P/F, 3.5%, j	Cash Outflows (Total cost for the following month) as % of Total Cost of Project, All Negative		Cash Inflows (Payments before markup received) as % of Total Cost of Project	
		$C_j = a_j - a_{j-1}$	$PV[C_j]$	$S_j = h_j - h_{j-1}$	$PV[S_j]$
0	1.000	3.30	3.30	-	-
1	0.966	18.60	17.97	-	-
2	0.934	24.50	22.88	-	-
3	0.902	33.90	30.58	-	-
4	0.871	15.70	13.67	2.25	1.96
5	0.842	4.00	3.37	16.11	13.56
6	0.814	-	-	21.51	17.51
7	0.786	-	-	29.97	23.56
8	0.759	-	-	13.50	10.25
9	0.734	-	-	12.46	9.15
	ΣC_j	-100.0	-91.77		
	ΣS_j			95.80	75.99

NPV (3.5%, 9 mo) = $(1+m_f)\,\Sigma\, PV[S_j] + \Sigma PV[C_j] = 0$

$m_f = -\{\Sigma\, PV[C_j] / \Sigma\, PV[S_j]\} - 1$

$= -(-91.77 / 75.99) - 1$

$= 1.208 - 1$

$= 0.208$ or 20.8%

The **optimum markup** is 20.8%

Determination of the Minimum Acceptable Price (Revised)

Total chargeable cost of project	¢359,000,000.00
Revised optimum markup @ 20.8%	74,672,000.00
Contract price before bond premium	¢433,672,000.00
Bond	869,100.00
Minimum Acceptable Price (MAP)	¢434,541,100.00