STRUCTURING FINANCE TO MEET CLIENT'S NEEDS

Full Paper

A STAGE-BY-STAGE FACTOR CONTROL FRAMEWORK FOR COST ESTIMATION OF CONSTRUCTION PROJECTS

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ABSTRACT

Construction companies compete primarily on time and cost. Central to cost-based competition is the capability to accurately predict the cost of delivering a project commonly referred to as cost estimation. Typically, estimation of project effort needs to be made at various stages of a project. Little extant literature investigates the effects of factors critical to effective estimation at various project stages. Most literature on cost estimation focuses on specific estimation methods as generic technique and little attention has been paid to the unique requirements at each project stage. This study attempts to identify the critical factors for effective estimation at various stages of typical construction projects.

Drawing from organization control theory and cost estimating literature, this paper develops a theoretical framework that identifies the critical factors for effective cost estimation during each of the project phases of a conventional and/or a DB (Design-Build) construction project. The underlying logic is that as a cost estimating effort progresses, both task programmability and output measurability improve. As a result, control effort will shift from input-oriented control to a combination of output and behavior control.

Keywords: cost estimation, construction project, organizational control, input control, output control, behaviour control.

1. INTRODUCTION

Construction contractors compete primarily on time and cost for delivering projects. The benefits or cost of early or late project completion, respectively, can be converted into monetary values for the clients. Essentially, competition is based on cost of delivering projects to the client. Central to cost-based competition is the capability to accurately predict the cost of delivering a project—commonly referred to as cost estimation. Overestimated cost could result loss of opportunities by the client and loss of contract by the contractor. On the other hand, both client and contractor could incur significant losses due to underestimated cost. Accurate cost estimation reduces the risk of cost overrun, provides confidence on project outcomes to the management and therefore contributes to the strategic management of the organization. As stated by Hicks, “without an accurate cost estimate, nothing short of an act of god can be done to prevent a loss, regardless of management competence, finance strength of the contractor” (Hicks, 1992).

Typically, estimation of project effort needs to be made at various stages of a project. At the conceptual stage, a ball park figure is needed to ascertain whether the feasibility of the project would allow a start. Later at the bidding and construction stages, fairly reliable estimates are needed for tendering and budget control purposes. Due to differences among different project stages on estimation objectives and in the availability of information required for using various estimation methods, effective estimation at different project stages is likely to depend on different sets of factors at each stage. Most literature on cost estimation focuses on specific estimation methods as generic techniques with little attention on the effects of factors critical to effective estimation at various project stages.

This study attempts to identify the critical factors for effective estimation at various stages for two dominant types of construction projects, conventional and Design-Build (DB) project, respectively. This paper starts with a review of current cost estimation literature on construction projects. Emphasis is on the accuracy level, critical factors and characteristics of different stages. Then, drawing from organizational control theory, a framework for grouping critical factors at different project stages is proposed. Finally, conclusions are drawn and implications for further research are discussed.

2. PRIOR RESEARCH

2.1 FACTORS INFLUENCING THE ACCURACY LEVEL

Forecasting construction price is heavily dependent upon historical price data, professional expertise and judgment. Limited design and construction information about a proposed construction project at early design stage may mean that quantity surveyors must rely on assumed or default values for many of the project details, which may cause inaccurate estimates if those assumptions or default values do not hold in the subsequent design and construction.

One of the critical indicators of the effectiveness of estimation is the accuracy level. Table 1 summarizes findings on cost estimation accuracy for construction projects dating back to the 70s'.

Typically, estimation accuracy is defined as the ratio between actual cost and estimated cost (Flanagan and Norman, 1983). However, the definition of actual and estimated cost varies. For example, lowest bid was used by Flanagan and Norman (1983) as actual cost while Morrison (1984) used mean bid received as actual cost. Similarly, pre-tender estimation has been used as estimated cost by some (Flanagan and Norman, 1983; Morrison, 1984) while contract value was used as estimated cost by others (e.g. Gunner and Skitmore, 1999).

There are also slight variations in the focus used to calculate the accuracy levels among the studies. For example, Barnes and Thompson (1971) and Gunner and Skitmore (1999) used statistical methods such as Mean Magnitude of Relative Error (MMRE) and Coefficients of Variation (CV) to test the accuracy level from the cost data of past projects while others (Cheong, 1991; Huxley, 1991) used survey to obtain project managers or quantity surveyors' recollection on accuracy levels. Despite the inconsistencies, the accuracy from these studies portraits a general picture of the trend and level of construction cost estimation accuracy over the last three decades. It shows that estimation accuracy level for construction projects hardly changed over the past 4 decades and remains at around 10% level.

Table 1 Summary of Literature on Estimation Accuracy

Source	*Year project undertaken*	*Accuracy (Range)*	*Sample size*	*Estimation Method*
(Barnes and Thompson, 1971)	1970	6%	159 contracts	Unit rate Bill of quantity
(Barnes, 1972)	1972	10% (7%)	228 Projects	
(McCaffer, 1976)	1976	5.17%	132 Projects	
(Flanagan, 1980)	1970-1974	5.49% (8.22%)	64 Projects	Elemental pricing bill of quantities
(Flanagan and Norman, 1983)	1971-1978	11%	166 Projects undertaken by 2 country council	Approximate Quantities
(Jupp and McMillan, 1981)	1981	5%	49 Projects	
(Morrison, 1984)	1978	11.97% (8.88-12.86%)	557 Projects undertaken by 7 quantity offices	Elemental pricing bill of quantities
(Cheong, 1991)	1991	5% -10%	1 quantity surveyor company	
(Huxley, 1991)	1978-1989	10%	1310 projects that attached 7287 bids	Survey from project manager
(Gunner and Skitmore, 1999)	1980-1991	10%	181 Projects	Elemental pricing bill of quantities
(Ling and Boo, 2001)	1992-1998	9% (4%-12%)	42 projects from six quantity surveyor company	

A wide range of factors influencing cost estimating have been identified by extant literature. Koehn, Fallon et al. (1978) found that government regulations, plan changes, quality of the contractor management team, priority on construction deadlines, and completeness and timeliness of project information impacted on construction cost. Shash and Al-Khaldi (1992) identified bidding situations, project characteristics, experience on similar type of project, delays in periodic payments, type and size of contract, project location and the estimating process itself as factors influencing estimation accuracy. Similarly, a study by Al-Harbi, Johnston et al. (1994) reported that major problems facing cost estimators included, in order of importance, intense competition, incomplete project scope definition, unforeseeable change in material prices, changes in owners' requirements, current workload, and error in judgment. In addition, experience (Lowe and Skitmore 1994), project complexity, technological requirement, project information, project team requirement, construction arrangement, project duration and market requirement (Akintoye 2000) were found to influence estimation accuracy, while season, location, type of project, contract duration, and contract size were also found to influence estimation accuracy by impacting on contract cost (Hegazy and Ayed 1998).

More recently, studies on cost estimation seem to have shifted away from earlier focus on identifying cost factors and focus more on developing and testing mathematical models that produce estimates through factor analysis and regression analysis. For example, Trost and Oberlender (2003) identified eleven factors from 45 elements through exploratory factor analysis, including basic process design, team experience and cost information, time allowed to prepare the estimates, biding and labor climate, and site requirements. Then, based on 67 completed construction projects, a regression model was tested as a prediction tool.

Most studies reduce the large number of cost elements by grouping factors into categories of factors with common attributes. In this study, we regroup the factors identified by earlier studies into 11 categories as shown in Table 2. The factors discussed above are assigned into these categories based on their similarity. The detailed scheme for factors allocation is referred to Table 3. This categorization will be used in the next section in developing the framework for controlling estimation efforts.

Table 2 Summary of literature on factors influencing estimation accuracy

Factor Category	Source										
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
	1978	1988	1992	1994	1994	1997	1998	1999	2000	2001	2003
1. Project Information	★	★	★		★				★	★	
2. Team Experience		★	★	★	★	★		★	★		★
3. Cost Information					★				★	★	★
4. Estimation Process			★			★				★	★
5. Team Alignment	★									★	★
6. Estimation Design								★		★	★
7. Expected accuracy				★		★			★	★	
8. Review and acceptance of estimate										★	★
9. Project Environment Factors	★	★			★	★		★	★		★
10. Project Attribute Factors		★	★			★	★	★	★		
11. Contingent Factor	★		★		★	★	★	★			

Note: [1]. (Koehn, Fallon et al. 1978); [2]. (Skitmore 1988); [3]. (Shash and Al-Khaldi 1992); [4]. (Lowe and Skitmore 1994); [5]. (Al-Harbi, Johnston et al. 1994); [6.] (Kaming, Olomolaiye et al. 1997); [7]. (Hegazy and Ayed 1998); [8]. (Gunner and Skitmore 1999); [9]. (Akintoye 2000); [10]. (Ling and Boo 2001); [11]. (Trost and Oberlender 2003)

2.2 PROJECT PHASES AND PROCUREMENT SYSTEMS

The conventional procurement system and Design-Build (DB) are two widely-adopted procurement systems in the construction industry. According to Masterman (2002), in 1998, 41% of construction projects in the UK was using the conventional system, compare with 40% of construction project using DB system. Overall, 81% of construction projects in the UK were based on these two systems. Other systems include management-oriented system and discretionary system (Masterman, 2002). For simplicity, the discussion in this paper is limited into the two dominating systems, the conventional and design-build systems.

Under the conventional procurement system, the client contracts separately with designers and contractors and deals directly with most stakeholders involved in the project. In contrast, under a standard DB system, the client usually contracts with a prime contractor to perform both design and construction under a single contract. Typically, the client deals directly mainly with the contractor. The commonly used method is the client starts with own design team to formulate project brief and initial design. Then, prepares either limited documents for a tender or negotiates with a DB contractor. The majority of the design team is then novated to the contractors.

The processes of these two systems in procuring and delivering a typical project are illustrated in Figure 1. As shown in Figure 1, the conventional procurement system can be divided into 5 stages, Conceptual stage, design stage, tender stage, pre-construction stage and build stage.

At the *Conceptual stage*, the typical objective is strategic planning. Estimates are usually prepared as input for feasibility analysis. Relatively little effort is expended carrying out this type of estimate which will be used only as a very coarse screen to gauge the degree of further interest. At this stage, the project scope is not well defined. The typical expected accuracy level at the strategic/conceptual stage is between 30% and 50% (Ashworth and Skitmore, 1982).

At the *Design stage*, cost estimates are continuously adjusted as the design evolves. The typical objective for cost estimation at this stage is evaluating the design feasibility within budget constraint. At this stage, a considerable amount of engineering design work has been completed, and bills of quantities and materials take-offs have been carried out. The availability of detailed design information enables the effective use of traditional estimation method such as detailed break down cost element. Because of increased availability of cost information as design progresses, the expected accuracy level at this stage is around 20% (Morrison, 1984).

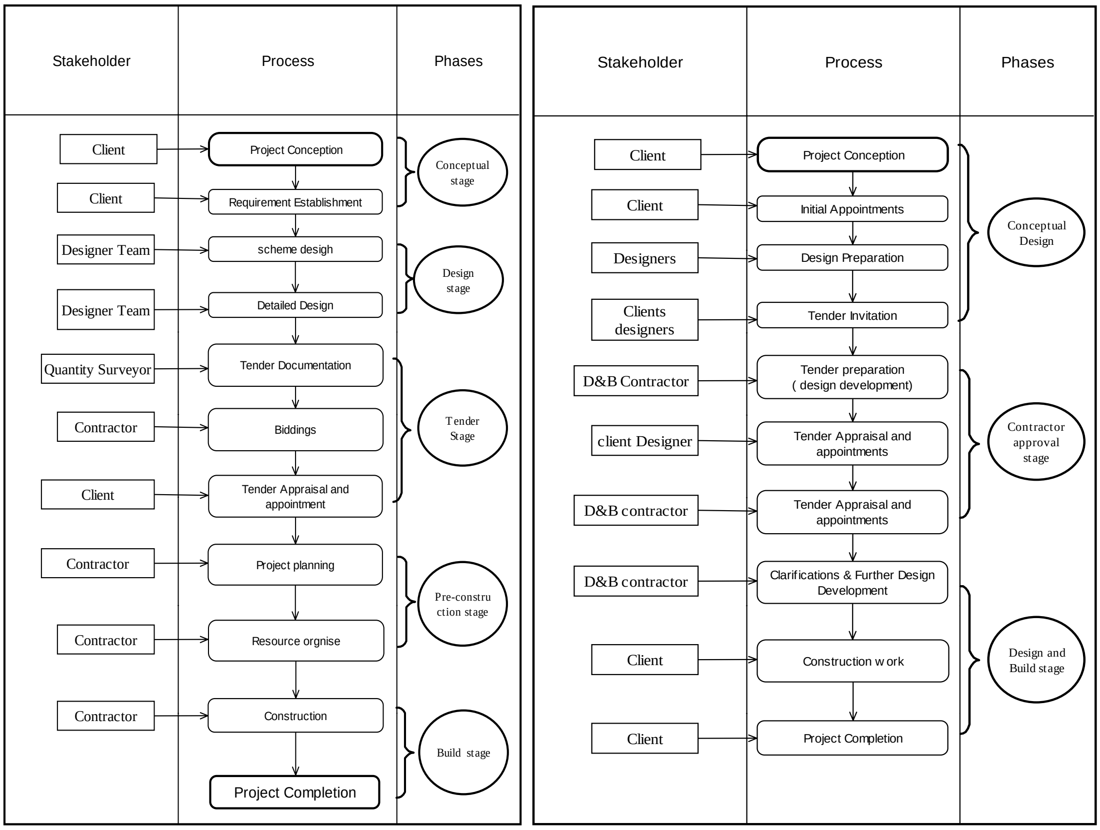
At the *tender stage*, focus is shifted to prepare cost estimates for competitive biding. Estimates are derived based on subcontractor quotations, quantity takeoffs, construction processes, management overhead and profit markup. The expected level of accuracy typically centers around 10%.

At the Pre-construction stage, the main objective shifts to outline cost items for cost control and budget predictions during construction. At this stage, the project scope is clearly defined. The expected accuracy level is typically around 5% due to the strong focus on cost control (Ferry and Brandon, 1991).

Finally at build stage, the focus here is firmly on cost control. The cost accuracy improves as project moves closer to completion. Since this paper deals with cost estimation whereas the emphasis of this stage is on cost control, the discussion below will focus on the stages from conceptual to pre-construction

Figure 1

Standard Conventional Project Standard D&B Project



The project under DB system as shown in Figure 1 is typically divided into three distinct phases, conceptual design, contractor approval, and design and build.

The conceptual design stage of the DB project is to develop a project plan that outlines the basic requirements for the project. Compared to the conceptual stage of traditional Design/Bid/Build projects, the project plan includes more detailed design specification and construction process definition. Historically, the conceptual phase has the most significant impact on the cost of DB projects (Stillman, 2002). It is the sole responsibility of the client to make sure that the project plan is built on sound business case.

The contractor approval stage is identified as a critical stage for the success of a DB project and probably a stage where most problems are likely to be encountered. Difficulty of communicating detailed requirements through briefing without the aid of drawings or bill of quantities is a major concern. At this stage, cost estimation is the primary concern of contractors. Contractors need to have confidence in the accuracy of their estimates of the fixed-price lump sum based on client's basic performance requirement. The contractor needs to make a bid based on limited requirement information from the client. Estimation accuracy at this stage is crucial to the contractor's return/loss from the project. Contractors often employ multiple estimation methods rather than relying on any single approach (Crockett, 2001). Since detailed design such as floor drawings has not been drawn up at this stage, it is essential that the estimator is experienced in estimating similar projects. For the clients, effort is concentrated on selecting the contractor with appropriate skill sets, experience and good reputation.

Once the contract has been entered into, the contractor will take the responsibility of obtaining necessary planning, building regulation and any other statutory approval to carry out the design. During this stage, the design process is typically fully integrated with cost estimation to meet budget constraint and client approval for design specification. It is therefore possible to evaluate the constructability and cost impacts of particular designs. As a result, the estimates produced at this stage tend to be more accurate than those produced at the design stage of conventional design/bid/build projects. This ability to more accurately predict costs contributed to the ability of contractors to manage down project costs.

2.3 ORGANIZATIONAL CONTROL THEORY

In this study, organizational control theory is adopted as the theoretical basis for constructing a stage-by-stage estimation framework. This section introduces the organizational control theory. Control is conceptualized in this paper as influences exerted by an organization using various mechanisms that help align the actions of its employees with the interests of the organization (Tannenbaum, 1967). Organizational control theory identifies three types or modes of control that can be directed at achieving the behavior necessary to secure desired performance: behavior control, output control and input control (Snell, 1992). They differ in the ways each influences organizational members' behaviors and performance.

Behavior control seeks to secure a specified type of behavior in the belief that the behavior delivers the right results. Behavior controls are procedures that lay down a sequence of operations that must be followed. Cost estimation methods exemplify this form of control.

Output control specifies the schedule of outputs desired. The assumption is that people, who know what their targets are, adopt appropriate behaviors to achieve them. E.g. specifying expected estimation accuracy is a form of output control. Another example of output control is to link performance (output) to promotion.

Input control regulates the input into the transformation processes. In the case of cost estimation, input includes historical estimation, design information, experience of the estimators and material price. This may be achieved through mechanisms such as selecting the right people, improving data quality and integrating design with cost estimation. Input control may also be implemented by developing relevant knowledge, skills and values in existing organizational members.

Figure 2 presents Ouchi's control framework (Ouchi, 1979) which subsequently forms the basis for many empirical studies using control theory (Snell, 1992; Kirsch, 1996; Kirsch, 1997;Eisenhardt, 1985;Govindarajan and Fisher, 1990;Henderson and Lee ,1992). In Figure 2, task programmability is defined as the degree to which appropriate behaviors can be specified in advance (Eisenhardt, 1985) and output measurability is defined as the degree to which output can be reliably and accurately measured (Ouchi, 1979). The framework (Ouchi, 1979) shows that when task programmability is high, it is possible to specify the behaviors necessary to achieve a desired result so behavior control is appropriate. When output measurability is high, then output control can be monitored to achieve the desired result. If neither of these conditions applies, then, following Snell (1992), input control is the appropriate control mode to deliver high performance.

Figure 2 Origination control Model (adapted from (Ouchi, 1979))

	Task programmability	
	High	Low
High output measurability	**Cell 1** Output and/or Behaviour Control	**Cell 3** Output Control
Low output measurability	**Cell 2** Behavior Control	**Cell 4** Input Control

3. THE FRAMEWORK

Based on the control framework presented in Figure 2, the key input, output and process factors for cost estimation at each project stage are identified for construction projects under the conventional and DB systems respectively. We argue that the levels of task programmability and output measurability change with project stage. Therefore, the locus of controlling estimation task at different stages should be dependent on the level of task programmability and output measurability. Below, we develop a stage-by-stage framework that outlines the appropriate controls for each stage. Then, the key input, output and behavioral factors that could be controlled for estimating task at each project stage are identified.

3.1 PROJECT STAGES AND CONTROL MODES

Under the conventional procurement system, the task programmability and output measurability of cost estimation increase as a project progresses through stages as more information about project design, specification and construction methodology become available. At the conceptual stage, the project scope is not well defined and the design has not yet been undertaken. The only information available for cost estimation is owner requirements and historical project data. Output measurability is likely to be low at this stage because the estimation is based on inaccurate data. The typical level of cost estimation accuracy at this stage is around 30-50% for construction projects (Ashworth and Skitmore, 1982). Estimation at this stage heavily relies upon estimator's experience to make subjective judgment about the magnitudes of key cost factors (Skitmore, 1988) suggesting task programmability is low. Estimating method or process (behavior control) at this stage appears to have limited effect on estimation effectiveness. Therefore, output and behavior control have little impact on the estimation effectiveness at this stage. According to control theory (see Figure 2), control effort should focus on input control.

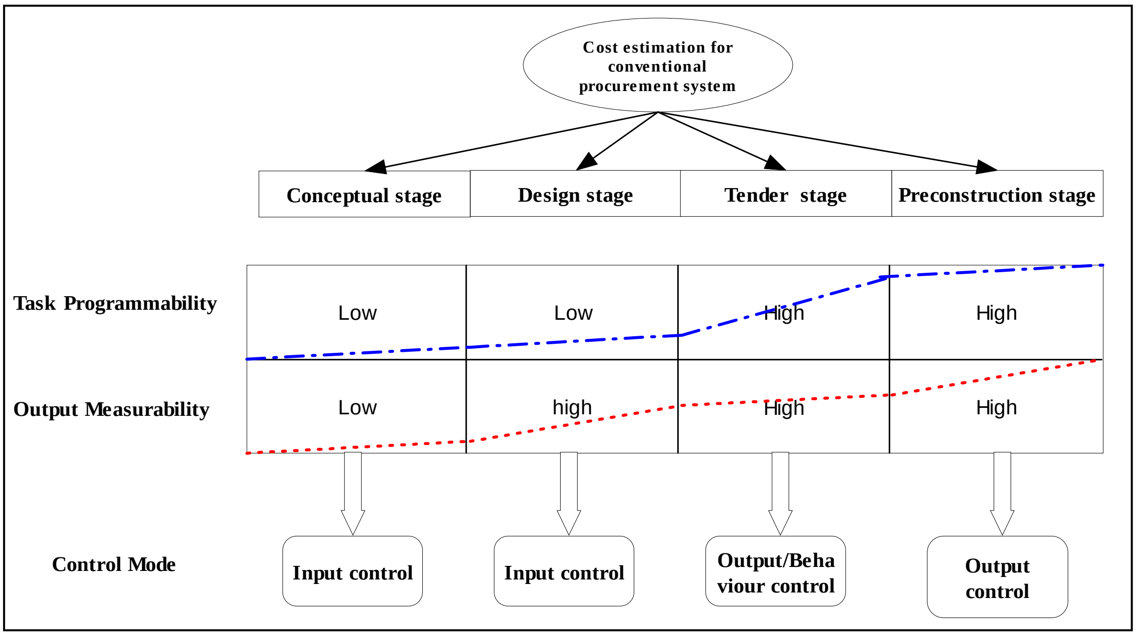
Then at the design stage, a considerable amount of engineering design work has been undertaken, and bills of quantities and materials take-offs have been produced. Output measurability increases as detailed drawings and specification become available to the estimator. Typical estimation accuracy at this stage is around 20% (Morrison, 1984). Since detailed design provides a more objective basis for cost estimation, more elaborate estimation methods and procedures can be used to aid cost estimation--task programmability increases. At this stage, although the reliance on behavior and output control increases, input control is likely to be the dominant control mode because limited improvement in task programmability and output measurability constraints the effect of output and behavior controls. Estimator's experiences still plays an important role in estimating effectiveness.

Next at tender stage, the focus is on producing an estimate that provides the basis for competitive bidding. It is crucial to the contractor that the estimate is accurate in order to make a reasonable return on investment. Output measurability is likely to be increased because the contractor will be able to factor in its construction process cost more accurately. Typical estimation accuracy at this stage is about 10% (Flanagan and Norman, 1983). Task programmability is likely to be improved since more sophisticated estimation methods and processes are justified to be used at this stage. Subjective judgment from human is likely to be minimized at this stage. The locus of control shifts from input control to output and behavior controls.

Finally at the pre-construction stage, the focus shifts to project cost control. Task programmability remains unchanged since estimation methods usually do not change at this stage. Output measurability increases as requirements are crystallized, the construction processes specified and project plan agreed upon. The strong focus at this stage is typically placed on controlling output while behavior control and input control plays enabling roles.

The relationship among control modes, task programmability, output measurability and project stages discussed above are replicated in Figure 3.

Figure 3 Control Model for conventional system cost estimation



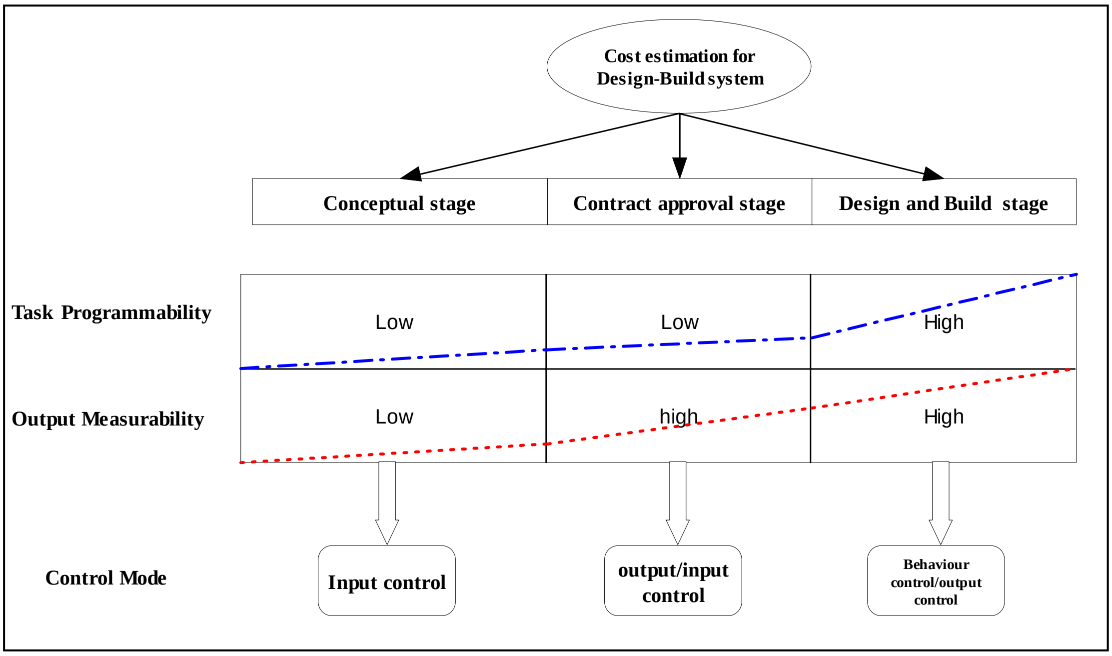
The relationships among control modes, task programmability, output measurability and project stages for a DB project is different from that for a conventional design/bid/build project depicted in Figure 3. At each stage of a DB project, there are iterations in design and build. A unique feature of this type of projects is that detailed drawings and specifications are not fully developed upfront. Instead, they are developed as the construction is in progress. It is not unusual that the floor-drawings for the next level are completed the same time when the construction of the level below is completed. The main benefit from this procurement method is the time advantage it may have over other types of procurement methods.

At the conceptual stage of a DB project, the estimator still faces the same difficulties as in the same stage of a conventional design/bid/build project. The dominant control mode at this stage is input control (See Figure 4).

Next at contract approval stage, estimation accuracy becomes the focus of the contractor. Based on cost estimates, the contractor makes a bid for constructing the project (Akintoye, 1994; Molenaar and D.Songer, 1998). Compared with the conceptual stage, output measurability improves as some design details become available. Task programmability is likely to be increased as more elaborate estimating method and processes can be used in this stage thus reducing the solely reliance on expert judgement in the conceptual stage. For conventional design stage cost estimation, the outcome is based on detailed design document. In contrast, for a DB project; the outcome is based on close communication with client about project requirements (Stillman, 2002). Therefore, Input control still plays a vital role at this stage. The dominant control modes at this stage are likely to be a mix of input and output control with behaviour control plays an enabling role.

Finally at the design and build stage, design specifications are gradually being crystallized, construction processes have been tested and possibly adjusted, and the completed portion of the facility is available for visual inspection. These contribute to the gradual improvements in output measurability. Repeated estimating cycles will lead to improved task programmability levels. Therefore, the dominant control modes here are likely to be output control and behaviour control.

Figure 4 Control Model for DB system cost estimation



3.2 INFLUENCE FACTORS

Having identified the factors influencing cost estimation and the control modes for each of the project stages, we here further group influence factors into two categories, control factors and idiosyncratic factors. Control factors are the factors that can be controlled by estimators to improve the performance of estimation, which are sub-divided into input, output, and behavioural control factors. Idiosyncratic factors are factors outside the control of the estimator that influence cost estimation. This category includes three subcategories, project environment, project nature and contingency factors. The classification scheme is presented in Table 3. Since idiosyncratic factors, which have same impact on the estimation effectiveness regardless of project stage, have been studied by many earlier studies, they will not be discussed here. Their inclusion in Table 3 is for completeness.

Table 3 Influence factors

Control Factors				
	FI-Input Control Factor		**FB- Behavior Control Factor**	**FO- Output Control Factor**
Project Information	Project scope definition FI_1	Estimating Process	Schedule control FB_1	Expected accuracy Level FO_1
	Estimation assumption accuracy FI_2		Increasing cost planning and control activity FB_2	
	Owners requirements clarity FI_3		Formal defined estimating work process FB_3	Review and acceptance of estimate FO_2
	Completeness of project Design FI_4			
Team Experience	Experience in local market FI_5	Team Alignment	Involvement of resource (Labor, cost) in preparing estimate FB_4	Benchmarking……………FO_3
	Experience in similar projects FI_6		Level of team integration and alignment FB_5	
	Experience in similar contract type FI_7		Level of involvement of project manager FB_6	
Cost Information	Historical data for similar job FI_8		Effective communication FB_7	
		Estimation Design	Formal structure to categorize and prepare cost estimation FB_8	
			Estimation methodology FB_9	
	Historical data quality (relative and accurate) FI_9		Standard procedure for updating cost information FB_10	

Idiosyncratic Factors		
FE- Project Environment Factor	**FN- Project Attributes**	**FC- Contingent Factor**
Market condition index FE_1	Project complexity FA_1	Weather FC_1
Market competition FE_2	Size of contract FA_2	Market price fluctuations FC_2
Environment restriction FE_3	Site constrains FA_3	Sudden material/equipment shortage FC_3
Equipment/Resource availability FE_4	Procurement system FA_4	
Site requirement FE_5	Contract work type FA_5	Season FC_3
Technology requirement FE_6	Project type FA_6	

Mapping the control factors in Table 3 to the models for the conventional projects and DB projects as presented in Figures 3 and 4, respectively, we propose two corresponding models in Figure 5 for controlling influence factors during each project stage.

Figure 5 shows that for a conventional project, the emphasis in the conceptual stage should be on input factors such as project information, cost information and team experience. In the design stage, the attention should be shifted to estimation design and estimation process in addition to project information and team experience. Entering the tendering stage, the focus is on expected accuracy level, benchmarking, team alignment in addition to estimation design and estimating process. Finally at the pre-construction stage, the emphasis narrows down to review and acceptance of estimate, estimation design, team alignment and benchmarking.

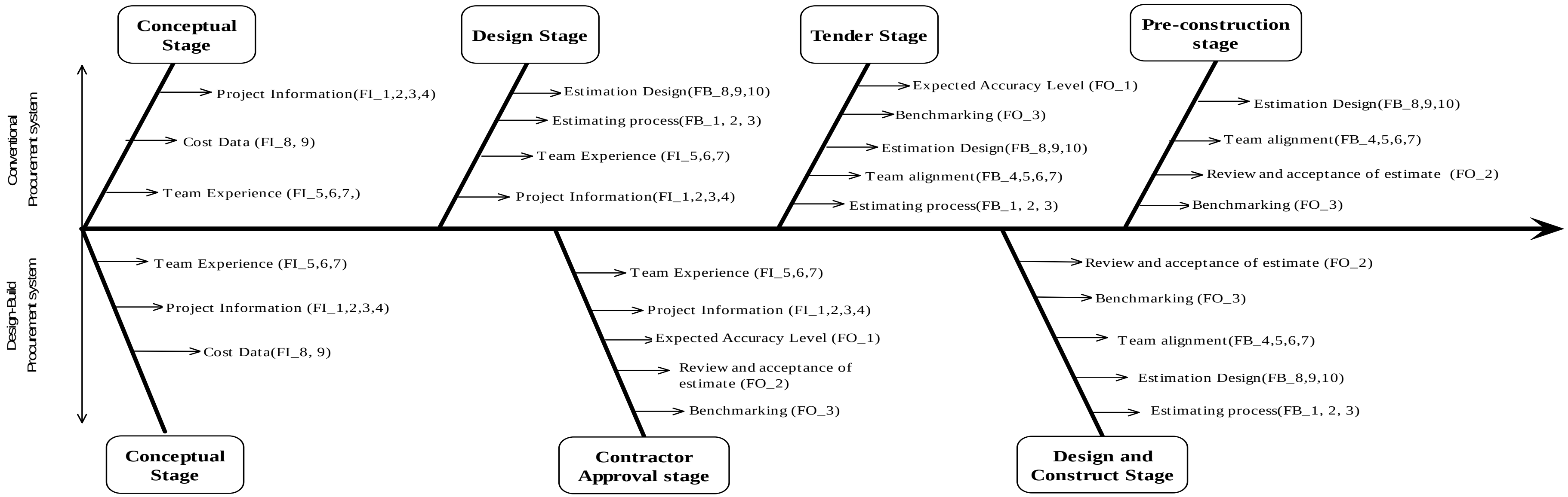
Similarly, Figure 5 also shows that for a DB project, the emphasis in the conceptual stage is the same as those for the same stage in a conventional project, namely project information, cost information and team experience. Next in the contractor approval stage, since the bidding process is moved earlier than in a conventional approach, the focus on control factors shift to a combination of output and input control factors including project information, team experience, expected accuracy level, review and acceptance of estimate and benchmarking. Finally in the design and construct stage, attention is on output and behavior factors such as estimating design, estimating process, team alignment, review and acceptance of estimate and benchmarking.

4. Conclusion and Discussion

Drawing from organization control theory and cost estimating literature, this paper develops a theoretical framework that identifies the critical factors for effective cost estimation during each of the project phase of a conventional and/or a DB construction project. The underlying logic is that as a cost estimating effort progresses, both task programmability and output measurability improve. As a result, control effort will shift from input-oriented control to a combination of output and behavior control. The validity of this framework needs to be tested in further empirical studies. Eventually, the framework may help construction companies to place their organizational resources on controlling factors that are critical to estimating effectiveness.

Figure 5 Stage-by-Stage Control Factor Framework

Scope	Little project information available; Past similar project information.	Based on client's belief Preliminary sketch design data	Detailed scope of project; Quantities surveyor's Bill of quantities; Detailed design drawing; detail specification.	Detailed drawing and specification, construction schedule, extensive site inspection, project plan information for vender and subcontractor
Objective	Economical Appraisal	Prepare Bill of Quantity/Budget for tendering	Biding/Tendering	Cost outline/Planing
Stakeholder	Owner/Investor	Designer/Architecture	Bidder	Contractor



Stakeholder	client	Client/Contractor	Contractor/Client
Objective	Economic appraisal and developing project requirement	Client: selecting contractor Contractor:Biding/Tendering	Contractor: fulfill the requirement of client Client: ensure the contractor's progress is in accordance with agreed programme
Scope	Project objective and preliminary requirement	Written project requirement without detailed drawings or standard bill of quantities	Necessary planning, building regulation and any other statutory approval to carry out the detailed design

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