

Construction Project Cost Feedback in Developing Economies: the Case of Pakistan

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Abstract

Construction projects are fraught with uncertainty and they are learning processes. As such, managers need to constantly use field data to refine planning. Feedback is an effective management tool because it serves an informational function that enhances work performance. The construction industries in developing economies like Pakistan suffer many problems such as delays, cost overruns, and miscommunication of information within organisations.

A research focusing on the communication system and feedback control processes among the members of general contracting organisations in Pakistan has been conducted. Three cases were selected from a list of general contracting organisations for study through formal and informal interviews. Construction companies in Pakistan do not have effective systems to collect feedback data from the site. They collect feedback data only through monthly cost bills. There is also no practice of standardization of data. The main reason for this is the heavy use of subcontracting and lack of formally educated personnel in the construction industry. Suggestions are made to improve the feedback system and project performance.

Keywords: *Cost control, feedback, uncertainty, learning, project performance.*

INTRODUCTION

The term 'feedback' originates from the field of cybernetics founded in the late fifties by Norbert Wiener. The term quickly entered colloquial speech and was adopted as a term in disciplines as varied as psychology and biology.

Feedback, applied to interpersonal communication, carries with it the idea of evaluation or judgement of performance. Communicating information about requirements, expectations, scope, costs, schedules, and technical data is a vital element in achieving quality in construction projects.

Feedback is an effective management tool because it serves an informational function that enhances an individual's work performance and is an important process affecting productivity of construction organisations. Construction projects everywhere are prone to problems of communication and a great deal of effort has gone into ways of improving communication. The construction industry in Pakistan suffers many of the problems common to other developing countries such as delays, cost overruns, accidents, and miscommunication of information within organisations.

The objectives of the this paper are:

- To describe how construction organisations incorporate feedback in the management of cost control processes in projects in Pakistan.
- To identify factors influencing feedback control processes in these organisations.
- To develop strategies for improving estimating and cost control by improving feedback mechanisms.

The scope of the research is limited to the communication system and feedback control processes among the members of a single contractor's organisation. Three cases have been selected from a list of general construction organisations in Pakistan. The efficient management of construction projects towards continuous cost reduction is a major challenge facing the industry in developing countries. This paper discusses the possibilities of using feedback information for continuous cost reduction.

Communication and feedback

Schermerhorn (1996) defines communication as an interpersonal process of sending and receiving symbols with meanings attached to them. Communicating information such as requirements, expectation, scope, cost, schedule, and technical data is a vital element in producing quality in construction projects.

The process of communication involves an interchange of thoughts, information, knowledge, or opinions. Transmitting information to an individual is only part of the total process. Communication has not taken place unless the person receiving the information is in a position to understand what the information means and then to respond to it. The response constitutes *feedback* and is an essential part of the total communication process.

Schermerhorn (1996) described feedback as the process of telling someone else how you feel about something that person did or said. A manager should make sure that any feedback is understandable, acceptable and plausible, all from the recipient's point of view. Feedback typically consists of information provided to an individual concerning the outcomes of their performance. It provides information about the correctness, accuracy, and adequacy of work behaviours. Feedback control systems of various kinds at various levels operate continuously throughout the life of a project.

Schermerhorn (1996) offers specific guidelines for giving "constructive" feedback:

- Give feedback directly and with real feeling, based on trust between you and the receiver.
- Make feedback specific rather than general, using good, clear, and preferably recent examples.
- Give feedback at a time when the receiver seems most willing or able to accept it.
- Make sure the feedback is valid, and limit it to things the receiver can be expected to do something about.
- Give feedback in small doses; never give more than the receiver can handle at any particular time.

Thus, it would seem that timeliness, accuracy, relevance and efficiency are important considerations in order to make feedback effective.

Problems of feedback in the construction industry

Harris and McCaffer (1989) observed that the construction industry is unlike many manufacturing situations because it is concerned mostly with one-off projects. This naturally creates difficulties for effective management control, because each new contract often has a fresh management team; labour is transient and recruited on an ad hoc basis. In addition, sites are dispersed throughout the country and this tends to cause problems in effective communication with other parts of the company; subcontractors and 'lump' labour are common. Added to all these are ever-changing weather conditions. The problems encountered in the provision of feedback are related to conflicting interests, and poor communication.

Guervara and Boyer (1981) analysed the communication problems known as overload, gate keeping and distortion within construction. They observed that when overload exists, there is not enough feedback, face-to-face communication modality, or interaction between employees. When gate keeping occurs, there is not enough feedback or employees are not satisfied with the communication, or both. When distortion exists there is inadequate feedback, or insufficient interaction and under-load.

Feedback and cost control

A major objective of construction organisations is to minimise cost, which contributes to profit. As such costs must be monitored and controlled, whether from the point of view of the owner, the designer, or the contractor. Project cost control data are important not only to the project management for decision making, but also to the company's estimating and planning departments because these data provide feedback information essential for effective estimates and bids on new projects (Halpin, 1985).

In designing and using a cost control system, it is good to keep in mind the main purposes, which such a system serves. Pilcher (1992) describes these purposes in the following terms:

- to provide immediate warning of uneconomic operations, in the long and short term;
- to provide the relevant feedback, carefully qualified in detail by all the conditions under which the work has been carried out, to the estimator who is responsible for establishing the standards in the past and future;
- to provide data to assist in the valuation of those variations that will arise during the course of the work;
- to promote cost consciousness; and
- to summarise progress.

Having solid project controls in place provides for opportunities to control costs. Generating profits, instead of incurring more losses, is the backbone and main purpose of a working cost control system (Younker, 1993).

Learning

The basic principles of learning curves is that skill and productivity in performing a task improves with experience and practice (Barrie and Paulson, 1992). Ogunlana (1991) describes how design cost estimating accuracy could benefit from promoting learning. A consideration of the underlying reasons for the observations made regarding the practice and accuracy level in estimating suggests that motivation to learn is not high. Thus, the generally held view that estimating performance is good enough persists because estimators' attention is not drawn to evidence contradicting their assumptions. This oversight derives from the absence of a system requiring regular monitoring of estimating performance. He suggested that learning can be improved and estimating performance increased through the collection and use of feedback data.

Lowe and Skitmore (1994) investigated experiential learning theory and the current perception of experiential factors in the accuracy of pre-tender cost predictions. They compared the preferred learning styles of a sample of experienced pre-tender cost estimators with those of novice quantity surveyors and investigated how estimators have developed as a result of these experiences. Experiential factors which stimulate personal development in pre-tender estimators are considered and a mechanism to improve the accuracy of pre-tender estimates is proposed linking experiential learning theory with the introduction of feedback and self-monitoring systems.

Information system and cost control

General objectives for an information system designed to aid management in the planning and control of engineering and construction projects may be stated as follows:

- To provide an organised and efficient means of measuring, collecting, verifying, and quantifying data reflecting the progress and status of operations on the project with respect to schedule, cost, resource, procurement and quality.
- To provide standards against which to measure or compare progress and status. Examples of standards include CPM schedules, control budgets, procurement schedules, quality control specifications, and construction working drawings.
- To provide an organized, accurate and efficient means of converting the data from the operation into information. The information system should be realistic and should recognize: (a) the means of processing the information (e.g.; manual versus computer), (b) the skills available, and (c) the value of the information compared with the cost of obtaining it.
- To report the correct and necessary information in a form which can best be interpreted by management, and at a level of detail most appropriate for the individual managers or supervisor who will be using it (Barrie and Paulson, 1992).

Cost estimating

The traditional methods of construction procurement in most parts of the world all generally involve some form of competition between a number of contractors, with price usually playing a major part in the selection of the contractor eventually chosen to carry out the work. Contractors need some reliable method of price forecasting, and therefore likely costs, for future construction work.

In order to formulate a bid, a contractor needs to include a number of other factors in addition to the costs of the direct inputs to the project. Specifically, it needs to know about its direct costs; the cost of operating the business. Indirect costs may be defined as those costs that the contractor faces whether or not it actually carries out any work. In crude terms, the commercial value for construction work will include the total of the direct costs, that is the net estimate, with appropriate additions for indirect costs represented basically by overheads and profit.

The integrated approach

Smith (1995) described how some estimating packages may be combined with other models to form a comprehensive integrated contractor's financial management system. Integration of estimating into financial management processes means that contractors can then achieve a truly integrated approach. The integrated view of the relationship between estimating, tendering, budgeting and cost control is shown in Figure 1.

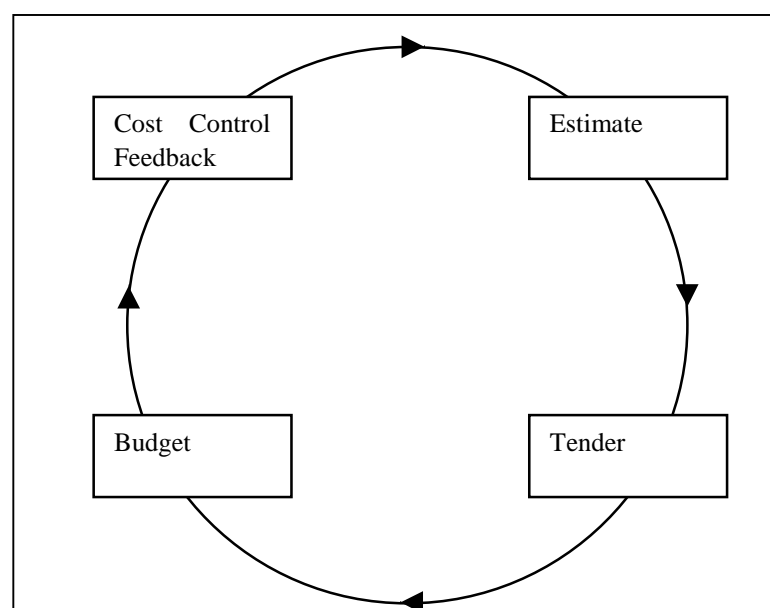


Figure 1: The Integrated Approach

Source: Smith (1995)

Methodology

Generally two approaches are used for data collection: questionnaires and interviews. The idea of a survey based on questionnaires was considered unsuitable because of a limited number of samples available. Interviews and site visits were thus favoured in order not to constrain the respondents in their views and permit clarification of responses. The main objective was to understand current practices used in the projects, and more particularly, to observe how the project control processes are currently being carried out.

Access to the sources of data was gained through the contractors of the projects surveyed. Examination of the project documents was done on four projects, one multi story commercial plaza project, a road project, a residential project, and a highway bridge project. Interviews were conducted formally and informally. Important contacts for interview purposes included site engineers, quantity surveyors and estimators of the general contractor's organisation.

The scope of this research is limited to the communication system and feedback control processes among the members of general contracting organisations. Three cases have been selected from the list of general contractors in Pakistan. The selection was made to provide a fair representation of construction practice in the country.

THE PROJECTS SURVEYED

Current practices case A

- *Cost Estimation:* The Company hires well-reputed consultants, separate for each trade. Consultants design the project and send drawings to the Company. The Company checks the design using her own design team and make an estimate of the project. Estimation is done by the Quantity Surveyor of the Company. In case of any mistake, the estimate is sent back to the consultant for rechecking or correction. The consultant makes the necessary changes and returns it to the Company. Head Office sends this along with instructions to the Project Manager for execution on site. The Project Manager discusses it with the supervisors and site staff before work is carried out.
- *Site Work:* Separate supervisors are provided for each trade i.e. civil construction, electrical installation, wood working, public health services, etc. Every supervisor is responsible for his work. All materials are purchased in bulk by the Head Office and supplied to the site stores. A Storekeeper is in charge of the store at site. He maintains the record of material in and out. Monthly store statements are made and sent to the Project Manager and a copy to the Finance Department, where payment is made to the suppliers as the material reaches the store.

Current practices case B

- *Cost Estimation:* The Company hires the services of consultants for project design and company staff does the cost estimation. Quantity surveyors, after getting the necessary instructions from the Head Office, prepare the estimate. The company does not provide any contingency in estimates but considers it as part of overhead expenditure.
- *Site Work:* The company works mostly on sub-contract basis, which they consider safe. The company believes that due to inefficient project managers, departmental labour is not safe and also very risky. Basic cost is provided to the project manager from Head Office. He is responsible to work within this cost. Usually he compares the basic cost provided to him in detail with the estimate and if he finds any mistakes, he sends it back to the Head Office for correction. The Project Manager has no concern for cost control beyond the basic cost provided to him. The Head Office receives feedback from the site office through monthly bills of work done for payment to the subcontractors. The Project Manager also sends a monthly store statement on which receipts during the month as well as consumption and balance of stock at the end of month are shown. The head office does all material purchasing. The company employs a purchaser but he only deals with small items in case of emergency material required at site.

Current practices case C

- *Cost Estimation:* Estimation is done by the Quantity Surveyors of the company after design is complete. Fluctuation of the rate of construction materials is great. Every time before a bid, the Company has to get new rates for the estimation. Usually the Company considers a 20-25% contingency allowance, which includes taxes, overheads and profit for the Company. The Company has fixed the criteria for maximum wastage allowed at sites at 2% for cement and steel and up to 5% in case of aggregates. If wastage is more than this allowance, the Company investigates and fixes the responsibility to the concerned persons.
- *Site Work:* The company works by hiring its own labour and also by subcontracting work. A cost estimate is provided to the Project Manager, who is responsible to work within this cost. The Manager and Site Engineer make plans and schedules and work is performed according to design and specifications provided from the Head Office. The Site Engineer has very little, if any, responsibility for cost control. He is only responsible for ensuring that work on site progresses smoothly.

The Company employs a Quality Engineer who coordinates with clients. He holds daily meetings with the client about work done and planned work. He also discusses the quality of the work and queries raised by the client. He informs the Project Manager about the meeting on a prescribed Site Instruction Performa. The Project Manager decides about the issues raised by the client, whether genuine or not, and if they are, he instructs the Site Engineer to repair/rectify it. Cost controlling is the job of the Quantity Surveying Department.

The Quantity Surveyor is responsible for the following:

- Measurement of the work done by the Company and after necessary checking submits it to the client for payment.
- Checking the bill submitted by the subcontractors/suppliers and sending to the Head Office for payment.
- Making monthly statements on which quantities of work done in detail as per bill of quantity and submitting to the Project Manager.

For material purchase, the Company employs non-technical purchasers that are loyal to her. The Company has to rely on them because it has selected them after observing their work for a long time. A Quantity Surveyor also makes Monthly Store Statements after consultation with the storekeeper and sends it to the Project Manager.

PRACTICES IN CONSTRUCTION COMPANIES IN PAKISTAN

A discussion on the Pakistan construction industry with a focus on feedback practices now follows. What is happening in the industry, both negative and positive aspects, are described. Suggestions are made for improving the feedback system in two ways; first those requiring little or no additional investment and second, those requiring some investment in new technologies.

Integrated feedback system

This approach is meant to evaluate the effect of any activity in the system on all other subsequent activities. Integration of feedback results in an integrated system that views the overall working and execution of the system as one single unit rather than individual fragments. The end result is better productivity and output. In Pakistan, lack of awareness of feedback has resulted in negative effects in the current working system.

Criticisms of the current systems

- Companies often hire consultants for designing projects who have neither site experience nor links with the sites to get feedback information to improve their designs. Often during construction, design has to change as per site conditions or requirements resulting in delays and costs over run. Companies rely on consultants who are experts in different trades, for example structural design, decorator, electrical, mechanical, air-conditioning etc. There is no formal communication among these consultants. Sometimes there are problems during construction due to lack of coordination among all the design parameters.
- There is a lack of formally educated personnel in construction companies. Although the companies have employed experienced men for site work, site managers with formal education are seldom employed. These site managers seldom know the latest tools and techniques for site cost control and progress monitoring. Most site managers rose through the craft levels. Site managers try to keep Head Office management satisfied with regard to the total cost of the work while exercising productivity control as a secondary function. They are only interested in maintaining their reputation by following the orders of the head of the company.
- Almost all companies collect site performance feedback data from monthly cost bills. Loss of feedback data occurs since a monthly time frame is too long to allow effective monitoring and control of typically short-lived operations.
- Materials procurement is done directly by the Head Office. Site Managers have no idea about the different materials available in the market and there is a lack of coordination in the organisation. Cost estimation and purchasing of materials are separate functions. There is no formal communication between these two which is often a source of mistakes in the cost estimates.
- The heavy use of subcontracting labour by general contractors causes departures from the site cost control system. Because subcontracted work is committed cost, once engaged it can only be monitored to ensure that the general contractor's attendance and services are supplied only to the limit stipulated in the subcontract document. Site managers are generally unconcerned about labour productivity in general, since the responsibility has been shifted to the sub-contractor.
- All companies work on the basis of business-by-relationship. Their trust is in the people not in the system. This may work in small organisations, but is unlikely to work in large organisations. When new people are employed, it is difficult to build trust immediately.

Positive aspects of the current systems

- Companies have long-term relationships with suppliers and work on a business-by-relationship basis. This technique works very well. For well-reputed companies, suppliers are eager to supply the materials even in advance on credit basis.
- Some companies check the designs made by consultants and make changes when necessary. In this way, counter checking can be done before construction in order to avoid delays.
- Companies focus on quality to maintain their reputation. In the private sector, people are mainly interested in quality product supplied at reasonable cost. Companies involved in residential schemes have to be strict on quality.
- Companies control costs by maintaining very strict control over use and consumption of materials.

Suggestions for Improving Feedback System

Under the current system, estimating, tendering, execution and controlling are viewed as different and isolated functions. The generated feedback in any of these functions is either not highlighted or at the most, remains associated with the isolated functions. Each suggestion for improvement in some way needs additional resources, expenses and training. The efforts in making any feedback control system work may be tedious, but the benefits are assumed to be worth the effort. Suggestions to improve integrated feedback systems can be viewed in the following two ways: improving the existing system; and using new technologies to effect improvement.

Improvements to existing system

- Awareness of all the team members about the integrated feedback system by training through workshops, education, practice and encouragement from higher management.
- Developing procedures to handle a feedback system based on organisational hierarchy.
- Make separate cells in the estimating department, where actual/planned performance should be monitored and recorded.
- Feedback should be considered as a separate and necessary activity.
- Generate feedback data regularly.
- Analyse the generated data.
- Investigate discrepancies.
- Weekly or bi-weekly calculations of discrepancies are also suggested because of the typically short duration of many work packages in construction projects.
- Standardization of feedback performance record.
- Recording all the data for future reference in a historical database.
- Modify organisational structure if present structure is in conflict with the effective use of feedback.
- Documenting everything.

New technologies

The introduction of computer based technologies to any process is inevitably a trade off between cost and savings. The reasons for the introduction of computers are speed, consistency, flexibility and integration. Computers today are an accepted tool for construction. In most construction companies, computers are used first for data processing and record keeping. They replace traditional data assembling, computing, summarizing and record then keeping functions. Many companies only use computers in their head offices. It is also economical to use computers on site. The quality and reliability of actual data from the site helps control during the execution period and also helps establish an historical database for future use. Cost feedback data from past projects is a fundamental tool for estimators, and computer records of them can be a most useful tool. For simple projects involving the same sort of work, estimates of unit costs often can be taken directly from computer data recorded from past projects. There is no hard and fast method on

collecting site data to use as feedback. Some researchers have done some studies the generation of reliable and accurate on site data. Some of these are now considered.

Site Data Capture System Formulation (SDCS)

Marasini (1996) established a procedure for collecting and reporting field data by site data capture system (SDCS). Supervisors are provided with planning and scheduling data, construction drawings and specifications. They have adequate field knowledge about what is going on. They collect site data and send it to site office. The assumption here is that the company is using some planning and controlling software in the site office. All information gathered from the site are grouped into one or more forms of reports and are sent to middle and top management. Relevant information is sent to estimating, accounting, planning and monitoring systems. Management decisions are passed to supervisors via site office. Sometimes, both head office and site office functions are conducted through a single office.

SDCS consists of three steps of data reporting. The first step is daily data collection from the site. Actual resources used and work performed is recorded in a palm-top computer together with information on weather conditions, major causes of interruption of work and change orders on a shift basis. Each shift report can be prepared as per requirement and daily reports are prepared regularly. The second step is the production of weekly reports by reading seven day's data. This process continues until the activity is completed. The first and the second stage reporting together provide input to the monitoring system of the company. Using such tools, progress reports and other information systems, a company database can be established. When the activity is completed, all information regarding resource use and expenditures are stored as a historic database which is used for estimating and planning future projects. SDCS alone produces productivity databases. This function is included in third stage reporting. With this framework, the site data capture system has been developed. Field data are collected using a palm top computer on a daily basis. This system is called "Supervisors Kit" as it facilitates field supervisors to carry on their work in an efficient manner.

Web-based Construction Documentation system

Sa-ngaimusk (1999) developed a web-based construction documentation system. She explained that the web based construction documentation system is also useful for recording feedback. The web database technology used for this purpose is built around a relational database management system and the World Wide Web (WWW). The WWW provides information throughout web pages in hypertext as electronic documents. Clients can be located in a computer network within a field construction project linked to the head office. The system enables field personal to assess and use the forms and reports that are tailored to suit the needs of each project. Field engineers generate daily reports and post these documents from their sites via web pages. All documents posted through the web page will be kept in a central database on the server that may be located in the head office. These documents will be generated as on-line reports.

No doubt other systems are being developed elsewhere. For instance, Navon and Goldschmidt (1999) reported on an automated labour control system being developed in Israel. However, such automated systems may be too technically advanced for a developing country like Pakistan. Any system introduced needs to consider the condition of the country especially the ease in using it under local conditions and with local personnel.

CONCLUSIONS AND RECOMMENDATIONS

The use of feedback cost control data in three companies in Pakistan has been reported in this paper. Two major conclusions can be made based on the investigation made.

1. All companies collected feedback data from the monthly cost bills, but there was no systematic procedure for recording, documenting and sorting the data. Loss of feedback data may occur since a

monthly time frame is too long to allow effective monitoring and control of typically short-lived operations. There was also no practice of standardisation of feedback data recorded from site performance data.

2. The Following factors influence the feedback control process in construction organisations.
 - The heavy use of subcontracting labour by general contractors causes departures from the site cost control system. Because subcontracted work is a committed cost, once engaged it can only be monitored to ensure that the general contractor's attendance and services are supplied only to the limit stipulated in the subcontract document. Site managers are generally unconcerned about labor productivity in general, since the responsibility has been shifted to the sub-contractor.
 - There is lack of formally educated persons in the construction companies. In almost all companies, site managers rose through the craft levels. They do not know the latest tools and techniques for site cost control and data collection from site and recording for future reference. Most cost forecasting by site management relied heavily on subjective and rather optimistic judgements.
 - Site managers try to keep Head Office management satisfied with regard to the total cost of the work while exercising productivity control as a secondary function. The focus is on maintaining reputation by following the orders of the company's chief executive.

Based on the foregoing conclusions, the following recommendations are made to enable contractor organisations in developing countries to improve their performance.

- As much as possible, contractors should employ formally educated site managers for effective and efficient site controlling and monitoring.
- Summary cost reports should be prepared at regular time intervals by the site management of contractor's organisations. These reports will help the project manager to determine the cost status of the project and pinpoint those work classifications where expenses are varied.
- The head office management should direct the site management to establish communications feedback systems between the various field forces and between the field and head office. Such communications can minimise the number of repeated errors or field problems that often occur as a result of the traditional failure of communications between the construction forces and the designer of the project.
- Standardisation of feedback performance records is most important so that usefulness of the data is maximised. Site management should take necessary measures to adopt it. The formation of the data bank from these values will be useful and it should be updated on a regular basis to keep it in line with current technologies and construction methods.
- Head office management of the contractor organisation should establish a historical database where all summary reports, site data and standardized data should be recorded for further reference. This activity should be under the estimation department and at least one person should be responsible for it.
- Contractors should make necessary arrangements for the awareness of all the team members about the feedback system by training, workshops, education, practice and, most important, encouragement from higher management either formal or informal.
- Work-study techniques (i.e., method study, work sampling and work measurement) must be included in a site cost control system by project management. Work-study can play an important role with respect to future estimating, monitoring progress and indicating where management action is required.
- Excessive subcontracting should be avoided because subcontracting results in considerably different approaches and attitudes towards cost control being formed between the subcontractors.
- There is continuing need for institutional strengthening and manpower development in the areas of project management, information and database management systems. The Government and industry associations could arrange necessary workshops, training and seminars on this issue and also direct the engineering universities for the same.
- The Government could minimise the import duty on construction equipment as an incentive for companies to import and use latest technologies.

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