

HIGH-RISE BUILDING CONSTRUCTION IN BANGLADESH: EXPERIENCE OF QUESTIONNAIRE DEVELOPMENT AND ON-SITE DATA COLLECTION

M.A. Salam, S. Sarkar, D.J. Blackwood and H.J. Staines

Schools of Science and Engineering, and Computing, University of Abertay, Dundee, DD1 1HG, UK

In Bangladesh, the growth in the building industry, particularly in residential high-rise construction, is having considerable influence on the country's economic development. But this type of construction often suffers from time and cost overruns. To obtain first hand data, a field survey has been conducted among developers, consultants, project engineers and contractors in Dhaka, Bangladesh using structured interviews involving a questionnaire with a view to estimating the risks of time and cost overruns. The questionnaire has two sections relating to risks concerned with time and cost overruns and there were 110 respondents. This paper describes how the important parameters were identified for inclusion in the questionnaire and how a data collection strategy was developed to ensure the elicitation of maximum relevant information. It also describes the experiences of the data collection and amendments of the questionnaire that became necessary during the survey. The paper also describes the lessons, which have been learned from the survey, and guidance is given as to how such a future survey should be conducted.

Keywords: cost, high-rise, overrun, questionnaire, survey design, time.

INTRODUCTION

Construction is unique in stimulating the growth of other sectors (Hillebrandt 1985) and this contribution varies according to the nature of the society in which construction takes place (Okpala and Aniekwu 1988). Okpala and Aniekwu (1988) felt that the increasing demand for infrastructure development, coupled with ailing national economies in most developing countries, requires the construction industry to be more economic. The reputation of the construction industry depends on the ability to complete projects on time, within budget and to the proper quality (Chan and Kumaraswamy 1994). According to NEDO (1988), timely completion of projects is the most important indicator of an efficient construction industry. Time overrun is the main cause of cost overrun and it affects both clients and contractors. Clients incur losses for delayed financial return and contractors suffer from increased overheads.

In common with other developing countries, demographic changes in Bangladesh are resulting in massive migrations of people from villages to urban areas. The capital city of Dhaka, Bangladesh is facing severe over-population with an estimated population of 9.3 million in 1996, likely to exceed 10 million by the turn of the century (Rahman 1996). These changes have created enormous pressures on housing. Government expenditure in Bangladesh on construction and housing in the 1987–8 financial year were Tk. 10 345 million (£129 m) and Tk. 2 345 million (£29 m) respectively while in 1995–6 it was Tk. 39 107 million (£489 m) and Tk. 10 013 millions (£125 m) (Bangladesh bureau of Statistics 1997). However, even though government spending

is increasing, it is not nearly enough to solve the housing problems and, therefore, over the last 10–12 years, private companies have stepped in to initiate real estate business through the construction and sale of middle to high-rise apartment buildings. The main reasons for high-rise rather than low-rise construction are scarcity of land and land prices.

Like other developing countries, such as Nigeria (Okpala and Aniekwu 1988, Elinwa and Buba 1993), Malaysia (Young 1988) and Indonesia (Kaming *et al.* 1997), high-rise projects suffer from time and cost overruns. Previous research shows that poor management causes most time and cost overruns. Therefore, efficient time and cost management should increase the efficiency of the construction industry, which in turn would help the national GDP.

A PhD project at the University of Abertay Dundee investigated how time and cost overruns on high-rise projects in Bangladesh can be minimized. There appear to be no previous relevant primary data on which research could be carried out. It was therefore decided to carry out a rigorous and in-depth questionnaire survey of high-rise projects among the major participants i.e. developers, consultants, project managers and contractors/sub-contractors. This survey was carried out between mid-February to early-August 1998 in Dhaka, Bangladesh. Major issues that this study set out to address included the following:

1. The identification of parameters of delays and costs.
2. The development of a questionnaire using the identified parameters.
3. The development of a data collection strategy to ensure the elicitation of maximum relevant information in the context of Bangladesh.
4. Description of the experience of on-site data collection using the questionnaire.
5. Provision of guidelines as to how such a future survey should be conducted

Although the research focused on high-rise building projects in Bangladesh, the findings should be relevant to similar projects in other developing countries, as they face similar problems in terms of time and cost overruns (Morris and Hough 1987).

CONSTRUCTION OF QUESTIONNAIRE

A questionnaire is the bridge between researchers and respondents. The questions are the vital elements which perform the actual interrogation. Rossi, Wright and Anderson (1983) treated a questionnaire as a set of instruments and stated that its success depended on how effectively the instruments could be handled. The accuracy and validity of data collected depend on the questions asked and the ways in which the respondents perceive and respond to them. Thus the construction of a questionnaire is a vital element.

Risk identification

In the construction industry, identification of risks is as important and difficult as their control or management, yet it gets least attention in the literature (Raftery 1994). Many researchers use categorized or formal system for identification of risks (see, for example, Kwakye 1997 and Chapman and Ward 1997). A formal system involves a rigorous analysis process rather than an intuitive approach (Mawdesley, Askey and O'Reilly 1997) which helps researchers to focus on almost all risk factors, even on very minor ones, which would otherwise be ignored in an informal system. Interviews or brainstorming meetings can also be used in the risk identification process.

Table 1: Source of time overrun

Phases	Sources	Risks
Inception	Inception	Planning; surveying; land acquisition; and change of planning.
Planning and design	Planning and design	Delayed soil investigation; developers'/clients' decision making; insufficient communication between the owner(s) and the consultant(s); delayed completion of planning and design; change of planning and design by client; and financing by client to planner and designer.
	Bureaucracy	Obtaining permission for planning and design; gas; water; electricity; road cutting from concerned authorities; and excessive bureaucracy.
Construction	Material	Slow delivery; shortage; damage; changes in types and specifications; delay due to quality; price escalation; import; and delay in the production of special manufacture of building materials
	Manpower	Shortage; skill; and productivity.
	Equipment	Slow delivery; shortage; failure; productivity; and unskilled operators.
	Financing	Financing by contractors; delays in contractors' progress payment by clients; cash flow problem; non-or delayed payments of instalments by customers; and bad debts.
	Changes	Design changes by owners or their agents; design errors made by designer; change of contractor(s), sub-contractor(s) or engineer(s); construction errors; unpredictable site (geological; water table etc.) conditions; and mistakes in soil investigation.
Transfer	Scheduling and controlling	Preparation and approval of site / shop drawings; waiting for sample material approval; planning and scheduling deficiencies; lack of training personnel management support to model the construction operations; lack of data base in estimating activity duration and resources; judgement and experience of the estimator in estimating time and resources; inspection and testing procedure used in the project; accidents; type of contract used; application of quality control; and inadequate early planning of the project.
	Social and environmental	Bad weather; insufficient utilities available on construction site; social and cultural factors; strike / disruption; and unpredictable or catastrophic events
	Contractual relationship	Unco-operative developer; joint ownership of the project; slowness of the developers' decision making process; poor organization of the contractor or consultant; the relationship between subcontractors' schedules in the execution of the projects; conflict between contractor(s) and consultant(s); difficulty of co-ordination between various parties working on the project; legal disputes between various parties in the construction project; controlling sub-contractors by general contractors in the execution of work; unavailability of financial incentives for contractor to finish ahead of schedule; negotiation and obtaining contracts; and unavailability of professional construction management expertise.
Transfer	Transfer	Non-complaints by financial obligations by customers; default by contractors; and default by developers / clients.

A comprehensive survey of literature from developing countries provided much information on risk variables for inclusion in the survey. From this review, 73 delay and 22 cost overrun risks were identified (Assaf, Al-Khalil and Al-Hazmi 1995, Okpala and Aniekwu 1988, Elinwa and Buba 1993, Ogunlana, Promkuntong and Jearkijrm 1996, Kaming *et al.* 1997). Some additional risks were included from intuition and the researcher's field experience in Bangladesh.

Table 2: Source of cost overrun

Serial No	Risks
1	Inflation
2	Price fluctuation of materials
3	Fixed overhead cost from delays
4	Fraudulent practices and Kickbacks
5	Shortening of contract period
6	Errors in estimating
7	Insurance
8	Pilfering of materials
9	Damage of materials
10	Wastage of materials
11	Labour cost increase
12	Unavailability of labour
13	Bureaucracy
14	Poor financial control on site
15	Disputes on site
16	Effects of weather
17	Litigation
18	Fluctuation of transportation cost
19	Frequent design changes
20	Absence of construction cost data
21	Improper planning
22	Slowness of owners decision making

Composition of questions

The questions were divided into two sections. Section A comprises 8 questions eliciting personal and organizational information. Section B comprised the questions based on identified risks on time and cost overruns (Table 1 & 2) on a specific project. Alreck and Settle (1985) suggested that large number of questions should be grouped into sections or sub-sections to simplify the task. Due to the large number of delay risks identified they were categorized according to phases (Okpala and Aniekwu 1988; Adams and Barndt 1988) and sources (Chapman and Ward 1997). The phases considered were inception, planning and design, construction and transfer, with the planning and design phase sub-divided into planning and design related risks and bureaucracy related risks. Risks in construction phase were sub-divided into eight sources: material, manpower, equipment, financing, changes, scheduling and control, social and environmental issues and contractual relationships. Cost overrun risks were included directly in the questionnaire. Additional spaces were kept in each phase or source with a view to new risks if found during interview. Section B began with some questions relevant to the specific project, which were only asked of the developers as they were in the best position to know the accurate answers.

Questionnaire format

Responses can be of two types: structured and unstructured. Structured questionnaires are less time-consuming for respondents and, therefore, likely to attract higher response rates. Also, It has the benefit of taking less time to input data during data processing. But the composition of a structured questionnaire requires more time and attention at the beginning. In this study, the questionnaire was mainly structured with some space provided for respondents' own comments against each question.

Scaling

Scaling is an inherent part of structured questions as it enables to measure the 'unmeasurable' answers. Scaling is the branch of measurement that involves the construction of an instrument that associates qualitative constructs with quantitative metric units (Trochim 1999). In most scaling, the objects are text statements, usually statements of attitude or belief. Generally numbers are used to convert the statements into scaled responses. A five point (1 to 5) odd numbered interval scale (Likert or verbal frequency) is preferable as it has got a mid-point (Chan and Kumaraswamy 1997; Tummala *et al.* 1997) rather than an even numbered scale (Kaming *et al.* 1997). A too long or a too short-ranged scale is best avoided, as sometimes it can be confusing to respondents. In the current study, a traditional interval scale of 5 to 1 from 'the most important' to 'the least important' was used. A column for time overruns in days for the risk relevant to time overruns and similar columns for cost overrun risks in Tk. in thousand were provided.

MODE OF SURVEY

There is a variety of modes of survey. The researcher must consider the research objectives, type of information needed, rate of response, validity and reliability (bias), budgets and time. Rossi, Wright and Anderson (1983) divided mode of survey as self-administered and interview-administered, whereas Trochim (1999) did it as questionnaire and interview.

The personal interview has more advantages over either mail survey or telephone survey, but its disadvantages are bias and expense making it unsuitable for wide spread samples. In this study, from the very beginning the idea of telephone interview survey had been ruled out on cost grounds. It was estimated that data collection by personal interview could be cheaper than mail survey. According to Casley and Lury (1981) postal survey response rate is generally very low in developing countries due to respondents' lack of consciousness. Therefore, the total number of questionnaire sets mailed including pre-paid return postage would have to be quite high to get a target of 120 responses from different type of respondents. Furthermore, the international postal system is, at best of times, subject to delays and unreliability that could not be countenanced in the present context. On the other hand, for conducting personal interviews the major cost would be the return airfare as living costs in Bangladesh is inexpensive compared to developed countries. The other problem envisaged with postal questionnaires, and subsequently justified, was the use of English language as the medium for the questionnaire, which is not the native tongue of the respondents. Some unavoidable technical terms in the questionnaire in English could convey ambiguous meaning to the respondents. A further problem affecting the use of postal survey was the collection of an appropriate and an up to date set of respondents' addresses. At present it is very difficult to get the exact number and addresses of the companies in Bangladesh as few organizations keep properly archives.

Regarding validity and reliability of a survey there is always a possibility of bias in the data obtained through personal or telephone survey (Bryman and Burgess 1994). According to Sappsford and Jupp (1996), this bias can happen from interviewer's lack of experience and integrity. In postal survey, the addressee may not always be the right person to respond and if the respondents are unable to answer some questions, they look for someone else for the answers (Rossi, Wright and Anderson 1983). This can also result in a kind of bias; which suggests that bias can feature in any form of

Table 3: Sampling statistics

Type of developer	Total	Sampled	Contacted	Surveyed
REHAB developers	49	30	26	15
Non-REHAB developers	151	35	28	15

survey. It was decided to confine the area covered in the survey to the capital city Dhaka as approximately 90% of high-rise buildings is constructed there.

Considering all the various advantages and disadvantages of different modes of survey it was decided to conduct the survey of this study by personal interview by the researcher using a questionnaire. In the event it was decided to recruit interview assistants, with prior experience in questionnaire survey, to assist in the interview process. Two MURP (Masters in Urban and Regional Planning) students were engaged and they conducted a total of sixteen out of the 110 interviews under close guidance of the researcher. The researcher always queried any ambiguity in the answers to ensure that the answers were genuine. This decision had the benefit of giving the researcher first-hand experience in the field and the results would be more consistent. To elicit the maximum response from the industry, two letters, one from the Director of studies and the other from a local academic supervisor, were attached to the questionnaire, basically to add weight to the survey taking account of the social context of Bangladesh.

Data collection

REHAB (Real Estate and Housing Association of Bangladesh) is the only organization, which keeps information on high-rise developers. REHAB had 49 members by 01 October 1997. In addition to these there are a large number of developers (not member of REHAB); some of these are professional developers having completed other constructing and pipeline projects whereas others were construction at best one or two projects in their own land on an experimental basis. It is estimated that there are approximately 300 to 350 apartment developers in Dhaka. Two hundred addresses of different developers were collected for sampling. Addresses of REHAB developers as well as some non-REHAB developers were collected from the REHAB office. Addresses of other developers were collected from newspaper or magazine advertisements. 30 REHAB and 35 non-REHAB developers were sampled randomly from 49 REHAB and 151 non-REHAB population respectively, ultimately to obtain data, 15 from each category based on one specific project per developer. Each category sample was made somewhat larger assuming that some developers might not be interested to provide data (details in Table 3).

Pilot test

At the time of preparation of questionnaire it was not possible to do a pilot test. So, prior to the main survey, a pilot survey was carried out among two developers, two consultants, one project manager and one sub-contractor. Based on their suggestions, some amendments to the survey were made. For the purposes of this research a high-rise building is considered to be six-storied and upwards because of the prevailing regulations in Dhaka where in some residential areas buildings with more than six-storeys are not permitted, and a considerable number of such buildings are being constructed. Earlier it was intended to ask information on cost overruns from all respondents but it was found that none except the developers knew actual cost and cost-overrun on a project. It was therefore decided to ask only the developers on the

specific project the cost overrun questions. The frequency from both time and cost overrun column was deleted because when the respondents answered time and cost overrun variables they also considered the frequency with importance.

Data collection procedure

It was anticipated that data collection via the questionnaire survey would be a time consuming, exhausting and sometimes frustrating. This proved to be the case. The intention was to obtain data from all the parties. In order to observe proper protocol the researcher attempted to seek appointment with the managing director to obtain data from developer category and for access to other parties. Only 7 managing directors responded themselves; in the other cases the questionnaires were handed down to staff in the marketing or accounting divisions. In most cases securing an interview was very time consuming, the worst case requiring 11 visits over 60 days.

The respondents of developer category were asked to select one project that had been completed in the last 5 years. Data from 15 companies after contacting 26 sampled REHAB members were obtained. Among the 11 not responding, 3 were not interested in giving data, 2 claimed that they had no time or cost overrun; two stated that they only develop land and sold plots; two had just started projects; and further contact were needed with two companies which had fulfilled target. The researcher needed to contact 28 non-REHAB developers eventually to secure data from 15. Among the remaining 13, 8 had just started; 3 were not interested.

Once the interviews with developer category on a project were completed, addresses of the consultants, project managers (who were mostly civil engineers and contractors) who were engaged with that specific project were obtained and approached for interview. In the consultant's category, 17 were architects and 12 were engineers; in-house consultant architects or structural engineers were easily accessed for interviewing. It was found that the same consultant or design engineer was appointed for different projects with different developers. In these cases, they were interviewed using separate sets of questionnaire for different projects.

The greatest problems arose when sub-contractors and project managers had left the original developer. Various informants helped in finding them. However, in some cases the developer's head office declined to furnish the addresses of ex-employees. One developer explained that their staff were not allowed to give interviews. Altogether 24 project managers were interviewed (23 were civil engineers and one electrical engineer). It was noted that the project managers were most spontaneous to give interviews during the first visit, and their co-operation in arranging interviews with other categories, especially with the contractors was appreciated.

In most projects it was found there were no general contractors. There were 19 civil engineering, 4 plumbing, 2 electrical, 1 painting and 1 carpenter "sub-contractors". A few sub-contractors were not so spontaneous in giving interviews, possibly because they might be not get future work if they revealed their overruns. Interestingly, one civil engineering sub-contractor claimed that there was no time overrun as the developer did not impose a deadline for completing his part of work. All 110 interviews were carried out as shown in the Table 4.

Table 4: Statistical details of interviewees

Type of interviewee		Actual no.	Target no.
Developer	Managing Director	7	
	Marketing officer/manager	21	30
Consultant	Accountant/ accounts officer	2	
	Architectural Designer	17	29
	Structural designer	12	30
Project Manager	Civil engineer	23	24
	Electrical engineer	1	30
Sub-contractor	Civil	19	
	Plumber	4	
	Electrical	2	27
	Painter	1	
	Carpenter	1	
Total		110	120

Interview technique

Some times, the questionnaire set was left with the interviewee and the researcher returned later for the interview. In a few cases the interview was taken readily with the interviewee's agreement, mostly with project managers. Most of the time the interviewer asked the questions and on the interviewee's instructions filled in the questionnaire as this saved time. At the time of interview interviewees also referred to another set of questionnaire and if the interviewees had any confusion about any question, the interviewer interpreted it for them. Sometimes a mini tape recorder was used for interview when the respondent was short of time and answers were transcribed later. Their general comments were written in the blank spaces.

ANALYSIS

Data will be ranked separately according to importance indices based on weight given to each variable by the respondents and ranges of scale (Assaf, Al-Khalil and Al-Hazmi 1995, Shen 1997, Chan and Kumaraswamy 1997). Percentages of respondents scoring up to certain significance level of scale will be evaluated as used by Okpala and Aniekwu (1988), Elinwa and Buba (1993) or Chan and Kumaraswamy (1997) to avoid the problem of having same importance index with more than one variable. As the number of variables is high, it might be necessary to group the variables into sub-headings simply by averaging the variables in each group (Assaf, Al-Khalil and Al-Hazmi 1995). An exercise to obtain the ranking order in terms of percentage of time and cost overruns for each variable will be carried out and these will then be compared with the ranking of individual variables and groups. The ranking of individual variables or groups will not necessarily be the same for different type of respondents; and it cannot be directly compared (Baldwin and Manthei 1971). Rank agreement factor method (Okpala 1986) or rank correlation coefficient method will be adopted (Mendenhall *et al.* 1993) and could be used for comparing the ranking between any two different types of respondents at one time. Statistical t-test, z-test or χ^2 -test will be used as appropriate for different levels of significance 5%, 1% and 0.1% etc to verify association on certain variables or groups.

CONCLUSION

1. As anticipated, the task of data collection was tough for various reasons, not least the inclement weather. The main difficulty was the lack of a proper archive of

- names and addresses of developers and the developers' reluctance to furnish addresses of project managers and sub-contractors who had left them.
2. After initial suspicion and reluctance, the interviewees became more co-operative when they became familiar with the objectives of the survey. Project managers and some sub-contractors were very co-operative as they wanted to establish who was responsible for cost and time overrun since they felt that developers always laid the blame on them. They also genuinely believed that the results of such a survey should ultimately benefit the industry.
 3. In all cases time was at a premium and interviews had to be as fast as possible. The pilot survey was very useful in that it showed how the actual survey could be conducted efficiently and also to establish the suitability of the questionnaire.
 4. Tape recording was very helpful, especially in the case of busy developers, both from practical viewpoint and in encouraging co-operation from the interviewees. However, the researcher would not recommend this mode to be the sole instrument for interview as it creates considerable work for the interviewer.
 5. The use of MURP students for assisting in the interview process was found to be very useful and cost effective, helping to achieve timely completion of the survey.

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