# *How contractors in Ghana include risk in their bid prices*

# HOW CONTRACTORS IN GHANA INCLUDE RISK IN THEIR BID PRICES

**Samuel Laryea[1] and Will Hughes[2]**
*School of Construction Management and Engineering, University of Reading, P.O. Box 219 Reading, RG6 6AW, UK*

The way that contractors in Ghana establish a bidding price, and include allowances for risk in their prices is investigated using unstructured interviews and documentary analyses. The contextual nature of tendering practices suggested that there may be differences in approach between countries. Therefore one objective was to test whether there are systematic differences between the approaches in different places. Seven contractors were studied to ascertain how they put together a price, and how risk apportionment influences price. Most of them established their bidding price by building up prices for labour (14%), plant (9%), materials (45%), overhead (15%) and profit (10%). The main determinants of price seemed to be the actual direct costs; level of competition; delivery time of the project; payment regime; and clarity of tender documents. Risk allowances of 5-7.5% were included in the profit margin of some bill item prices. This was based mainly on the direct judgement of the quantity surveyors who calculated the price, based on their intuition and experience. No formal and analytical risk models were used. Indeed, none of the contractors indicated any knowledge of published risk models. The contractors' risk allowances seemed to be guided by concerns about competition and winning the job rather than the true cost of risk. Thus, looking at the three systematic processes of formal risk management, it cannot be concluded that contractors in Ghana practice formal risk management, although it is clear that they do take account of risk when pricing their work.

Keywords: contractor, Ghana, interview, pricing, tendering.

## INTRODUCTION

It is standard textbook knowledge that contractors tend to include a hidden premium for risk in their bid prices (see for example, a textbook prepared on behalf of The Aqua Group practitioners by Hackett *et al.*, 2007: 35). A study on the contingency allocation practices of 12 small-to-medium US contractors by Smith and Bohn (1999: 101) explained that such premiums can be thought of as a contractor's estimated value of the extraordinary risks they will encounter in a project. Extraordinary risks are normally project risks that are not covered by bonds, insurance, or the contract (Tah *et al.*, 1993) for which contractors need to self insure using contingency (Smith and Bohn, 1999). Most standard estimating textbooks express contractor contingency as a fixed percentage of 5-10% of the contract value. However, the severe nature of competition in the construction market indicates that this figure could be high. Three empirical studies have shown that risk premiums form around 0-5% of a contractor's bidding price (see Neufville and King, 1991 who investigated the risk and need-for-work premium practices of 30 US contractors; Shash, 1993 who studied the bidding

[1] s.laryea@reading.ac.uk
[2] w.p.hughes@reading.ac.uk

Laryea, S. and Hughes, W. (2009) How contractors in Ghana include risk in their bid prices. *In:* Dainty, A. (Ed) *Procs 25th Annual ARCOM Conference*, 7-9 September 2009, Nottingham, UK, Association of Researchers in Construction Management, 1295-1304.

practices of 30 US contractors; and Smith and Bohn, 1999 who studied contingency allocation practices of 12 US contractors).

Several formal and analytical models for contractor's risk analysis at the tender stage have proliferated since 1971 (summarised in Laryea and Hughes, 2008). The analytical approaches assume that contractors include risk contingencies in their bid proposals (see unpublished PhD thesis on the relationship between risk and price in tendering by Laryea, 2008a: 60-61). However, the way that contractors actually calculate prices and account for risk when bidding is not clearly articulated in the construction management literature (see Laryea and Hughes, 2008). In specific relation to Ghana, the process used by contractors for putting together a bidding price, including how risk is taken into account, is yet to be investigated. The contextual nature of tendering practices suggests that there may be differences in approach between countries. Therefore one objective was to test whether there are systematic differences between the approaches in different places. The objectives here are:

- To ascertain how contractors in Ghana establish a construction price; and
- To ascertain how they include risk in their bid prices.

Ghana is a typical developing country[3] with a growing economy and construction sector (as shown in analysis of the causality links between the growth of the construction industry in Ghana and the growth of its macro-economy by Anaman and Osei-Amponsah, 2007). In Ghana, the absence of research of such nature meant that a vital gap in knowledge about the tendering practices of contractors will be filled.

# HOW CONTRACTORS APPROACH RISK IN THE TENDER PROCESS

The research literature on how contractors approach risk apportionment in the tender process is reviewed in Laryea (2008a: 34-63). Furthermore, the research literature on the relationship between risk and price in tendering, mechanisms used by contractors for pricing risk, and formal and analytical risk models in construction is summarised in Laryea and Hughes (2008). The way that risk pricing is approached in different business sectors such as finance, insurance and construction is articulated in Laryea (2008b). Laryea (2008c) describes public sector tendering processes in Ghana based on a case study. Therefore, this section of the paper summarises generally the concept of risk in specific relation to contractors and contractor risk management practices.

## Risk in relation to contractors

Little attention has been focussed on a precise definition and evaluation mechanism for project management risk specifically related to contractors. Project Management Institute (2004: 238) define risk as an uncertain event or condition that, if it occurs, has a positive or a negative effect on at least one project objective, such as time, cost, scope, or quality. However, three risk definitions may help to articulate a better understand of risk in the context of construction contractors. First, in developing a systematic influence diagram-based model for contractors risk analysis at the tender stage, Al-Bahar and Crandall (1990: 534) described risk as "an exposure to the chances or occurrences of events adversely or favourably affecting project objectives as a consequence of uncertainty." Second, a practitioners' textbook prepared on behalf of the Aqua Group by Hackett *et al.* (2007: 35) defined risk as "the possible loss resulting from the difference between what was anticipated and what finally

[3] Human Development Report 2007-2008, *Annual Report*, United Nations Development Programme (2006 data published in 2008 http://hdr.undp.org/en/reports/global/hdr2007-2008/)

happened." Third, a financial analysis and management textbook by Fisher and Jordan (1996: 70) defined risk as "the possibility that realised returns will be less than the returns that were expected".

Thus, risk may be understood in the context of contractors as a positive or negative deviation to expected profit. This aligns with Chang and Tien's (2006: 171) definition of risk as "a measure of the probability and consequence of not achieving a goal." Risk is not the same as risks, although the terms are often used interchangeably in the literature. Whiles risk is the deviation to an expected outcome, risks are the actual deviation-causing events. As explained in a financial analysis textbook by Fisher and Jordan (1996: 70), forces [risks] that contribute to variations in return constitute elements of risk. Al-Bahar and Crandall (1990) defined risk event as what might happen in favour or in detriment of a project. In examining the way software practitioners are taught to perform risk management, Pfleeger (2000: 266) stated three criteria for identifying a risk event. First, a loss associated with the event, often called the risk impact. Second, the likelihood that the event will occur, with risk probability often measured with a number between zero (impossible) and one (certain). Third, the degree to which the project team can change the outcome, either by mitigating the risk's causes before they occur or by controlling the risk's effects afterwards. An experiential-based textbook by Park (1979: 170) explained 12 risk events contractors face as: weather, unexpected job conditions, personnel problems, errors in cost estimating/scheduling, delays, financial difficulties, strikes, faulty materials, faulty workmanship, operational problems, inadequate plans or specifications, and disaster.

**Contractor risk management practices**

Risk management is mostly defined as a logical process of risk identification, risk analysis and evaluation, and risk monitoring and control (PMI, 2004).

Contractors have often been portrayed to be poor at managing risk by for example, authors such as Baloi and Price (2003: 262), Ahmed *et al.* (2002: 4) and Kangari and Riggs (1989: 126). In developing an analytical model for modelling global risks, Baloi and Price (2003) said: "…many contractors are unfamiliar with these risk factors and do not have the experience and knowledge to manage them effectively. As a consequence, conflicts, poor quality, late completion, poor cost performance and business...Contractors have traditionally used high mark-ups to cover risk but as their margins have become smaller this approach is no longer effective...Contractors rarely use these techniques and tools in practice. More often than not construction contractors and other practitioners rely on assumptions, rules of thumb, experience and intuitive judgement which can not be fully described by prescriptive or normative models. Individual knowledge and experience, however, need to be accumulated and structured to facilitate the analysis and retrieval by others."

According to Ahmed *et al.* (2002), "The construction industry has a poor reputation in coping with risks, many projects failing to meet deadlines and cost targets." Kangari (1989) said: "…the construction industry has a very poor reputation for coping with risk. Risk analysis is either ignored or done subjectively by simply adding a contingency. As a result many major projects fail to meet schedule deadlines and cost targets with attendant loss to both contractors and owners."

However, these assertions may not be true generally. Since general contracting started in the early parts of the 19th century, contractors have used various means to survive risks in construction industry. Most contactors resorted to speculative house building in the 19th and 20th centuries to sustain labour force and business costs through the

peaks and troughs of contracted work. In modern times, there is a growing tendency for contractors to use their positive cash flows to invest in projects, rather than house building. Most recently, successful contractors are diversifying into businesses whose cycles counteract those of construction (Oxford Encyclopaedia of Economic History, 2003:1:511). Contractors are minimising risk by declining work perceived as too risky, subcontracting large portions of their work to others, and apportioning risk in wage structures. In essence, they are passing on risk to others. A questionnaire survey of 19 contractors in Australia by Bajaj *et al.* (1997) identified five of the ways used by contractors for identifying risk at the tender stage of projects: (1) Risk review (by senior staff at the start of the tender pricing); (2) Contact (discussions with subcontractors, architect and client); (3) Research (ascertaining information about subcontractors, client, consultants, economic climate, etc); (4) Site visit (visiting site to ascertain the access situation, location, obstructions, etc); and (5) Finance (issues regarding payment and financial obligations).

## CONTRACTOR INTERVIEWS AND DOCUMENTS

Exploratory interviews and documentary analyses carried out in seven construction firms in Ghana are reported. In-depth interviews with the QSs (estimators) who price the actual work and some directors were carried out in 2006 and 2007. Each interview was unstructured and recorded with the interviewee's permission. Each one lasted roughly 95 minutes. The contractors were all in the Financial Class D1 category i.e. those licensed by the Ghanaian Ministry of Works and Housing to build the largest projects. D1 contractors are likely to consider prices more carefully because of the complex and risky nature of their projects and the professional background of their staff; they have well situated offices that can be easily located; and they are assumed to practice formal contract administration procedures because of the professional background of their staff and the size of their organisation and projects.

The literature review provided a basic scheme of things to look for, but the main purpose of the approach to interviewing (unstructured interviews) was to allow the respondents to focus on what they felt was important, so the main headings in the content analysis emerged from reading the interviews, and indexing them by the issues that were most important to the respondents. This was interpreted from the way that they described their work. The interviews were analysed by indexing the contractors' statements and collating those common to the particular themes in the study for a qualitative interpretation.

In each firm, documents used by the contractors in the actual price build-up process were collected and examined / analysed. In some of the firms, the respondents described their price build-up process and illustrated it with documents from their estimating files. These documents were examined and its content analysed. In other firms, the researcher requested and gained access to documents used in the pricing of work in order to examine them and obtain a uniform basis of analysis across the firms.

All the contractors have operated in Ghana for at least 15 years doing all types of projects, apart from roads. Their senior estimators have an average of 21 years' experience. Average turnover for 2006 was GH¢4.5m (or ~ USD 4.5m). An average workforce of about 950 people is directly employed in their offices and construction sites. The workforce comprises management, professional and administrative staff, artisans and labourers. The nature of the unstructured interviews used in eliciting information from the contractors in Ghana and its analysis is similar to how it was applied in the case of UK contractors, as previously described.

**How contractors in Ghana establish a bidding price**

The profit and loss statement for 2005/2006 for one of the firms was analysed. The estimators' matrices for building up unit rates for resources were also analysed. The results of these documentary analyses are reported.

*Bidding price components*
The five elements of a bid price that were mentioned by all the contractors were labour, plant and equipment, materials, overheads and profit. However, only one contractor mentioned that they also include a contingency for unforeseen works. An analysis of the 2005/06 profit and loss statement of one major contractor showed that gross profit was 18% of total contract earnings for the year. The ratios of other costs showed labour (14%), plant (9%), materials (45%) and overheads (15%).

*Labour price components*
The interviews and documentary analyses showed that the common elements that form the basis for building up labour prices are: basic annual salary (27x12), workmen's compensation (5%), inclement weather (10 days), redundancy (4 weeks), social security contribution (12.5%), out-of-station allowance (10 days), sick day with pay (2 weeks), medical facilities, funeral grant, transfer allowance (1 month), tools allowance, leave / travelling days (23 days), height allowance, safety and health, ex-gratia (8 weeks), insurance (11/2%) and a margin for profit and overheads (10%). An observation of these 17 labour price components shows that four of them are statutory provisions. Eight of the items are Collective Bargaining Agreements (CBA) between the Association of Building and Civil Contractors of Ghana (ABCCG) and the Construction and Building Materials Workers' Union (CBMWU) of TUC. The other five are included by the contractor themselves to cover labour-related risks.

*Material price components*
The contractors also have a common way of calculating material prices. The basic arithmetic is the addition of cost of the material at ex-stock, transportation cost, waste allowances and overhead and profit margin (5-10%). For both normal and specialist materials, they often rely on quotations from their suppliers to build up prices.

*Overheads margin components*
A fixed percentage of 15% is often added to the estimated unit cost of resources (plant, labour and materials) to cover the cost of overheads. Most of the contractors described this as "a charge for the administrative costs of a project". An analysis of the profit and loss accounts of one of the firms gave an idea of the centres of overhead costs. Total overhead was 14% of contract earnings for the year 2005. The elements of overhead costs comprised vehicle insurance and licensing (0.06% of total overhead costs), staff welfare and safety (2.31%), tyres and tubes (4.73%), tender bidding, bonds and guarantees (1.33%), vehicles spares and repairs (10.84%), electricity and water (2.61%), freight and handling charges (3.34%), rates and licensing (0.15%), fuel and lubricants, cube and soil test analysis fees (0.20%), casuals/subcontractors w/tax (5.59%), tools and miscellaneous (0.24%), canteen expenses (4.12%), machinery spares and repairs and maintenance (4.87%), outstation allowance (6.77%), overseas travels (11.18%), hire of transport (1.88%), building maintenance (0.03%) and factory inspection fees (0.00%).

*Profit margin components*
Profit margins: All the contractors indicated that the profit margin is allocated in conjunction with overheads. The profit is not apportioned as a percentage of the total estimated project cost. The margin is added to that for overheads (O&P) and this is

apportioned locally on the estimated costs for the items in each work section. The views expressed by the contractors can be summarised with what one contractor said: "…we apply a fixed percentage on each project for profit and overheads…a smaller contractor will apply a smaller percentage for profit and overheads because his overheads are less…bigger contractors charge bigger margins for profit and overheads. The 15%-35% margin we apply for profit and overheads is also supposed to cover our price for unforeseen works. For bigger projects, the profit margin could be reduced since variations will most likely occur. However, we are sometimes compelled to reduce our profit margins so that we can win a tender. The work is often awarded to the lowest price".

On their profit and contingency allocation practices, one contractor said: "…the size of the project influences the percentage we apply for profit…in general, we apply higher percentages to smaller projects for profit whereas bigger projects are assigned lower percentages for profit…we do this because the same amount of time and human resources are required for preparation of different concrete grades…hence, if you are a client and you want to save money, it will not be wise for you to use a big contractor like us to execute small jobs where you could use a smaller contractor …also, you would have to allow for certain things…but you cannot be exact…some will go against you, and others will go in your favour…depending on the situation, we usually include a fixed percentage between 5-15% for profit and contingencies. A higher profit margin is apportioned for smaller projects whereas bigger projects are allocated lower percentages for profit since the same amount of time and human resources are required to prepare different concrete grades. Hence, it will not be advisable for big contractors to execute small jobs whereas clients will be wise not to use big contractors for small projects".

One problem the contractors mentioned was that some other contractors (mostly indigenous Ghanaian contractors) would just engage private QSs to price a job for them. Then they will bid sometimes without even knowing whether the price would be adequate to perform the job or not. Unfortunately, sometimes they get and job. Later, some clients came back complaining and asking whether they can go and complete the project that was awarded to 'quack' contractors.

**How contractors in Ghana include risk in their prices**

All the interviewees indicated that they try to include "something" in their estimates for "unforeseen works". On what constitutes unforeseen works, one of the contractors said "unforeseen works related mainly to specialist works, since most other aspects of a job are quite normal." One Chief QS said: "…it is difficult to know the right prices for specialist bill items without consulting a specialist subcontractor". Apart from specialist works, most contractors described the other areas of a project as "quite normal" especially if that kind of work has been done in the recent past." Some of the problems faced by the contractors when pricing tenders were expressed by one of the respondents as follows: "…the main areas of difficulty have to do with the pricing work where there is not enough design detail or specification….for these items or areas, we are often not sure exactly what to price because as I told you, there is a lack of clarity in either the design or specification of the work to be priced….There is initially a discussion of the problem area first to see if someone could point out the detail through closer observation / inspection….In certain aspects of the work where a lump sum is required, we allow about 5% in the price…we call this a contingency for the unforeseen works…we apply this percentage in situations where a bill of

quantities is not provided by the client but must be produced by us based on the drawings and specifications that they give us…this percentage is also applied in areas of the work that we often view as complex, and areas where there are not enough design details…reinforcement is often one major item that attracts this allocation".

Therefore, it is difficult for the contractors to know the right prices for specialist items without consulting specialist subcontractors. However, in order to meet a deadline, some of them said they would rely on their own experience to arrive at a rough approximate estimate and then add about 5-10% of the estimated value. The specialist items could also be priced based on a similar job that has been done in the recent past. Some of the main specialists' works they described are industrial plumbing, steel work, galvanised heavy duty PVC piping, structural steel, and electrical work. One contractor said "prices for other specialist materials like 'alucobond' and 'marble' need more time and attention to detail otherwise you would lose money on the job".

If there is a continuous flow of work, then some of these specialist items would be priced more regularly. Some of the contractors indicated that at times when they are not sure of what should be done, they decide the prices for some of the specialist items through discussions with colleagues. A director in of the firms said "…we may also discuss with any of our QSs here in the firm or a QS in another firm, who may recently have priced something similar. Then, we base the price of the new works on the colleague's price and additions for any price changes (exchange rates) and add about 10-20% for any changes in price in overseas markets". Sometimes, they also search the prices on the internet, and then add the appropriate transportation, shipping and import duty tax charges. When they rely on experience, they ask questions such as – two years ago, how much did you price it? And what changes have occurred? Sometimes not all the materials in a tender document are available locally – again 'alucobond' was cited as a typical example.

One contractor said: "...prices obtained from suppliers for bidding purposes need to be used carefully. You need to tell the suppliers/subcontractors that you need the quotes for a tender. Most suppliers tend to place the actual order from overseas at the time when an actual order is placed by the contractor, and this could result in significant price changes". In pricing contingencies, one contractor said "…we know the allowances to price in from experience and the projects we do. If things go adversely against us in one or two projects, we could change what we do but for now it is ok".

## DISCUSSION

Five main points are brought forward for discussion. First, the risk allowances included by the contractors were based mainly on a fixed percentage of the estimated cost of a bill item. Some also included arbitrary lump sum allowances as they calculated quantities and unit rates. One contractor described risks as: "unforeseen events that can eat into our profit". Most contractors said it was difficult to include realistic prices for 'unforeseen events' because of competition. Thus, the amount of contingency allocation is guided by concerns about competitors and winning the job rather than the level of project risk. However, this does not necessarily mean that the contractors assume more risk than usual as argued by Smith and Bohn (1999).

Second, out of the nine main risk pricing mechanisms of contractors reviewed, just one is used by contractors in Ghana, i.e. including the risk as a percentage in the profit margin. The 5% risk allowance included in bid prices, in some cases, also appeared to be higher than the risk margin of 0% and 3% found of US contractors by Smith and

Bohn (1999) and Neufville and King (1991) respectively. Here, the main factors affecting pricing levels appeared to be: (1) the actual direct costs; (2) level of competition; (3) delivery time of the project; (4) promptness of payment; and (5) clarity of tender documents. The risk assessment practices were based mainly on the experience and subjective judgement of the QS and the managing director who were believed to make about 95% of the decisions on pricing levels.

Third, an analysis of the 2006/07 profit and loss statement of one firm showed that overhead was 15% of the yearly expenditure. This seemed to give the arbitrary 15% margin that contractors normally apportion for overhead some scientific basis. The ratios of other costs showed labour (14%), plant (9%), materials (45%) and overheads (15%). This implied that overhead is 15% of the yearly expenditure. This does not seem to agree much with Brook (2004: 109) which states the ratios as: labour (23%), plant (5%), materials (28%) and subcontractors (44%). Therefore, it implies that not much of the main contractor's work is subcontracted. The main factors that influenced pricing levels appeared to be the actual direct costs; level of competition; delivery time of the project; promptness of payment; and clarity of tender documents.

Fourth, looking at the three systematic risk management processes reviewed, it cannot be said that contractors in Ghana practice formal risk management; although it is clear that they take account of risks when pricing their work. No analytical risk models or rigorous analysis are applied to determine contingencies. Indeed, none of the contractors indicated any knowledge or application of any mathematical approach for analysing project risks. This is similar to findings of a similar interview study of 12 contractors in the US where Smith and Bohn (1999) found that none of the contractors had any knowledge of the mathematical models or techniques proposed for formulating contingency allowances in estimates. Instead, all the contractors relied on the QS's skill and experience to price risk based on a fixed percentage of the estimated costs or an estimated number of days for which risk events are most likely to occur during the contract.

Fifth, the building up of prices for labour and materials showed that some allowances were included for risks identified by the contractors. The contractors assessed factors such as the client's ability to pay, project location, the parties involved, and contractors' own ability to perform before deciding to bid. This agrees largely with the literature in Smith and Bohn (1999) in relation to factors considered by 12 US contractors prior to deciding bid/no-bid. An examination of the project characteristics plays a key role in shaping the allocated profit margin. From the way that they build up prices, risk is captured. Hence, they do not perform any one-off formal risk assessment event. Most of them claimed that most aspects of a project are the normal things they do everyday. Where contractors are not sure, they subjectively include an arbitrary allowance of 5-10% to cover any "unforeseen events".

## CONCLUSIONS

The study reported shows that the contractors in Ghana clearly consider risk when building up prices for a job. The main mechanisms used for taking account of risk in the contractors' bid prices are lump sums and a single fixed percentage of the estimated cost of a bill item. The risk allowances were mainly based on the experience and subjective judgement of the Estimator and the Managing Director who are believed to make about 95% of the decisions on pricing levels. Most contractors indicated that most aspects of a project are the normal things that they do all the time. Just a few aspects of a project normally have bespoke features that create uncertainty.

In such cases, if they are uncertain about what amount to price, they simply include an arbitrary allowance of between 5-10% in the item price to cover unforeseen events.

Thus it is clear that the mechanisms used by these contractors in Ghana to price for risk when bidding are mainly intuitive and experiential in nature. Formal risk analysis techniques have proliferated in recent years. However, none of the published or commercial risk analysis techniques are used. This indicates that these contractors in Ghana do not manage risk in the sophisticated manner reported of their counterparts elsewhere in Europe, US, Asia and Australia. The level of the construction industry and nature of projects in Ghana may not warrant the use of formal risk management techniques in the bid pricing process. Besides, any calculated risks may not be included in the final price because of competition. Most contractors said it was difficult to charge realistic prices for risk because of competition. Risk premiums are shaped by concerns about competition and winning the job rather than the true cost of risk. Thus the main determinants of price appeared to be the actual direct costs; level of competition; delivery time of the project; promptness of payment; and clarity of tender documents. Risk did not seem to have much of an influence on pricing levels.

## REFERENCES

Akintoye, A. S. and MacLeod, J. M. (1997) Risk analysis and management in construction, *International Journal of Project Management*, **15**(1), 31-38.

Anaman, K. A. and Osei-Amponsah, C (2007) Analysis of the causality links between the growth of the construction industry and the growth of the macro-economy in Ghana, *Construction Management and Economics*, **25**, 951-961.

Brook, M. (2004) *Estimating and tendering for construction work*, 3ed, Boston: Butterworth Heinemann.

Hughes, W. P., Hillebrandt, P., Greenwood, D. G. and Kwawu, W. E. K. (2006) *Procurement in the construction industry: the impact and cost of alternative market and supply processes*, London: Taylor and Francis.

Laryea, S. (2008a) *How contractors take account of risk in the tender process: theory and practice*, Unpublished PhD thesis, University of Reading.

Laryea, S. and Hughes, W. (2008) How contractors price risk in bids: theory and practice, *Construction Management and Economics*, **26**(9), 911-924.

Laryea, S. (2008b) Risk pricing practices in finance, insurance, and construction, In: *RICS Construction and Building Research Conference*, 4-5 September 2008, Dublin Institute of Technology, Dublin, Ireland.

Laryea, S. (2008c) The tendering process and performance analysis of a building project in Ghana. In: *RICS Construction and Building Research Conference*, 4-5 September 2008, Dublin Institute of Technology, Dublin, Ireland.

Laryea, S. (2007) An experimental approach to project risk identification and prioritisation. In, *CME25: Construction Management and Economics: past, present and the future*, 15-18 July 2007, University of Reading, Reading, UK.

Murdoch, J. and Hughes, W. (2008) *Construction contracts: Law and Management*, 4ed, London: Taylor and Francis.

Saunders, M.N.K., Lewis, P. and Thornhill, A. (2007) *Research methods for business students*, 4ed, Essex: Pearson Education.

Skitmore, M. and Wilcock, J. (1994) Estimating processes of smaller builders, *Construction Management and Economics*, **12**, 139-154.

Smith, G. R. and Bohn, M. C. (1999) Small to medium contractor contingency and assumption of risk, *Journal of Construction Engineering and Management*, **125**(2), 101-108.

Wilkinson, D. and Birmingham, P. (2003) *Using research instruments*, London: Routledge.

# THE EFFECTS OF PROCUREMENT PROCEDURES ON JOINT RISK MANAGEMENT

**Ekaterina Osipova[1] and Per Erik Eriksson[2]**

*1 Department of Civil, Mining and Environmental Engineering, Luleå University of Technology, 97187 Luleå, Sweden*

*2 Department of Business Administration and Management, Luleå University of Technology, 97187 Luleå, Sweden*

Over the last decade, researchers and practitioners have recognised that the relationships between the client and the contractor play a significant role for successful project implementation. The interest in joint risk management (JRM) has increased as it strengthens collaboration between project actors and contributes to a more effective risk management process. The lack of an iterative and cooperative approach to risk management is a weakness in current procurement practice; although several empirical studies show that the project actors are positive about implementation of JRM. The purpose of this research is to investigate how common the use of JRM is in Sweden and if the occurrence is affected by the chosen procurement procedures. Empirical data was collected through a questionnaire survey of 106 members of the Swedish Construction Clients Forum. The results show limited use of JRM in construction projects. Clients that work on a national/international level use JRM to a greater extent than those on the local/regional market. The analysis also indicates that the use of JRM is positively affected by cooperative procurement procedures. In particular, the most significant relationship is found between collaborative tools and JRM - the higher the use of collaborative tools, the higher the use of JRM.

Keywords: client, joint risk management, procurement, risk, statistical analysis.

## INTRODUCTION

Many various risks are involved in construction projects. If risk is not managed it may have a negative impact on the project in terms of cost overruns, time delays and quality problems. Thus an effective risk management (RM) process is an important part of project management that safeguards main project objectives. If risks are to be properly managed, it is evident that the RM process must be systematic and based on the efficient collaboration between the project actors. However, research in the field of construction management indicates that RM is not carried out systematically throughout projects (Akintoye and MacLeod 1997, Lyons and Skitmore 2004, Osipova 2008, Simu 2006, Tang *et al.* 2007, Uher and Toakley 1999, Wood and Ellis 2003). Moreover, adversarial behaviour is common in the construction industry (Cox and Thompson 1997, Zaghloul and Hartman 2003), whilst the use of collaborative tools and joint activities (e.g. joint project office, workshops, partnering facilitator) is very limited (Eriksson and Laan 2007).

[1] Ekaterina.osipova@ltu.se

[2] Pererik.eriksson@ltu.se

Osipova, E. and Eriksson, P.E. (2009) The effects of procurement procedures on joint risk management. *In:* Dainty, A. (Ed) *Procs 25th Annual ARCOM Conference,* 7-9 September 2009, Nottingham, UK, Association of Researchers in Construction Management, 1305-14.

For many years, construction projects have been procured through traditional routes with lump sum payment mechanisms and standardised conditions of contract. These contracts assign responsibilities and liabilities of each party and formalise allocation of project risks. However, during the project implementation the identified risks may change and new risks may appear. Very often these unplanned changes and unforeseen risks may require joint efforts to be managed effectively. The concept of joint risk management (JRM) has been introduced by Rahman and Kumaraswamy (2002) and is based on the principles of collaborative relationships between the project actors. Despite the fact that JRM is argued to be the best option for managing unforeseen risks in projects, the use of this collaborative tool is limited. No studies have been conducted in Sweden in order to investigate to what extent JRM is used in projects and how different procurement procedures affect JRM. Thus the purpose of this research is twofold:

19. To explore the extent of JRM in construction projects.
20. To examine procurement procedures' effects on the use of JRM.

The study is based on the results of a questionnaire survey of Swedish construction clients. Through the literature review seven hypotheses about impact of different procurement procedures on JRM were formulated. The hypotheses were then statistically tested in order to find out what procedures play the most significant role for JRM implementation.

# LITERATURE REVIEW AND HYPOTHESES

## Joint risk management

The most extensive research on JRM has been conducted in Hong Kong by Rahman and Kumaraswamy (Kumaraswamy *et al.* 2004, Rahman 2003, Rahman and Kumaraswamy 2005, Rahman and Kumaraswamy 2008, Rahman and Kumaraswamy 2002). The main findings of their research are outlined below. The results of a survey of construction industry practitioners show their positive attitude towards the JRM concept. The majority of listed risk items were suggested to be managed through JRM to some degree. Both "hard/technical" (e.g. technical capabilities, similar previous work experience, adequate resources, price, and quality of performance) and "soft/relational" factors (e.g. an approach to joint problem solving, attitude towards collaboration, creativity/innovation, attitude to continuous improvement etc.) play an important role in forming a project team for JRM. Among the factors which create a successful collaborative environment, mutual trust, open communication among the actors, understanding each other's objectives and equitable and clear allocation of foreseeable risks were identified as the most important. Early involvement of subcontractors and main suppliers is vital as their competence helps in effective risk identification and risk assessment. A project team involving clients, contractors and consultants should thus be formed before the final contract award. This helps in facilitating an effective project briefing that, in turn, leads to better understanding of the project's objectives by the actors. JRM was identified by practitioners as the best strategy for managing unforeseen risks and risks that change during the project implementation.

Hartman *et al.* (1997) use the term "dynamic risk management" for the similar approach for proactive and joint management of risks. The study highlights the importance of project actors' beliefs in team efforts. Otherwise, it is impossible to achieve a win-win scenario.

## JRM and current procurement procedures

Empirical studies on RM practices in different countries (Akintoye and MacLeod 1997, Lyons and Skitmore 2004, Osipova 2008, Simu 2006, Tang *et al.* 2007, Wood and Ellis 2003, Zou *et al.* 2008) show that RM is not carried out systematically in many projects. While open discussion of risks in the early phases as well as their collaborative management throughout the project are found to be important drivers of effective RM, the communication of risks between the actors does not work. Despite of the visible advantages of collaborative work it is often the case that each actor is focused on his own part of the project and management of associated risks. Traditional procurement procedures based on formal contracts are often seen as a main barrier to effective collaboration in construction projects (Kadefors 2004). Moreover, in traditional procurement there is more focus on price and short-term result than on collaboration and long-term relationships (Eriksson *et al.* 2008).

To overcome the insufficiencies of traditional procurement procedures, the concept of relational contracting (RC) has been explored extensively in the research literature and in practice (Carson *et al.* 2006). RC is a concept that focuses on the relationship between the contract parties and recognises mutual benefits and win-win scenarios through cooperation in the project. RC supports such cooperative agreements as partnering and alliancing, and facilitates teamworking and JRM (Rahman 2003).

Over the last decade, collaboration through partnering has been widely applied in many countries (Bayliss *et al.* 2004). Partnering is argued to be a means to overcome adversarial relationships and create collaborative project environment. Several studies show that industry practitioners are positive about collaborative relationships and believe they lead to cost and risk reduction (Akintoye and Main 2007, Black *et al.* 2000). The results of the other study (Drexler and Larson 2000) show that relationships in partnering projects are much more stable than in other types of projects. As JRM requires collaborative effort of project participants, partnering can be considered as a procurement strategy that facilitates JRM:

*Hypothesis 1. Collaboration through partnering is positively related to the use of JRM.*

From the perspective of dealing with risks, early involvement of contractors and consultants in joint specificarion is considered to be advantageous. It allows utilisation of their competence and expertise from the very beginning that, in turn, leads to better understanding of project risk. Cooperative work of the architects and contractors is argued to result in better technical solutions and help in avoiding many design and technical risks. Moreover, significant savings are possible in the beginning of project, since changes in the early phase cost less money than in the production phase (Uher and Toakley 1999). Thus, the second hypothesis assumes that:

*Hypothesis 2. Joint technical specification by client, contractor and consultants is positively related to the use of JRM.*

Open bid invitation is widely used in the construction industry. It creates competition between contractors and puts more focus on price and short-term results (Eriksson and Laan 2007). On the contrary, limited bid invitation, i.e. direct negotiations with one or two contractors, is argued to facilitate long-term relationships and, in turn, better collaborative environment (Eriksson *et al.* 2008). Thus, hypothesis 3 states:

*Hypothesis 3. Limited bid invitation is positively related to the use of JRM.*

The focus on price when evaluating project bids is a common approach in the construction industry (De la Cruz *et al.* 2006, Eriksson and Laan 2007, Rahman and

Kumaraswamy 2008). At the same time the soft evaluation parameters are often neglected. There are a lot of examples of poor contractor selection that led to significant cost overruns for clients as contractors always try to find ways to decrease their own cost (Branconi and Loch 2004). In order to create a successful collaborative environment that supports JRM, these soft/relational parameters must be taken into account. Some examples of such parameters are contractor's resources and competence, previous experience with the contractor, size and financial stability, attitudes towards changes and continuous improvement, references, and collaborative ability (Eriksson 2008). Thus, the next hypothesis is formulated:

*Hypothesis 4. Consideration of soft parameters during bid evaluation process is positively related to the use of JRM.*

Today subcontractors carry out the largest part of construction work, which results in multiple points of responsibility as well as difficulties in risk communication (Loosemore and McCarthy 2008). In order to better control the whole supply chain, more attention should be paid to including subcontractors in the project team. The results of a survey conducted by Rahman and Kumaraswamy (2004) indicate positive attitudes towards bringing subcontractors and suppliers very early in the project, before the contract is awarded. This helps in facilitating an effective project briefing that, in turn, leads to better understanding of the project's objectives and JRM:

*Hypothesis 5. Joint procurement of subcontractors by client and main contractor is positively related to the use of JRM.*

The concept of RC highlights the importance of contract incentives in order to facilitate joint problem solving. Some payment mechanisms, for example, lump sum, shift all responsibility to one actor and do not underpin possibilities for performance improvement. A study by Muller and Turner (2005) indicates that lump sum contracts have adverse effects on communication between client and contractor. On the contrary, when incentives are used, rational decisions makers tend to put effort in minimising risk so they can get a reward (Knight *et al.* 2001). Moreover, they prefer to cooperate when tangible reward for problem solving is provided (Cheung *et al.* 2008). Turner and Simister (2001) argue that projects based on cooperation and not conflict require incentivisation of all involved actors. A survey conducted by Bubshait (2003) shows that incentive contracts are an effective instrument for promoting project actors' performance, however, their use is still limited in practice. Thus, it is predicted that:

*Hypothesis 6. Cost-reimbursable payment mechanisms with incentives or bonuses are positively related to the use of JRM.*

Finally, a number of collaborative tools are available for creating and supporting effective project environments (Bayliss *et al.* 2004, Black *et al.* 2000, Eriksson and Nilsson 2008). Some examples of such tools are: establishment of joint objectives, relational workshops, joint project database, team building activities, joint project office and partnering facilitator. Usually, the use of collaborative tools is limited in construction projects (Eriksson 2008) despite the fact that they are necessary for joint activities in general and JRM in particular:

*Hypothesis 7. The use of collaborative tools in the project is positively related to the use of JRM.*

# RESEARCH APPROACH

### Questionnaire survey

The main part of the study is a questionnaire survey of construction clients that are members of the Swedish Construction Clients Forum. The purpose of the survey was to analyse how different procurement related factors affect the project results. The questionnaire survey was developed consisting of three sections. The first section contained general questions about the respondent. The second section covered decision models during project procurement, e.g. payment mechanisms, choice of the main contractor, procurement of subcontractors, the use of collaborative tools etc. Finally, the third section discussed different aspects of the final project result. The questions were not focused on a particular project but on project performances in the clients' portfolios of procured and finished projects. Responses to the questions were rated on a seven-point Likert scale range: from 1 = very seldom/unimportant/very dissatisfied to 7 = very often/ important/satisfied.

The participants represented various types of construction clients: regional, national and international industrial and property companies, municipal and regional authorities, and government services and agencies. At the first stage, a letter with information about the survey, its purpose and importance for the construction clients, was send by the CEO of the Forum to the 140 organisation members. Then, the registered contact person within each organisation was contacted by telephone and asked to provide the details of possible respondent. At this stage six organisations declined to participate due to lack of time. Finally 134 questionnaires were sent and 111 responses were received after two reminders. From obtained responses five questionnaires were excluded due to the significant amount of missing values. From the population of 140 organisations, 106 usable questionnaires were received resulting in a response rate of 76%.

### Data analysis

When the completed questionnaires had been collected by mail, the data was entered into the Statistical Package for Social Science (SPSS). All questions were converted into variables and each answer alternative was coded using value labels. In order to test hypotheses, relationships between the dependent variable "use of JRM" and independent variables "procurement procedures" have been modelled using hierarchical regression analysis.

# RESULTS

To fulfil the first purpose of this research - to measure the extent of JRM in the Swedish construction projects - the mean value was obtained. The results indicate a limited use of JRM, as the average score is 3.1 on the seven point scale.

In order to test relationships between the use of JRM and procurement procedures two models were constructed. In Model 1, the following characteristics of the client are included: area of the client's activity, i.e. local/regional or national/international market; type of work mostly performed by client, i.e. new construction/rebuilding or maintenance work; and if the client follows public procurement regulation or not. Model 2 summarises both client's characteristics and cooperative procurement procedures: local/regional or national/international market, new construction/rebuilding or maintenance work, public procurement regulation, extent of partnering, joint technical specification, limited bid invitation, soft parameters during

bid evaluation, joint subcontractor selection, payment mechanism with incentives/bonus, and use of collaborative tools. The results of regression analysis show significant correlations between the dependent and independent variables (Table 2). For Model 1, R square change is 0.105 and significant at the 0.01 level. For Model 2, R square change is 0.385, i.e. almost 40% of variation in the use of JRM can be explained by the combination of the cooperative procurement procedures.

*Table 2: Regression analysis*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | R Square Change | F Change | df1 | df2 | Sig. F Change |
| 1 | 0.324 | 0.105 | 0.078 | 1.71 | 0.105 | 3.981 | 3 | 102 | 0.010 |
| 2 | 0.700 | 0.489 | 0.436 | 1.34 | 0.385 | 10.221 | 7 | 95 | 0.000 |

Table 3 presents detailed analysis of the hypotheses. In Model 1, the variable "area of the client's activity", i.e. if the client is active on local/regional market or national/international market, is significant at the level 0.05. The correlations between the use of JRM and individual procurement procedures are non-significant at the 0.05 level in six cases. This suggests that six hypotheses are rejected. The relationship between the use of JRM and use of collaborative tools is however positive and significant on the 0.01 level. Thus, Hypothesis 7 is confirmed: the higher the use of collaborative tools, the higher the use of JRM.

*Table 3: Coefficients*

| Model | | Unstandardised Coefficients | | Standardised Coefficients | | |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | t | Sig. |
| 1 | (Constant) | 1.538 | 0.820 | | 1.877 | 0.063 |
| | Public procurement regulation | 0.328 | 0.410 | 0.091 | 0.801 | 0.425 |
| | New construction/rebuilding or maintenance work | -0.185 | 0.545 | -0.032 | -0.340 | 0.735 |
| | Local/regional or national/international market | 0.993 | 0.429 | 0.262 | 2.313 | 0.023 |
| 2 | (Constant) | -1.046 | 1.093 | | -0.957 | 0.341 |
| | Public procurement regulation | 0.327 | 0.494 | 0.090 | 0.662 | 0.510 |
| | New construction/rebuilding or maintenance work | 0.329 | 0.448 | 0.057 | 0.735 | 0.464 |
| | Local/regional or national/international market | 1.062 | 0.365 | 0.280 | 2.910 | 0.004 |
| | Partnering | 0.179 | 0.126 | 0.179 | 1.416 | 0.160 |
| | Joint specification | 0.103 | 0.092 | 0.126 | 1.118 | 0.266 |
| | Limited bid invitation | -0.140 | 0.138 | -0.150 | -1.016 | 0.312 |
| | Soft evaluation parameters | 0.015 | 0.136 | 0.010 | 0.110 | 0.913 |
| | Joint subcontractor selection | 0.044 | 0.086 | 0.054 | 0.506 | 0.614 |
| | Incentive-based compensation | -0.023 | 0.171 | -0.017 | -0.135 | 0.893 |
| | Collaborative tools | 0.604 | 0.169 | 0.400 | 3.573 | 0.001 |

As the regression analysis reveals, there is a significant correlation between the area of the client's activity and the use of JRM (R Square is 0.105). Hence, an additional analysis was conducted to further investigate this relationship. A compare means analysis (Table 4) shows that the clients working on national/international market use

JRM to a significantly larger extent (mean value = 3.9) than those who work locally/regionally (mean value = 2.7).

*Table 4: Comparison of means*

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| Local/regional market | 72 | 2.7222 | 1.63778 | 0.19301 | 2.3374 | 3.1071 |
| National/international market | 34 | 3.9118 | 1.81522 | 0.31131 | 3.2784 | 4.5451 |
| Total | 106 | 3.1038 | 1.77780 | 0.17267 | 2.7614 | 3.4462 |

# DISCUSSION

During recent years, the Swedish construction industry has been trying to overcome the problems with increasing cost, project delays and quality problems. The actors have recognised the insufficiencies of traditional procurement and importance of relational contracting. However, the industry is still not efficient enough to expect rapid changes. There are a number of obstacles to increased collaboration (Eriksson *et al.* 2008). Some examples are conservative culture, adversarial attitudes, short-term perspective, traditional organisation of construction process and traditional procurement procedures. Despite the fact that collaboration through partnering has been introduced in Sweden, the use of partnering is still scarce and the use of collaborative tools is limited (Eriksson and Laan 2007). This study supports previous findings and shows the limited use of JRM in Sweden. It is also in line with a study by Tang *et al.* (2007) where the absence of JRM mechanisms was identified as the most important barrier to effective RM. One reason for the limited use of collaborative tools and JRM can be the lack of competence among the project actors. To involve a partnering facilitator that guides joint activities of a project team can be one solution to increase collaboration and promote the use of JRM.

The hierarchical regression analysis shows that the use of JRM is positively affected by the use of cooperative procurement procedures. Together, the use of partnering agreements, joint specification, cost reimbursable payment mechanism with incentives/bonus, limited bid invitation, soft parameters during bid evaluation, joint procurement of subcontractors, and collaborative tools increase the use of JRM. However, looking at the individual procedures, only the use of collaborative tools has a statistically significant positive effect on JRM. A strong correlation between the use of JRM and the use of collaborative tools is in line with previous research which indicate that collaborative project environment is a necessary condition for an effective JRM process (Rahman and Kumaraswamy 2008).

Furthermore, the results show that clients working on a national/international level use JRM in a greater extent than those who are working on the local/regional markets. This can be explained by the fact that larger national companies allocate more resources in development and improvement activities and have a broader competence when it comes to project management practices.

The fact that six hypotheses were rejected indicates that further research on effects of other procurement procedures on the use of JRM is needed. In order to obtain more evidence, further investigation based on qualitative data (e.g. interviews with the project actors) will be conducted. The fact that the cooperative procurement

procedures together correlate significantly with the use of JRM gives an indication of their significance in practice. In this study, the use of JRM is discussed only from the client's perspective. Investigation into attitudes of contractors and consultants would contribute to the significance of the research. The study is a part of a research project, which aims at developing and testing a JRM model that can be used for guiding JRM activities at the different project stages in order to facilitate project success. In the future work two case studies will be performed with a main purpose to explore how JRM is working in practice. The literature review, questionnaire survey and case studies results will then form the basis for development of a JRM model.

## CONCLUSIONS

Successful projects require stable relationships between the actors as well as collaborative environment for an effective management of project risks. The results of the study support previous research findings that the use of collaborative tools in general, and JRM in particular, is limited. Potential reasons for these limitations are discussed: traditional procurement procedures that are commonly used in the industry do not support collaboration. The other explanation can be that project actors experience a lack of competence in cooperative project management.

The following cooperative procurement procedures that facilitate collaboration and JRM are identified: joint technical specification by client, contractor and consultant; cost-reimbursable payment mechanism with incentives/bonuses; limited bid invitation, consideration of soft parameters during bid evaluation process; joint procurement of subcontractors by the client and main contractor; and the use of collaborative tools such as establishment of joint objectives, relational workshops, joint project database, team building activities, joint project office and partnering facilitator. Together these procedures have a significant impact on JRM, whilst the use of collaborative tools is the most important factor.

JRM is an important collaborative process aiming at safeguarding the project objectives and achieving a win-win scenario. The research results presented in this study are expected to increase awareness of construction clients about the importance of cooperative procurement procedures that support JRM.

## REFERENCES

Akintoye, A and Main, J (2007) Collaborative relationships in construction: The UK contractors' perception. Engineering, Construction and Architectural Management, 14(6), 597-617.

Akintoye, A S and MacLeod, M J (1997) Risk analysis and management in construction. International Journal of Project Management, 15(1), 31-38.

Bayliss, R, Cheung, S-O, Suen, H C H and Wong, S-P (2004) Effective partnering tools in construction: a case study on MTRC TKE contract 604 in Hong Kong. International Journal of Project Management, 22(3), 253-263.

Black, C, Akintoye, A and Fitzgerald , E (2000) An analysis of success factors and benefits of partnering in construction. International Journal of Project Management, 18(6), 423-434.

Branconi, C and Loch, C H (2004) Contracting for major projects: eight business levers for top management. International Journal of Project Management, 22(2), 119-130.

Bubshait, A A (2003) Incentive/disincentive contracts and its effects on industrial projects. International Journal of Project Management, 21(1), 63-70.