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Wood, GD and Ellis, R

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# AN EXPLORATION OF APPROACHES TO RISK MANAGEMENT APPLICATIONS WITHIN UK CONSTRUCTION PROJECTS

**Gerard Wood and Robert Ellis**

*School of the Built Environment, Leeds Metropolitan University, Brunswick Building, Leeds LS2 8BU, UK*

Risk Management (RM) is now widely accepted as an important tool in the management of projects. Through a series of semi-structured interviews with RM facilitators the trends and approaches to the practical application of RM are explored. The findings provide a number of soft benchmarks. The use of RM workshops for project teams is prevalent, though some prefer interviews with individual team members. The production of risk registers is routine. There is a reluctance to over-complicate the classification of risks. The use of Monte Carlo simulation through specialist software is widespread as a means of obtaining a greater degree of confidence in project budgets and associated contingency funds. Decision trees, spider diagrams and other more complex techniques are rarely, if ever, used. The use of historical data is limited. The rich data which emerges from the interview process offers a valuable insight into cost consultants' experiences of RM applications. There is a tendency to take an intuitive approach to risk attitudes. There is a degree of scepticism regarding the usefulness of complex risk analysis techniques and a predisposition to rely on judgement based on experience. These findings provide the foundation for further case-study based research.

Keywords: probabilistic estimating, risk analysis, risk attitude, risk management, workshop.

## INTRODUCTION

Since the mid-1980s many authors have suggested that the management of construction projects, large or small, benefit from a greater understanding brought about by the application risk management (RM) techniques. The well-known work of Perry and Hayes (1985) established RM as a concept of relevance to construction projects and elaborated upon a three-stage process that comprised identification, analysis and response. Perry and Hayes concluded that risk and uncertainty were not the sole preserve of large capital projects but that factors such as complexity, speed of construction and location also contributed to the inherent risk within a project. RM is now widely accepted as a vital tool in the management of projects and in recent years an array of documents have been published which aim to provide guidance for practitioners undertaking the RM process; examples include: CIRIA (Godfrey, 1996), HM Treasury (1997), APM (1997), ICE *et al.* (1998), BSI (2000) and RICS (2000).

Simultaneously, there has been an increase in research aimed at investigating RM practices in the construction industry, the basis of which has been largely survey-based questionnaires. For example, the works of Simister (1995), Potts and Weston (1996), Akintoye and MacLeod (1997), Jackson *et al.* (1997) and Amos and Dent (1997) all use (mostly postal) questionnaires and tend to focus on a quantitative

analysis of results. Edwards and Bowen (1998) question the adequacy and appropriateness of such opinion-survey research and suggest that methodological weaknesses undermine the validity and usefulness of their findings. They advocate the greater use of case study techniques using the real experiences of project participants to examine important soft systems issues. This paper, in part, responds to this challenge by exploring the attitudes and experiences of RM facilitators in the UK construction industry, with a particular focus on the processes, tools and techniques currently being used by leading cost consultants who offer a RM service. It is intended to act as a pilot study for further case study based research.

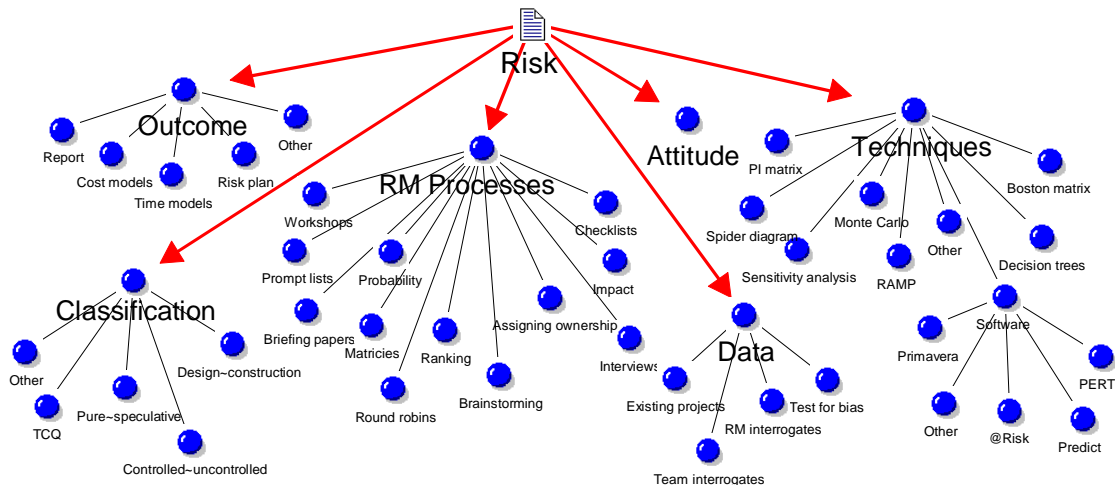
## **METHODOLOGY**

The purpose of this pilot study is to examine which RM procedures, tools and techniques are currently used by cost consultants. By adopting a qualitative approach it aims to generate rich data relating to the attitudes and experiences of RM facilitators.

An exploratory interview with a recognized expert in the field helped formulate a series of ideas, which were investigated further in a series of semi-structured interviews with practitioners. Interviews were conducted by two chartered surveyors in the School of the Built Environment at Leeds Metropolitan University. Whilst the research hoped to uncover trends and themes in the practical application of RM, the interview format deliberately avoided a mechanistic trawl through the recognized phases of risk identification, analysis and response. Rather, issues were allowed to emerge from an open discussion relating to the current practice and procedures adopted by each organization.

It is contended that since the concept of RM was recognized within the UK construction industry, cost consultancies have often facilitated the service on traditional building projects. To some extent this is evidenced by publications such as *Building Cost Techniques: New Directions* (Brandon, 1982) and the RICS QS Research and Development Forum on Risk Analysis (RICS, 1985), together with a number of articles in the *CQS* (e.g. Yates, 1986) and *CSM* journals (e.g. Hawkins and Solomon, 1989). Accordingly, the research study is drawn from the opinions of practitioners representing some of the leading UK cost consultancies. Building magazine's league tables, published between 1997-2000 and based on an analysis of fee turnover and the number of employees, were used to identify the leading twelve UK practices. Eleven companies agreed to take part in the scoping study. The practitioners interviewed are acknowledged within each organization as being experts in their field and are, in many instances, the respective heads of research and specialist consultancy units. However, the authors recognize that this restricted sample places limitations on any observations and conclusions resulting from the pilot study.

A provisional start-list of codes was based upon issues arising from the exploratory interview, a method preferred by Miles and Huberman (1994), and revised upon closer examination of the data. Transcripts of each interview were independently coded in NVivo data management software and differences in the coding categories were resolved prior to the creation of a hierarchical model that illustrates the key issues arising from the study (refer to Figure 1). Such techniques, Richards (1999) argues, could have a procrustean effect on the data. Therefore, the model merely provides the structure for a detailed exposition of each category which in turn reveals the range of experiences and the practices operating in each organization.



**Figure 1:** Qualitative (NVivo) model of RM procedures, tools and techniques

## THE RISK MANAGEMENT PROCESS

There is a general consensus amongst interviewees regarding the most effective forum for the early stages of risk management – the workshop. Almost all practitioners attempt to convene a RM workshop attended, where possible, by all major stakeholders: clients, project managers, designers, cost consultants, contractors (where appointed), end users and even in some instances external organizations such as a local residents’ association. However, there are often important tasks to be undertaken pre-workshop.

### Pre-workshop

Where time permits and the scale of the project allows, many consultants prefer to interview stakeholders prior to the workshop. The intention here is to get a general feel for the principal concerns of those involved in a project. This is seen by some as a crucial part of the process because of the quality of the information obtained.

*That tête-à-tête can lead you to explore some quite sensitive risks . . . whereas they would never come out in the workshop, not a chance and that’s often some of the very big ones.*

Another went further in identifying this as the only real opportunity for an honest exchange.

*The most productive meetings are when we see the individuals separately. We find that if you have a meeting with the client, the architect, the consulting engineer, all sat round the table, well you might as well pack it in because you’re going to get nothing. You’re going to get bullshit. They’re going to go “we think he’s lovely”, “we think he’s OK”, and then you say “can we have a meeting with the services consultant on his own?” You go to see him and you find that he’s entirely on the wrong fee basis, all this guy can do is your performance specification; he can’t do the design and then he starts pouring his heart out. I find that speaking to the individual consultant is more time consuming but it’s the only way you get the information.*

When interviews are not possible consultants often send out briefing papers to introduce the RM process and explain its aims and objectives. In addition, some send

out questionnaires or round robins as a means of obtaining at least some impression of the stakeholders' views prior to the workshop. They are sometimes referred to as risk identification forms and provide the basis for a first draft initial risk listing which can be tabled at the workshop.

### **Workshop**

The length of time dedicated to workshops tends to range from a half-day to two days depending upon the nature of the project and the willingness of the client to pay given that a two-day event is estimated to cost £10,000. The most common duration is a half or full day.

The workshops themselves tend to follow a similar format involving either group or individual brainstorming and Delphi techniques to identify risks initially. A number of facilitators use prompt lists to direct and stimulate the group's thinking and subsequently they employ checklists to ensure all issues have been aired. All consultants use the workshop to at least rank the identified risks, and most go on to perform some kind of scoring system to take account of both probability of the risk occurring and the consequent impact on the project (refer to later section on Risk Analysis Techniques).

Perhaps some of the most interesting observations relate to the perceived benefits of the workshop. Most acknowledge that brainstorming encourages lateral thinking and that the ranking and scoring process captures the collective intelligence of the project team and achieves a consensus on what are the major project risks.

*One of the benefits . . . is a better understanding of what the real risks are to the project and not the perceived risks.*

In addition, some suggest the workshop also provides an opportunity for valuable interfacing between all stakeholders, opens up channels of communication and can even become a team building event.

*. . . there are a lot of hidden things that people are trying to deal with by themselves which they see as "my particular issue: I'll deal with it under the table; I'll get it sorted out", when often the best thing to do can be to share that with people and get their input to it; get some advice; get some help.*

*You can get a good balance of people around the table at a workshop environment and the benefits are far greater than just the risk results.*

There are, however, one or two dissenting voices.

*I prefer to use individual interviews myself. . . that way you can get a fuller picture of what's going [rather than] a dozen people sitting round all just chirping in.*

Concern is also expressed that the views of participants can remain hidden in the workshop situation. For instance, if certain members of the design team are perceived by others to be the major contributor to risk, it is unlikely that this would surface at a round- the-table meeting. This view clearly links back to the preference for individual interviews raised earlier.

### **Post-workshop**

Following the workshop further evaluation of the issues is carried out and in the majority of cases a project risk register is published which identifies individuals to

take ownership of each particular risk. An accompanying risk report for the client including mitigation plans is also produced (refer to later section on Outcomes). Frequently, there are follow-up meetings with the project team, typically of one to two hours' duration, and in some cases there are further review meetings at certain project milestones, for example, at the letting of the contract when a number of risks may be passed over to contractors.

## ASSESSING A CLIENT'S RISK ATTITUDE

The interviews indicate that there is little or no formal assessment of the risk attitude of the client organization or individuals within it. This does not necessarily mean it is not taken into account, but it appears to either emerge from the process or is dealt with through an intuitive response.

*I suppose that the perceptions that if they continue with risk workshops then they're fairly sensitive to risk.*

*We know our clients quite well . . . we know that some of them are risk averse and some of them are not . . . we don't have a process, but we maybe do it intuitively, I'm not sure.*

*It's a gut feel – you can feel it when you go in and start talking to clients.*

Despite this, certain comments reveal that there is sometimes a deliberate transfer of risks without any formal consideration of who is most able to manage them.

*In a lot of instances they [clients] probably pay more money, but the bloke is so much more comfortable and maybe he sleeps better because it [risk] is passed down the line.*

*Some clients are just totally risk averse – they look to pass everything on to the contractor.*

## CLASSIFYING RISKS

There are a variety of approaches to categorizing the identified risks. Perhaps the most common is to use the origin or consequence of the risk, for example, programme risks, cost risks, site risks etc. or to use specific building elements such as structure, services or even a full BCIS type breakdown. A number classify risks according to the stages within the development process along the lines of the RIBA plan of work – design development, specification, procurement, tendering, construction etc. On larger projects, risks are often grouped either within different phases or in line with the project Work Breakdown Structure. Others take a broader view by using categories such as political, environmental, commercial risks etc. or by focusing on capital costs, maintenance costs and life cycle costs. The differentiation of risk and uncertainty and the classifications of risk offered by some texts such as dynamic, static, pure, speculative, controllable and uncontrollable etc. are hardly ever adopted.

*I find people get really confused by it, really they are just hooks to hang identification on.*

In fact, only one respondent indicates an inclination to use such classifications. This bears out the suggestion by Perry and Hayes (1985) that such distinctions are usually unnecessary and may even be unhelpful.

## RISK ANALYSIS TECHNIQUES

A number of practitioners employ the use of some kind of probability impact matrix, at least initially, to help assess, rank and score the identified risks. Scoring systems range from simple low, medium, high ratings to more precise numeric scales such as those suggested in the RAMP guidebook (ICE *et al.*, 1998) where both probability and impact respectively are scored on a calibrated scale and one is multiplied by the other to give a combined value. The use of matrices is thought to help focus the minds of the team on what they have to manage and where the emphasis ought to be. But one interviewee warns that it is vital not to lose sight of the objective.

*A lot of teams get hung up on the scoring – “well how much is a point on these ratings; how much is a point worth?”.*

Almost all practitioners use computer software to calculate minimum, maximum and most likely values of each risk or combination of risks using Monte Carlo simulation. The most common package is @Risk followed by Predict. Whilst there appears to be a good general understanding of the principles adopted in simulation modelling, there is a little less confidence regarding the detailed workings of the model. Examples include the difficulties associated with the potential interdependence of variables and the selection of appropriate distribution profiles. Commonly, only a three-point triangular distribution is used, whilst some do also use normal and uniform distributions. The reasons for this are often simply a matter of practicality in the absence of statistical data.

*What we find though is that you haven't truly got proper data to do it accurately therefore we tend to use the three-point distribution.*

*There's never enough data to verify the distribution you're working on – it's simple to think in terms of maximum, minimum and most likely to get a triangular distribution.*

*If the client believes there is a normal distribution with tails on the end . . . then we will apply those . . . we almost select them in a pictorial way – “is this what you think your risk is like?”.*

A small number do actually test the impact of different distributions as part of their sensitivity analysis. Others rely on the recommendations of the documentation that accompanies the software.

*Actually this [manual] is quite good because it tells you what you should use for distributions. So we follow the book. It seems logical what they've recommended.*

Only one of the consultants interviewed ever uses decision trees, fault trees or event trees. Sensitivity analyses generally comprise a straightforward quantum test of the impact of changes in some of the variables. There is no use of spider diagrams with or without probability contours and no mention of influence diagrams, linear regression, torpedo models, neural networks or other more complex techniques. However, it is felt that it is important to retain a sense of perspective and context.

*You've got to get this relative in the global scheme of things. People [clients] are going to spend a couple of days at the outset of the job on their risk management . . . not more than a few days on the whole process from the beginning to the end of the job. Whilst all these tools are very nice you never get round to using them.*

In fact two of the consultants use little more than basic spreadsheet models and are rather sceptical of the usefulness of complex techniques.

*If you've got a risk in terms of construction . . . you can actually look at the construction programme and see the effect of that – we don't particularly go through what I call the scientific techniques.*

Finally, it is apparent that some consultants sometimes vary the models used depending on the nature of the project and the perceived level of RM expertise within the client organization and/or the project team.

## DATA SOURCES

A number of the consultants interviewed use checklists from previous projects to help identify potential risks on new projects and are in the process of creating their own database of risks. This is seen as particularly useful where the projects are of a similar type or with a repeat client. However, the majority of information comes from the project team during the workshop(s). The risks and values drawn out of the workshop participants are then interrogated, to some extent, by the rest of the team. This is considered to be a means of ensuring that the values are justified and goes some way to testing data for bias.

*If you see bias then challenge it, ask it to be justified – challenge it at the workshop, challenge it later if it is still seriously distorting what the risk register looks like.*

With regard to the actual figures and values used in a risk assessment, there appears to be only limited use of historical or out-turn data from previous projects. Some interviewees were refreshingly honest in their estimation of the level of sophistication in this respect.

*It would be nice to say that on 60% of our jobs the contingency sum has been exceeded by 5%. It would be nice to be able to do that. And we can't.*

*So we haven't got a fantastic database full of statistically correct cost information . . . when you say do we assess it for bias, no.*

*It's all subjective in the construction industry, we are not actuaries. We haven't got established statistics on how often tower cranes fall over so there's nothing else to go on except intuition.*

## OUTCOMES OF THE RM PROCESS

Whilst the immediate product of the RM workshop is commonly a risk register with accompanying action plans and mitigation plans there appears to be a general consensus that the real outcome of the RM process is a more realistic estimate of the project budget. Practitioners often use the risk register to assist in building the uncertainties and risks into the cost model. This may take the form of probabilistic estimates for various building elements, but in most cases the overall objective is to produce a more informed assessment of the necessary level of project contingency.

*Too many Qs just bump a load of money on the end to cover all eventualities . . . we want them [risks] priced because we want a realistic budget . . . we don't want just blanket contingencies – plus 10%.*



A number of consultants use Monte Carlo simulation to generate cumulative probability profiles and thereby indicate to clients the likelihood of any particular single cost figure being achieved. Commonly cited values of interest are the 50% probability and 80% probability figures. In some instances, for example on PFI projects, this would not simply relate to the capital cost but to the life cycle costs. However, others do not see how this probabilistic approach can really help a client.

*If I said to a client at Stage D that I'm 80% confident that we'll finish on budget, but there's a 20 % chance we're going to be over, that worries him.*

*. . . and it comes to a figure at the bottom – the risk of this job is £17M. Well I'm sorry, I'm old-fashioned and don't really see how that helps a client. Does he then borrow an extra £17M to cover his risk?*

There is also a perceived danger in forecasting a 'most likely' figure that is higher than a previous QS estimate because of the client's possible reaction.

*We've had this with a client saying "well Joe Bloggs says it's going to cost £5M and you're saying £5.5M – I think I'll go to him" . . . we have to explain that we're reflecting the true cost of the job rather than an optimistic cost.*

Few of the consultants interviewed carry out any kind of probabilistic programme risk analysis. Uncertainty regarding time is usually translated into cost and is therefore accommodated within the contingency. This is perhaps a reflection of the QS backgrounds of the majority of interviewees in that they may be most comfortable when dealing with the project cost parameters.

## CONCLUSIONS

This pilot study examines which RM procedures, tools and techniques are currently used by cost consultants. As might be expected practice is varied but there is some commonality in certain aspects of the approach to RM taken by this particular sample. To a limited extent it therefore provides some soft benchmarks. The use of RM workshops for project teams is prevalent and the production of risk registers is routine. There is a reluctance to over-complicate the classification of risks. The use of Monte Carlo simulation through specialist software is widespread as a means of obtaining a greater degree of confidence in project budgets and particularly in calculating accurate and realistic levels of contingency funds. Decision trees, spider diagrams and other more complex techniques are rarely, if ever, used. There is limited use of historical data.

In addition, the qualitative approach has allowed some rich data to emerge from the interview process which provides a valuable insight into the views and experiences of RM facilitators within the construction industry. Practice could be described as relatively unsophisticated and there is a tendency to take an intuitive approach to assessing risk attitudes. There is a degree of scepticism regarding the usefulness of complex risk analysis techniques and a predisposition to rely on judgement based on experience. There is also an implication that this is a pragmatic response to the amount of time and money clients are willing to invest in the process.

The issues raised in this study are to be used to form the basis of more detailed research into specific practices in this important field using case-study techniques.

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