

# The Practice of Risk Management by Cost Consultants in Northern Ireland

Maria Mc Namee

School of the Built Environment, University of Ulster Jordanstown, Shore Road, Newtownabbey, Co. Antrim, Northern Ireland, BT37 OQB

[mariamcnee@hotmail.co.uk](mailto:mariamcnee@hotmail.co.uk)

Srinath Perera

School of the Built Environment Northumbria University Ellison Place Newcastle upon Tyne UK NE1 8ST

[srinath.perera@northumbria.ac.uk](mailto:srinath.perera@northumbria.ac.uk)

## Key Words

Risk Management, Northern Ireland Construction Industry.

## Abstract

This research endeavoured to explore the practice of risk management by cost consultants in Northern Ireland. It attempted to subjectively investigate the cost consultant's appreciation of risk management practices and then further appraise the cost consultant's understanding and usage of the theories and techniques available to manage risk under the risk management framework. A case study based approach involving five consultancy practices was adopted. A series of semi structured interviews (one per each case study) was carried out. The data collected was analysed using the Delphi technique. The practice of risk management for each organisation was documented using an analysis and evaluation of project documentation substantiated with interviews. The research indicated that consultants have a broad awareness of risk management but disparity exists on considering it as a core service. All consultants were unequivocal in identifying the need for an improved risk management framework. It was evident that there was a lack of knowledge of the array of risk identification and analysis techniques available. The research has established that there is a severe need to bridge the void between the theories and techniques used to manage risk and those which are implemented in practice. There is a necessity to train consultants in the practice of risk management and educate clients in the benefits of enforcing risk management practices as an integral part of project delivery.

## **1.0 Introduction**

Risk management provides a systematic method of allocating risks in construction projects enabling projects to be managed with greater degree of anticipation and forethought.

Egan (2002) concluded that an astonishing 40% of construction projects are delivered late, 50% are over budget and 30% fail to meet the user's expectations. The steady increase in the nature and complexity of projects, in particular over recent years, coupled with the developer's haphazard approach to risk 'as a risk seeker' (Mills, 2001), has led to overruns in relation to cost and time, and shortfalls in performance criteria (Pennock and Haines, 2001). Individuals within the construction industry are recurrently being faced with uncertain situations which are ultimately affected by factors which are unpredictable and often beyond their control (Akintoye and MacLeod, 1997). The industry's problems are compounded by the absence of reliable historical data of the uncertainties encountered by construction professionals (Dallas, 2006). A culmination of these factors has initiated a review in relation to the management techniques adopted on a construction project. This has subsequently led to the introduction of the concept of systematic risk management through risk identification, risk analysis and risk response strategies as principle components of a risk management framework.

Despite the wealth of risk management techniques and strategies available to construction industry professionals, the evidence from construction projects worldwide highlights that risk is being dealt with incorrectly (Thompson and Perry, 1992 cited Rahman and Kumaraswamy, 2002 and Edwards and Bowen, 1998). There is a lack of understanding of the systematic processes required to adequately manage risk. This is reinforced by a report carried out by NAO in 1999 'Modernising Construction', which concluded that the inappropriate and inadequate use of risk management coupled with a lack of understanding is a major hindrance to the improvement in construction performance (cited OGC, 2003). Professional quantity surveyors accommodate risk by the inclusion of a contingency allowance at tender stage (Hogg, 2000). While formalised risk management strategies are available they are seldom exercised by the quantity surveyor (Hogg, 2000). Moreover there is a lack of consistency, in the techniques for assessing and managing risk among professionals within the industry (Mulholland and Christian, 1999, cited Shang *et.al.*, 2005). This paper therefore seeks to appraise what quantity surveyors in Northern Ireland understand about the concept of risk management and its practice. It assesses their recognition of the theories and techniques adopted to manage risk and builds on the work of Wood and Ellis (2003) by exploring risk management practices, with particular focus on cost consultants in Northern Ireland.

## **2.0 Risk Management**

The principle components of the Risk Management framework are identified as risk identification, risk analysis and risk response (Hayes et. al, 1986, cited Edwards and Bowen, 1998). These stages are briefly reviewed in the following sections.

### ***2.1. Risk Identification***

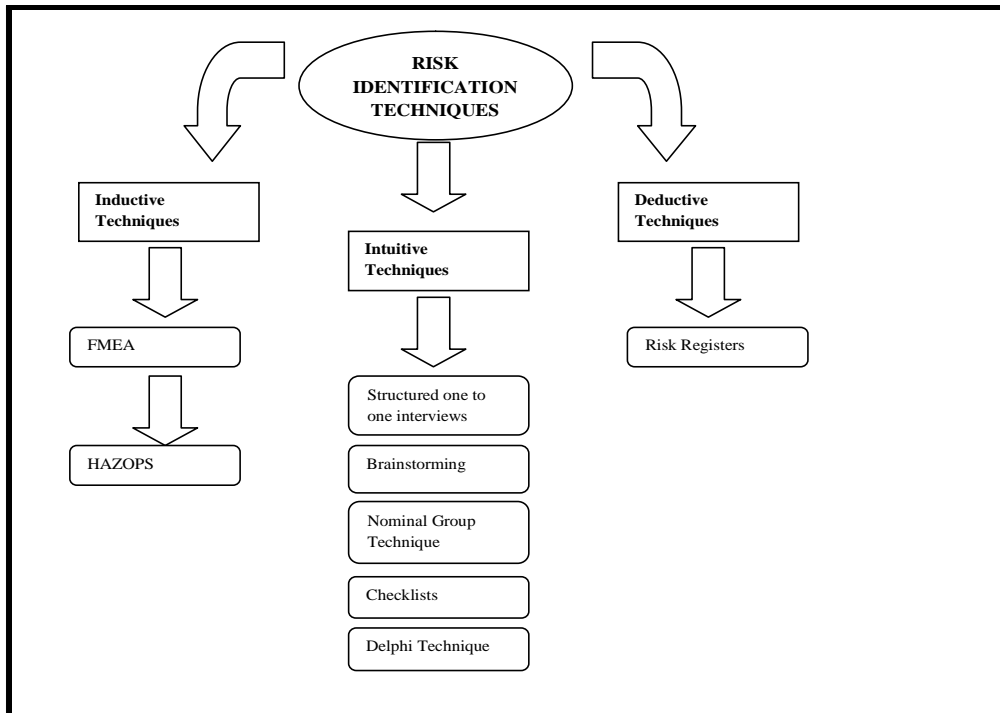
Exhaustive identification of the origin of risk and its impact within the construction industry is essential to enable the professional to adequately manage risk thus preventing the objectives of the project being jeopardised and subsequently ensuring project success (OCG, 2003).

It is evident that there is an inconsistency in the categorisation of sources of risk between researchers within the industry, some suggesting two sources of risk exist, endogenous and exogenous (Chapman, 2001) and others challenging this idea, defining the various sources of risk as internal, external or transmitted (Edwards,1995).

Risk classification, as a constituent of the risk identification process structures the diverse risks which impact on a construction project. However this is purely theoretical, as research has proven that the uniform categorisation of risk does not exist within the construction industry (Flanagan and Norman, 1993, Gould and Joyce, 2000). Once again it is clear that there is a lack of uniformity and thus ambiguity in the classification of risk by industry writers.

The fruition of risk management in recent years has resulted in the development of numerous risk identification techniques (Thevendran and Mawdesley, 2003) as illustrated in Figure 1. These techniques may be classified as intuitive, inductive and deductive (Walker and Greenwood, 2002). It has been suggested that the risk management process would achieve greater success if risks were identified and considered in a more methodical and absolute manner throughout the lifecycle of the project (Zou *et al.*,2007).

Figure 1: Risk Identification Techniques



## 2.2. Risk Analysis

Risk analysis aims to identify and quantify the possibility of major risks occurring and essentially assess its potential effect on project success (OGC, 2003) determining the expected time, cost and potential outcome where both likelihood and impact levels are provided (Williams, 1996).

Risk identified in the risk identification stage may be evaluated using either qualitative or quantitative methods of risk analysis. Significance is determined by assessing predictability, probability and impact (Galway, 2004).

Tools and techniques used to analyse risk include brainstorming, flowcharts and risk decision trees (Walker and Greenwood, 2002). More sophisticated methods such as sensitivity analysis (Flanagan and Norman, 1993), and Monte Carlo technique may also be employed to quantify the impact and likelihood of the risk occurrence.

### **2.3. Risk Response**

Sir Michael Latham (1994) in his report “Constructing the Team” stressed that no project is risk free and advised that risk should be appropriately managed by members of the design team. Risk response is the active minimisation, control and sharing of risk involving elimination, retention, transfer and reduction of risk (Rafferty, 1994, cited Baker *et al.*, 1997).

Risk transfer involves a shift in the burden of risk from one stakeholder to another (Edwards and Bowen, 2005). While risk transfer may achieve a transfer of liability from one stakeholder to another, it rarely absolves the client of answerability for the risk (Edwards and Bowen, 2005).

On the other hand risk may be reduced in an attempt to manage it. This involves a conscious attempt on behalf of the stakeholder to assess the risk in an attempt to reduce the probability of it occurring, its impact and the duration of the risk exposure (Fewings, 2005). It is however widely recognised that the process of risk reduction requires a provision of concealed resources, usually in the form of a contingency allowance, to protect the stakeholder should the risk event occur (Mills, 2001).

Risk retention should only be advocated where reduction or transfer of risk are impossible, where financially, it does not pose an excessive risk, and in instances where occurrence is regarded as unlikely (Williams and Heims, 1989, cited Akintoye and MacLeod, 1997). Even if the retained risk is shared, the client still must embody a pro-active approach and accept responsibility for its management to minimise its impact.

Risk avoidance involves taking preventative measures to avert jeopardising project objectives to ensure that the risk cannot arise again. This does not result in a design team that is ignorant of the potential for risk induced problems on site rather a team who at the risk identification stages is made aware of the severity, source and impact of the potential risk. There are instances where the risk is totally unacceptable, and serious measures such as a project reappraisal are essential. Where the project is deemed unviable it may lead to project termination (Ashworth and Hogg, 2007).

While the most effective form of risk response is to allocate risk to the party most capable of managing it (Mills, 2001) in reality this is not always the case (Kartam and Kartam, 2000). Risk should be frequently monitored and controlled throughout the duration of the project (Smith, 2003). Edwards and Bowen (2005) suggested that although monitoring and controlling is critical to project success it is often not correctly implemented.

#### ***2.4. Attitudes to Risk***

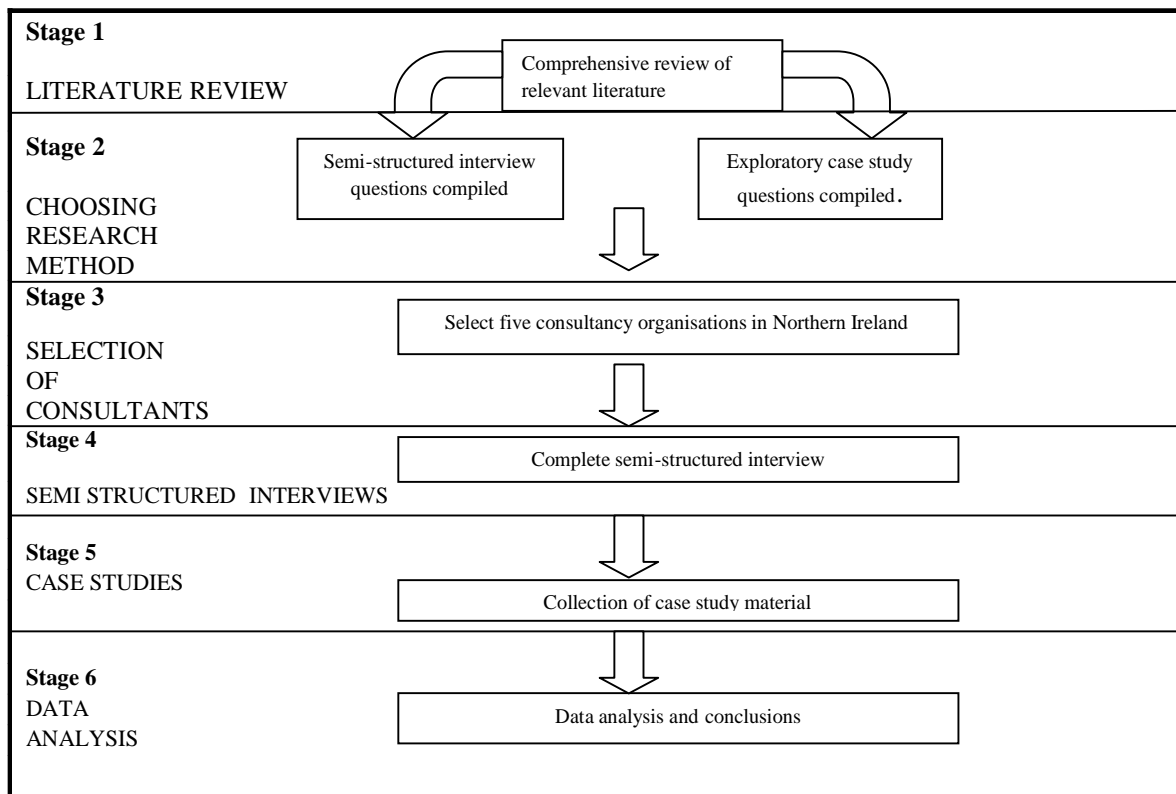
Biases in judgement are mirrored in the construction industry (Mc Kim, 1992) with professionals often adopting an intuitive approach to the estimation of probability (Byrne and Cadman, 1984). The attitude of individuals and indeed the organisation may have a detrimental impact on the effectiveness of the risk management process (Hillson and Murray-Webster, 2006).

An investigation into the risk management framework illustrated widespread concern that the theories and techniques used are neither adequately developed (Adnan, 2006) nor correctly implemented (Dallas, 2006). This provided a solid foundation on which to subjectively investigate the quantity surveyor's appreciation of risk management practices and then further appraise the consultant's understanding and usage of the theories and techniques available to manage risk under the risk management framework.

### **3.0. Research Methodology**

A case study based approach closer to the qualitative research paradigm was employed to examine the experience of project participants in a similar manner to Edwards and Bowen (1998) and Woods and Ellis (2003). The methodology adopted is indicated in Figure 2 and explored in this section.

**Figure 2: Research Methodology**



**Stage 1- Stage 3**

Having juxtaposed the various interview processes it was decided to use semi structured interviews. The interview involved a systematic sift through the various stages of the risk management framework to determine the risk management processes currently being implemented by cost consultants in Northern Ireland. This formulated a series of trends in the execution of the risk management process in Northern Ireland, which were then verified by the implementation of exploratory case studies. Thus methodological triangulation was advocated to produce a more comprehensive and impartial insight into the situation in question (Altrichter et al., 1996). This methodology enabled the researcher to establish a Grounded Theory. Five consulting organisations in Northern Ireland were selected to participate in the research. A professional senior Quantity Surveyor within each organisation was selected for interviews. It is recognised that this restricted sample placed a degree of limitations on the conclusions reached.

**Stage 4: Implementation of Semi Structured Interviews**

The five quantity surveying professionals were interviewed using a semi structured interview format based on pre established framework of questions to direct the interview towards areas of particular interest in the risk management process. The Delphi technique (Chan *et al.*, 2001) was then employed

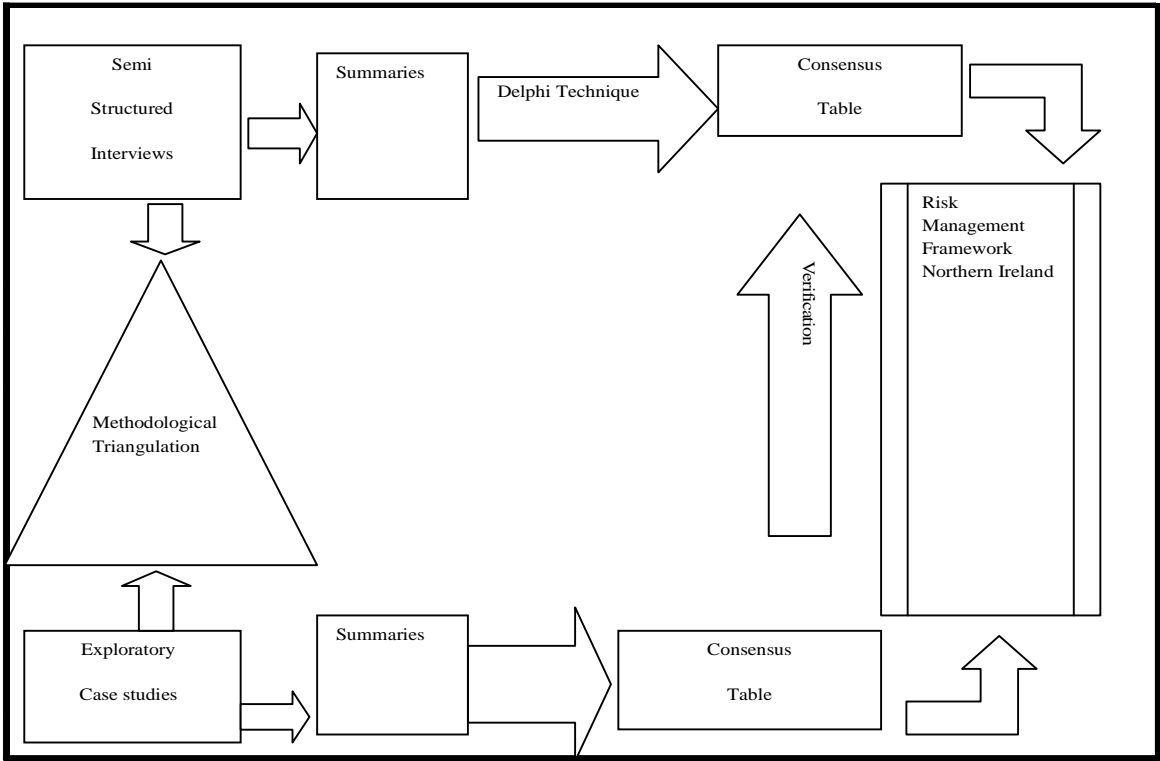
in an attempt to convert individual opinion into group consensus and improve the overall legitimacy and authority of the conclusions reached. The first round of the Delphi technique took the form of a semi structured interview. The second round involved the distribution of the consensus table via email to each of the consultants. Respondents were given the opportunity to comment on the summation of the interview and add comments where necessary. The results of the semi structured interview were then further verified by the implementation of exploratory case studies.

**Stage 5-6: Completion of Exploratory Case Studies**

Case studies were selected as identified by the professional interviewed based on a project on which risk management was applied. Results were recorded and content analysis was used to summarise responses. The Delphi Technique was used to validate responses. A consensus table was then constructed based on these responses.

Data analysis then commenced as illustrated in Figure 3.

**Figure 3: Flowchart indicating methodology adopted for data analysis**



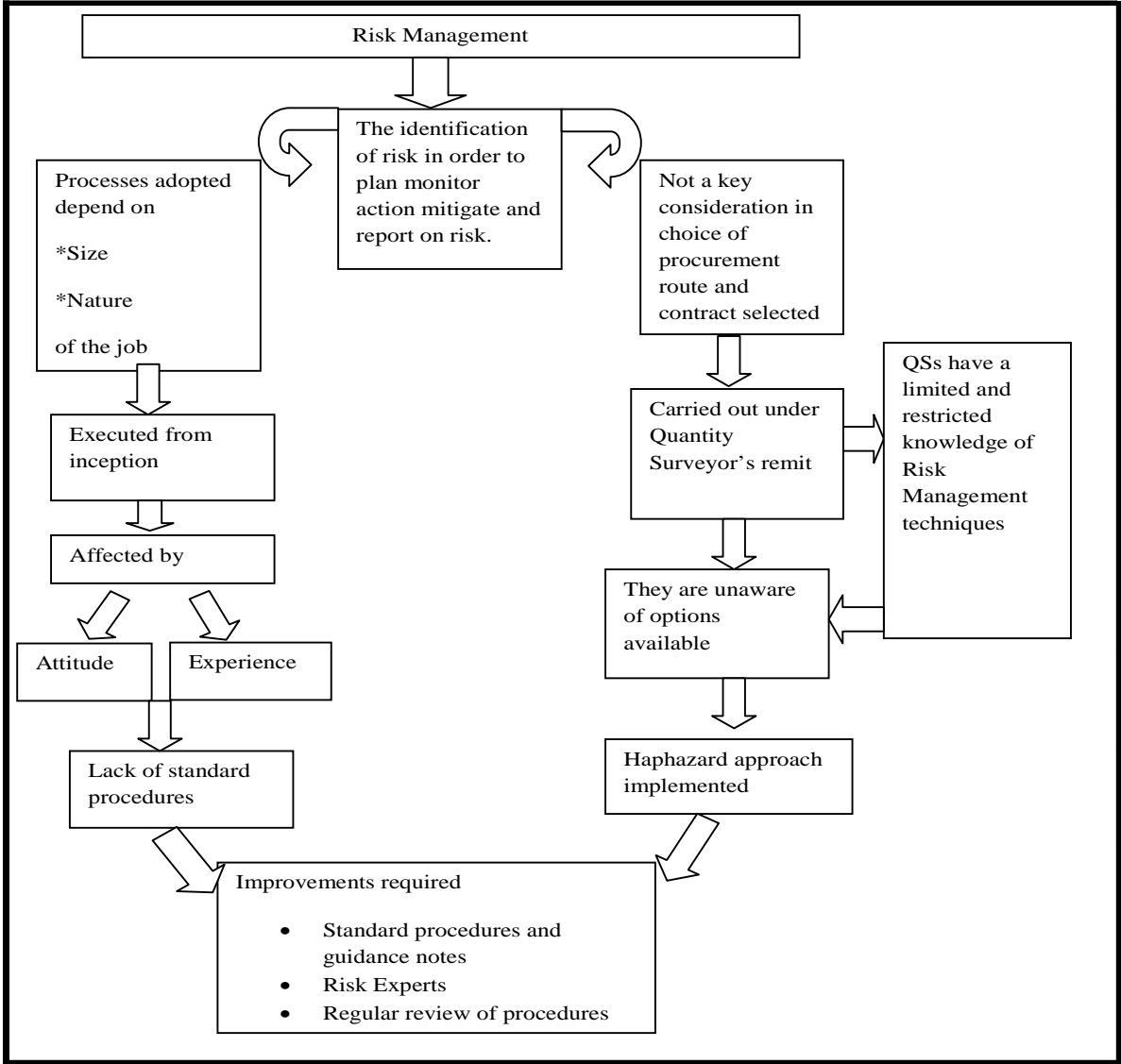


**4.0. Discussion and Analysis**

**4.1. Consultant’s Understanding of Risk Management**

The Quantity Surveyor’s interpretation of risk management in Northern Ireland may be broadly defined as the identification of risk to enable strategic advice to be provided in order to plan, monitor, action, mitigate and report on risk. Figure 4 illustrates the consultant’s understanding of risk management.

**Figure 4: A diagrammatical representation of the consultant’s understanding of risk management.**



Practitioners recognise the integral importance of risk management and its various stages of risk identification, risk analysis, risk response and risk monitoring and control. Consensus suggests that the majority of consulting quantity surveying practices undertake risk management as part of their remit of

activities. However several participants elucidated that the amount of time spent on risk management and the techniques adopted to manage risk were relative to the size of the project, thus concluding that the risk management approach is dependent upon project characteristics.

In smaller projects it involves personal intuition while on larger jobs a structured programme for managing risk usually exists. (Interviewee C)

Interviewees were unanimous in recognising the importance of executing risk management from inception, when the degree of risk and uncertainty is greatest due to a lack of information (Winch 2002). Exploratory case studies bear out this idea with all five projects implementing risk management in the very initial stages. However despite the fact that it is risk factors, innate within the construction industry (Odeyinka, 2000) which causes few projects to be completed within the budgetary expenditure, several interviewees suggest that risk management is not necessarily a core service of the quantity surveyor. On the contrary others opposed this suggestion adding that:

the client must be well informed as this [risk management] is the only way for the client to mitigate and plan ahead (Interviewee B)

All respondents were unequivocal in suggesting that while consultants have a basic understanding of risk management, the risk management framework in Northern Ireland requires much development:

...a lack of standard procedures means every organisation approaches it differently. (Interviewee A)

A lack of systematic, benchmark procedures results in a lack of awareness of the options available to manage risk essentially resulting in a haphazard approach being implemented:

An example [of a standard procedure] would be cost analyse. All Quantity Surveyors do cost analyse in the same way, the elements are set out in the same way and any capable and competent quantity surveyor can do them. I do not see risk like that. I see risk as the Government Bodies and even they have all different approaches to it. (Interviewee A)

Several respondents proposed the introduction of a standard procedure for tackling risk which advocates the use of guidance notes. Moreover all respondents concurred that quantity surveyors have an incomplete and restricted knowledge of the risk management framework with few aware of the formal approaches adopted to manage risk.

Respondents recognised that human involvement in the risk management process does introduce a degree of bias, and perhaps injects a degree of much needed realism into a situation. Consultants were unanimous in suggesting that experience is critical to the successful execution of the risk management framework:

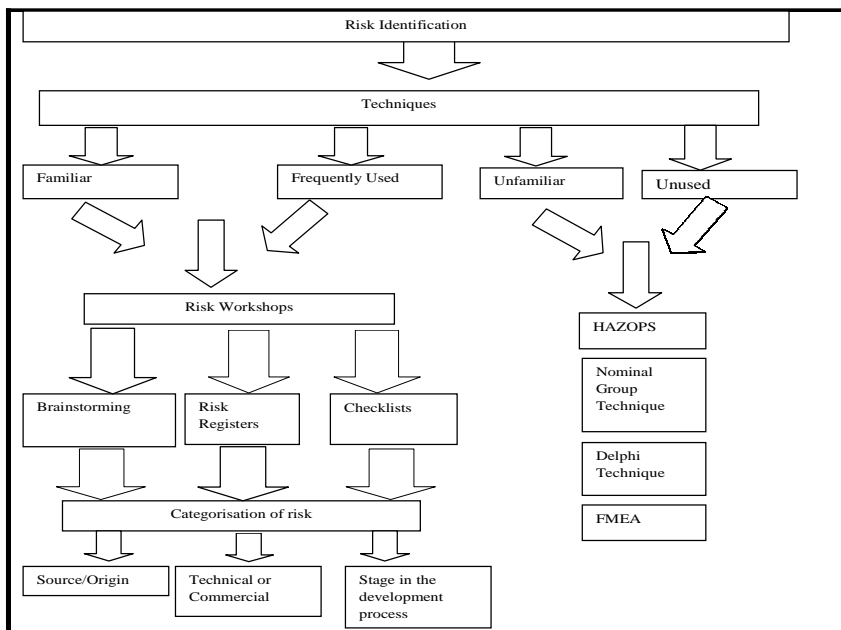
Inevitably intuition does have a role to play in the estimation of probabilities but this is primarily to do with experience. (Interviewee E)

Interestingly, while several of the project case studies investigated recognised that the attitude of the individual had an effect on the risk management process others disputed this theory. The effect of risk factors on the choice of procurement route or contractual procedure selected was an area in which respondents had conflicting views. While some suggested risk was a key consideration, alongside factors such as those of time, cost and quality, others suggested that the form of contract was often governed by policies set out by the client. Project case studies enforce this view with four out of five projects not considering risk as a principle consideration in contract and procurement route selection. Whether or not risk is a principal consideration appears to be dependent largely on the size and nature of the job.

#### 4.2. Understanding and usage of Risk Management techniques and theories

Figure 5 is a diagrammatical representation of risk identification process used in Northern Ireland.

Figure 5: A diagrammatical representation of risk identification as executed in Northern Ireland



Much disparity exists in the way in which risks are categorised. In some instances risk is classified according to its stage within the development process, using the RIBA plan of work structure. Alternatively others classify risk under categories of their origin while to the contrary, a broader view is adopted by other respondents who pigeonhole risk as either technical or commercial risk. This is

evidenced in the exploratory case studies. This concurs with the research of Wood and Ellis (2003) who suggest that the delineation of risk and uncertainty and the separation of risk into categories such as speculative, pure, uncontrollable and controllable are rarely implemented in practice. Furthermore the consensus view illustrated that the categorisation of risk is largely dependent on the stage of the project and the nature of the job. Risk Workshops, advocating the use of brainstorming techniques, is the risk identification tool which the majority of respondents are familiar with and this was verified through the implementation of exploratory case studies. Interestingly, exploratory case studies illustrate that not everyone involved in the risk workshop was familiar with the techniques of risk identification adopted.

In relation to the consultants' overall awareness of risk identification techniques it is abundantly clear that all of the interviewees are familiar with brainstorming, checklists and risk registers. The consensus view illustrates that HAZOPS, FMEA, Delphi Technique and Nominal Group Technique are alien methods of risk identification in the Northern Ireland construction industry:

Experience indisputably is recognised as a major component in the identification of risk:

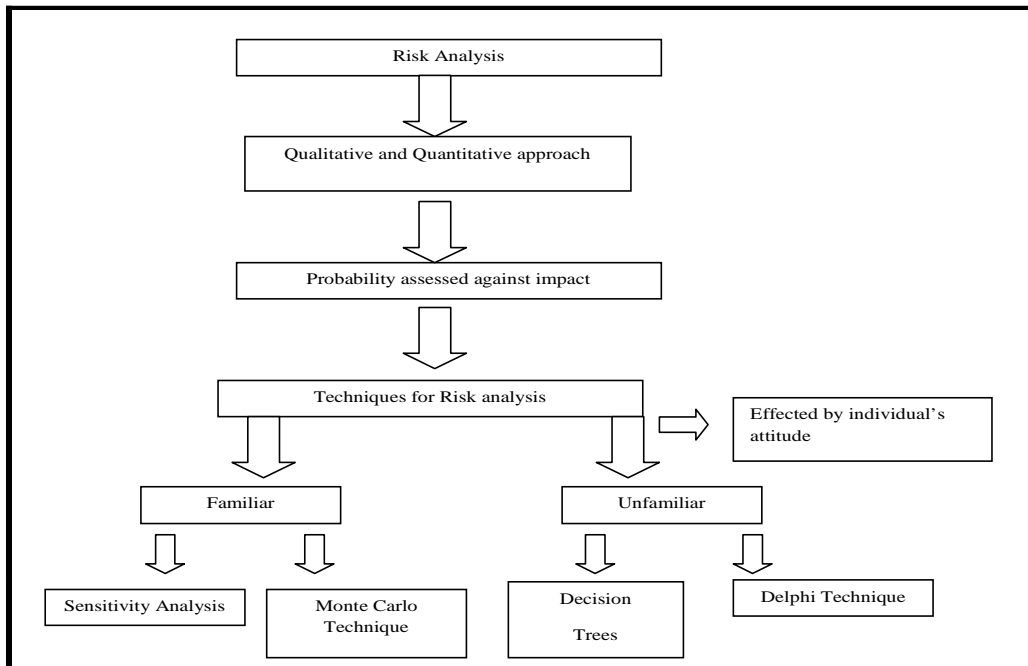
A lot of risk identification is down to previous experience and having an idea of where the pitfalls are. (Interviewee C)

Similarly the willingness of the individual to immerse themselves in the risk workshop determines its success. This is prominent in the exploratory project case studies where the importance of having a good facilitator capable of driving the process, was evident. Likewise the background of the individual is recognised as a factor which affects risk identification.

The consensus view illustrated that consultants recognised risk analysis as a procedure for identifying, evaluating and quantifying the risk and its potential outcome.

Exploratory case studies demonstrate that a qualitative and quantitative approach is embodied in practice with probability assessed against impact. This is illustrated in Figure 6 which provides a diagrammatic representation of the execution of risk analysis in the Northern Ireland construction industry.

**Figure 6: A diagrammatical representation of risk analysis as executed in Northern Ireland**



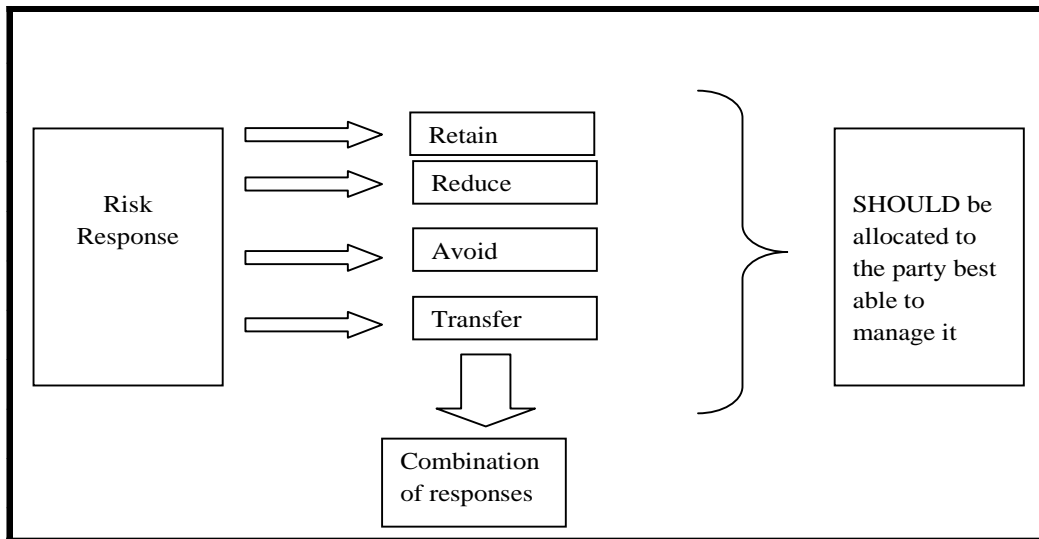
Consultants recognised that risk analysis involved a team based rating of risk in an open forum, with the consensus ruling. Only one consultancy advocated the use of @Risk™ software in their quantitative analysis of risk but the consultant did add that not everyone was familiar with this quantitative risk analysis tool.

All consultants are aware of Sensitivity Analysis and the Monte Carlo Technique as a form of risk analysis and furthermore the consensus view illustrated that these were the techniques interviewees were most familiar with. Only two respondents are aware of decision trees and only one interviewee is aware of Delphi Technique as a form of risk analysis. Interviewees are undivided in recognising that the attitude of the decision maker has a bearing on the execution of this stage of the framework:

An individual may be risk adverse, or less risk adverse (global thinker). In terms of the professional they should be able to give advice within their professional capability. (Interviewee B)

Risk Response is classified as the procedure by which the design team deal with a risk. Figure 7 illustrates how respondents were explicit in detailing reduction, retention, avoidance and transference of risk as the various risk response methods available to the risk manager.

**Figure 7: A diagrammatical representation of risk response as executed in Northern Ireland**



Exploratory case studies reaffirmed this practice emphasising that often a combination of response techniques are implemented. Very interestingly, all interviewees, while recognising the importance of allocating risk to the party best able to manage it, suggest that in reality this does not always happen:

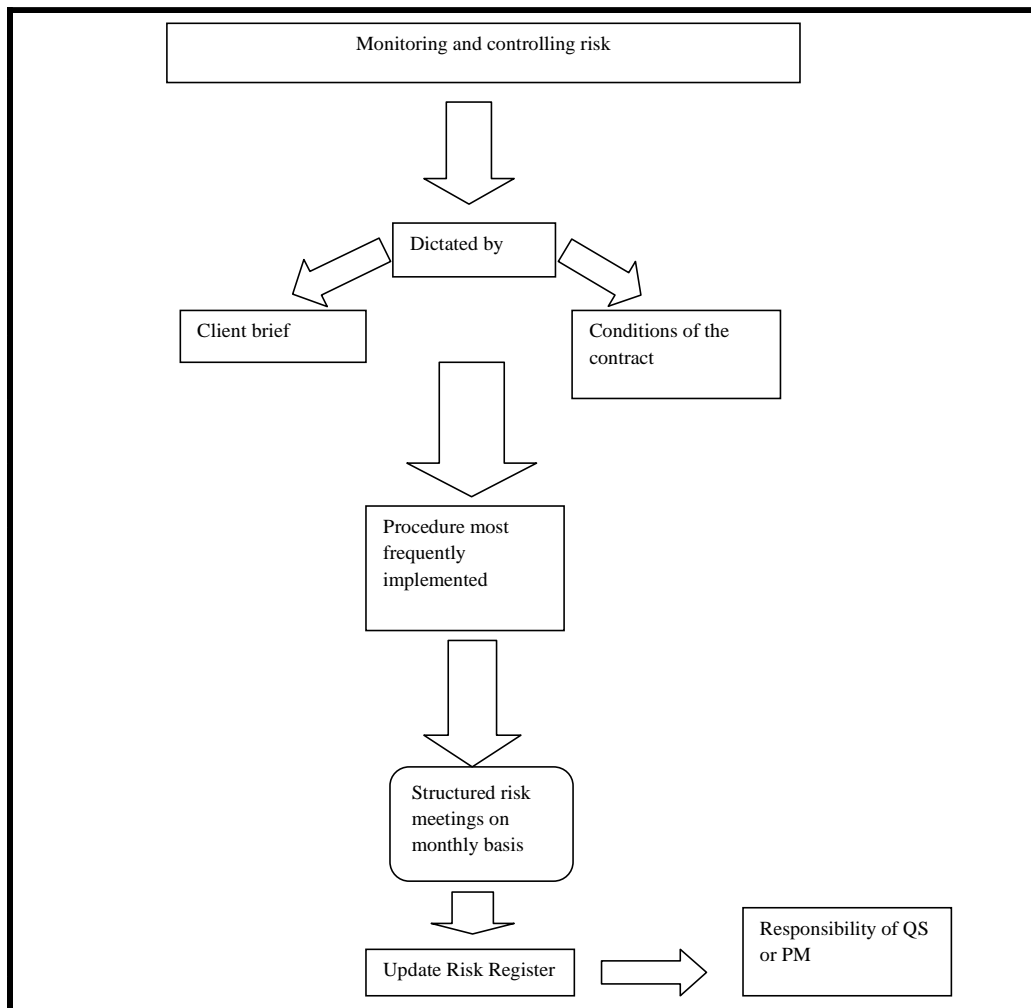
The risk needs to sit with the person best able to manage it. It doesn't always though for other reasons. (Interviewee D)

Risk Monitoring is accepted by all consultants as an integral component of the risk management procedure. However, one consultant did express concern that the monitoring of risk was not always executed accurately:

Often risk is not managed correctly. It is considered at the end of meetings and therefore people regard it as an addition to their normal job/hassle. If done properly on a big scheme it can reap great benefits. (Interviewee B)

This concurs with the research of Isaac (1995) who suggests that the time and effort required for risk management can generate negative attitudes in the team. It is evident that the procedures for monitoring and controlling risk are largely dictated by the client brief and the conditions of the contract. Figure 8 illustrates how the consensus view suggests that this usually takes the form of structured risk meetings on a monthly basis:

**Figure 8: A diagrammatical representation of risk monitoring and controlling as executed in Northern Ireland**

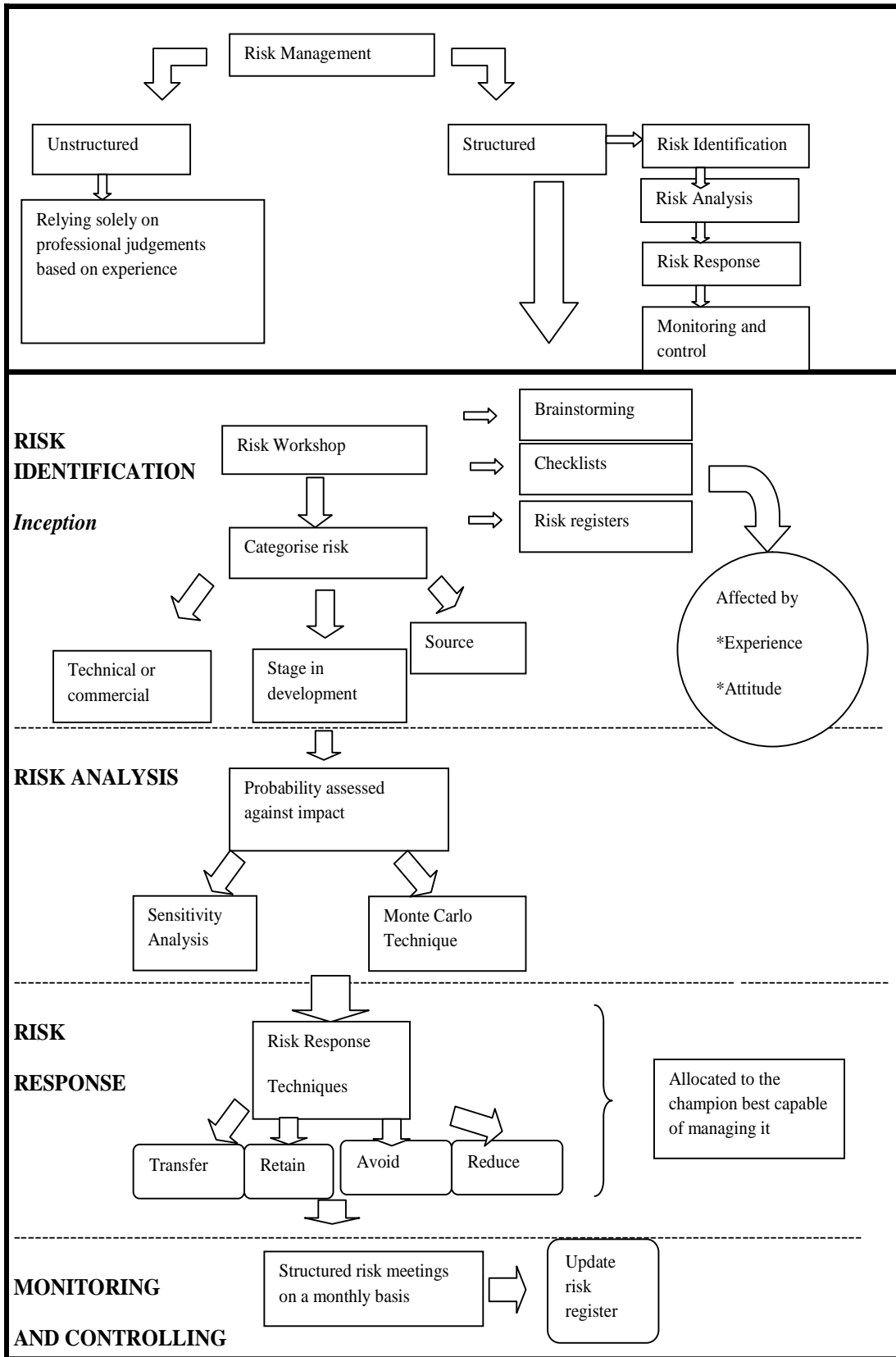


Exploratory case studies reiterate this with all projects investigated conducting risk meetings at predetermined intervals and updating the risk register accordingly. Caution however must be exercised as rigorous application of risk management procedures can often diminish professional fees.

#### ***4.3. Systematic Risk Management Framework used in Northern Ireland***

Following a detailed analysis of data collected Figure 9 was compiled to illustrate the systematic procedure implemented to manage risk in the Northern Ireland construction industry, based on the data collected for various stages of the risk management framework.

**Figure 9: The Risk Management process in Northern Ireland**





## **5.0: Conclusions**

Having sufficiently reviewed the concept of risk management and the risk management theories and techniques, the research sought to critically assess the extent to which risk management was understood by the risk practitioner. The objective was to analyse the degree to which risk management theories and techniques were understood and utilised in the Northern Ireland construction industry. Consequentially the research intended to determine whether a systematic technique for managing risk is adopted.

### ***5.1. The Consultant's Understanding of Risk Management***

In a broad sense it is evident that consultants have a general understanding of risk management. There is a stark awareness of the various stages of the risk management framework but it is nevertheless limited and undoubtedly there is a need for further systematic standard procedures to be introduced. Data analysis illustrated that risk management procedures are implemented to varying degrees dependent on the size and nature of the project and the sophistication of the client. Consultants appear relatively self assured about their ability to rely on their professional experience and judgement as a form of risk management rather than implementing a structured approach, which is considered time consuming and resource intensive. Irrespective of the approach implemented, whether it is structured or unstructured, the benefits of commencing risk management at inception have been realised.

### ***5.2. Understanding and Usage of Risk Management techniques and theories***

Data analysis illustrates that the Northern Ireland construction industry adopt relatively unsophisticated methods of risk identification. These include the use of risk workshops, involving brainstorming aided by checklists and previous risk registers. This satisfies the overwhelming urge to keep the risk identification process as simple and user friendly as possible in an effort to ease understanding. However even the effectiveness of these methods may be jeopardized by lack of understanding and lack of team participation in the risk management workshop. Risk identification was recognised as an important, yet not stand alone element which contributes to project success. Despite its importance, the categorisation of risk shows much disparity with no standard process for risk categorisation apparent. However literature reflects that this is a phenomenon which is not solely particular to Northern Ireland (Zou et al., 2007). Moreover it may be concluded that there is a severe lack of understanding of more sophisticated techniques such as HAZOPS, FMEA, Delphi Technique and Nominal Group Technique by consultants in the Northern Ireland construction industry. It would appear that consultants are opting for more unsophisticated techniques due to their familiarity with them. However research has shown that this creates a self perpetuating problem for consultants whose knowledge of theories and techniques is rarely broadened due to apprehension and scepticism.

It is evident that in practice a qualitative and quantitative approach is embodied in the process of risk analysis, ordinarily involving a team based rating of risk in an open forum. The adoption of relatively sophisticated risk analysis techniques, such as Sensitivity Analysis and Monte Carlo Technique is apparent involving the use of complex software. From the evidence presented it can be concluded that familiarity with risk analysis principles is apparent. Nevertheless understanding of the complete workings of such software is somewhat lacking.

It can be deduced that there is a degree of continuity in the risk response methods of retention, reduction, transference and avoidance applied in the industry. There is a principle understanding of the importance of allocating risk to the party best capable of managing it. The use of a combination of response methods is often advocated when appointing a risk champion.

Risk monitoring and control is paramount to the successful execution of risk management with the contract conditions or client brief determining the procedures to be implemented. Concern has been expressed over its tendency to generate negative attitudes in the team due to its time consuming nature. This coupled with the individual's attitude that risk monitoring and controlling is above and beyond their professional remit, introduces unwanted negativity which solely seeks to impede the process. A balance however must be achieved as the danger of rigorous application of monitoring and controlling procedures has also been recognised as a factor which can diminish professional fees.

### ***5.3. Systematic approach to Risk Management***

The risk management practices adopted by consultants by no means reflect the theoretical standards and techniques which are available, but there is a degree of continuity in the approaches adopted from one organisation to the next.

In relation to the extent of usage of risk management theories and techniques while theoretically a dynamic systematic risk management framework is recommended to manage risk, the practice of Northern Ireland cost consultants differs significantly. It is clear that there is a predisposition amongst consultants to embrace a more informal approach to risk management where possible, concurring with Ellis and Wood (2003) that it is a service that has been absorbed into conventional project delivery. Where formal risk management procedures are required, particularly for public sector clients, a more

strategic risk management framework as advocated by Hayes *et al.* (1986 cited Edwards and Bowen, 1998) has been implemented. However while there is consistency in the techniques adopted among consultants when juxtaposed with the techniques and theories available, it is apparent that Northern Ireland consultants opt for the more simplistic techniques with the exception of Monte Carlo technique and Sensitivity Analysis.

When researching the consultants' understanding of the theories and techniques used to manage risk, it was refreshing to discover that all consultants do recognise the need for the development of standard systematic procedures amongst quantity surveyors in Northern Ireland. This concurs with theories which suggest that there is widespread dissatisfaction that risk management procedures are neither properly developed nor correctly implemented. Inevitably the maximum benefits of risk management can only be realised when there is a more through comprehension of the many theories and techniques available to the manage risk.

While this study did not involve a detailed comparative analysis of risk management practices elsewhere in the world, it is evident from the work of other authors that the practice of risk management is executed throughout the construction industry worldwide, but perhaps to varying degrees. Kangari (2006) in his research into risk management practices in multicultural developments expressed the need for risk management research and training for areas of multicultural development, reinforcing that Northern Ireland is not necessarily the only area where knowledge of Risk Management is somewhat lacking. Moreover Adnan (2006) while studying the Risk Management practices in Malaysia suggests that techniques to manage risk require much development. Similarly Arabiat *et al.* (2007) in their study of Risk Management in Britain suggested that consultants question the suitability of formal techniques for managing risk and thus they are seldom executed in practice.

#### **5.4. Limitations**

Research is limited by the participation of consultants from practices of various sizes. Two of the five consultants interviewed were employed by large international consultancy firms. It was clear that such firms were increasingly advanced in their application of risk management techniques. Such consultancy practices, which realise the importance of risk management from projects executed elsewhere in the UK and indeed around the world, bring the benefit of their experience to their risk management strategies. They recognise risk management as a service which is developing and will continue to grow increasingly popular due to the inherent nature of the construction industry.

Research is also limited by the individual selected for interview and the case study material they selected from the consultancy in which they worked. Subsequently this will have a direct impact on the investigation into the knowledge of industry professionals in the field of risk management and their extent of usage of the named risk management techniques.

#### **5.5. Recommendations**

Research has established that there is a severe need to bridge the void between the theories and techniques used to manage risk and those implemented in practice. There is a necessity to train consultants in practice and educate clients in the benefits of enforcing risk management practices as an integral part of project delivery.

### **REFERENCES**

Adnan, H. (2006). Risk management in joint venture projects: an approach for contractors in Malaysia. *In: Dulaimi, M.F.ed, The joint international conference on construction culture, innovation and management-sustainable development through culture and innovation, 26-29 November 2006, Dubai.* Dubai: British University, p.44-45.

Arabiati, A, Edum-Fotwe, F.T & McCaffer, R (2007), Does client behaviour actively induce risk in construction projects? *In: Boyd, D (Ed) Procs 23<sup>rd</sup> Annual ARCOM Conference, 3-5 September 2007, Belfast, NI, Association of Researchers in Construction Management, 745-746.*

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

Altrichter, H., Posch, P. & Somekh, B. (1996), *Teachers investigate their work: An introduction to the methods of action research*. London: Routledge.

Ashworth, A. & Hogg, K. (2007) *Willis' practice and procedure for the quantity surveyor (12<sup>th</sup> Edition)*, Oxford: Blackwell Publishing.

Baker, S, Ponniah, D., & Smith, S. (1999) Risk response techniques employed currently for major projects, *Construction Management and Economics*, **17**,205-213.

Byrne, P & Cadman, D (1984), *Risk uncertainty and decision making in property development*, London: E & F Spon.

Chan, Albert P.C, Yung Esther H.K, Lam, Patrick T.I, Tam, C.M. and Cheung, S.O. (2001), Application of Delphi method in selection of procurement systems for construction projects, *Construction Management and Economics*, **19**,699-718.

Chapman, R. (2001), The controlling influences on effective risk identification and assessment for construction design management, *International Journal of Project Management*, **19**, (3), 147-160.

Dallas, M.F. (2006), *Value and risk management: a guide to best practice*, Oxford: Blackwell.

Egan, J., (1998), *Rethinking construction: the report of the construction taskforce*, London: DETR.

Edwards, L. (1995), *Practical risk management in the construction industry*, London: Thomas Telford Publications.

Edwards, P.J & Bowen, P.A., (1998) Risk and risk management in construction: a review and future directions for research, *Engineering Construction and Architectural Management*, **5**, (4), 339-349.

Edwards, P.J & Bowen, P.A. (2005), *Risk management in project organisation*, Oxford: Butterworth and Heinemann.

Fewings, P, (2005), *Construction project management-an integrated approach*, Oxen: Taylor and Francis.

Flanagan, R. & Norman, G. (1993), *Risk management and construction*, Oxford: Blackwell Scientific Publications

- Galway, L. (2004) Quantitative risk analysis for project management-a critical review, USA: RAND Cooperation
- Gould, F & Joyce, N, (2000), *Construction project management*, New Jersey: Prentice- Hall
- Hillison, D, & Murray -Webster, R. (2006), *The risk management universe-a guided tour*, London, British Standards Institution.
- Hogg, K. (2000), The role of the quantity surveying profession in accommodating client risk, *The Journal of Financial Management of Property and Construction*,5, (1-2)
- Isaac, I, (1995), Training in risk management, *International Journal of Project Management*, **13**, (4), 225-229.
- Kangari, R. ,(2006).Risk Management in multicultural development. In : Dulaimi, M.F.ed ,*The joint international conference on construction culture, innovation and management-sustainable development through culture and innovation,26-29 November 2006, Dubai, .* Dubai: British University p27-28.
- Kartam, N & Kartam, S. (2000), Risk and its management in the Kuwaiti construction industry:a contractor's perspective, *International Journal of Project Management*,**9**,325-335.
- Latham, M, (1994), *Constructing the team*, UK: HMSO.
- Mc Kim, R.A, Risk management-back to basics. *Cost Engineering*, **34** (12), 7-16.
- Mills, A, (2001), A systematic approach to risk management for construction, *Structural Survey*, **19**, (5), 245-252.
- Odeyinka, H.A, (2000), An evaluation in the use of insurances in managing construction risks, *Construction Management and Economics*, **18**, 519-524.
- Office of Government Commerce, (2003), *Achieving excellence in construction, procurement guide 4; risk and value management*, UK: Office of Government Commerce.
- Pennock, M.J. & Haimes, Y.Y., (2002) Principles and guidelines for project risk management, *Systems Engineering*, **5**, (2), 89-108.
- Rahman, M & Kumaraswamy, M., (2002), Risk management trends in the construction industry: moving towards joint risk management, *Engineering, Construction and Architectural Management*, **9**, (2),131-151.

Shang, H., Anumba, C.J., Bouchlaghen, D.M., Miles, J.C., Cen, M. and Taylor, M., (2005). An intelligent risk assessment system for distributed construction teams. *Engineering Construction and Architectural Management*, **12** (4), 391-409.

Smith, N. (2003) *Appraisal, risk and uncertainty*, London: Thomas Telford Publishing.

Thevendran, V & Mawdesley, M.J. (2004), Perception of human risk factors in construction projects; an exploratory study. *International Journal of Project Management*, **22** (2), 131-137.

Walker, P. & Greenwood, D. (2002), *Construction companion*, London, RIBA Publications.

Williams, T. (1996), the two dimensionality of project risk, *International Journal of Project Management*, **14**, (3), 185-186

Winch, G. (200), *Managing construction projects*, Oxford: Blackwell Science.

Wood, G and Ellis, R. (2003), Risk management practices of leading UK consultants, *Engineering, Construction and Architectural Management*, **10**, (4), 254-262.

Zou, P, Zhang, G. & Wang, J. (2007), Understanding the key risks in construction projects in China, *International Journal of Project Management*, **25**, (6), 601-614

## **Acknowledgements**

Maria is currently an employee of International Consultancy WYG Ireland. A special note of thanks is dedicated to Mr Keith Hogg (Associate Dean, School of the Built Environment) of Northumbria University for his contributions in internal reviewing of the paper.