ANALYSIS OF CONTRACTORS' PERCEPTION OF RISKS RELATED TO THE JBCC PRINCIPAL BUILDING AGREEMENT IN SOUTH AFRICA

Othman, A.A.E.[1] and Harinarain, N.[2]

[1]Architectural Engineering Department, The British University in Egypt (BUE), Cairo, Egypt
[2]School of Civil Engineering, Surveying and Construction, University of KwaZulu-Natal, Durban, South Africa
E-mail: [1]ayman.othman@bue.edu.eg and [2]Harinarain@ukzn.ac.za

ABSTRACT

The aim of this research is to analyse the contractors' responses and feedback obtained through the application of an innovative framework developed by the authors towards identifying, quantifying and classifying the risks associated with the Joint Building Contractors Committee Principal Building Agreement Series 2000 (JBCC PBA) in South Africa. Within this research both qualitative and quantitative techniques were used for data collection and analysis. Purposive sampling was used to identify the respondents, of which nine construction managers were interviewed. The interviews were structured so that they were carried out in a free and unbiased manner. Confidentiality was assured so that the interviewees were allowed to express their opinion and attitudes toward the research without fear. The Identification, Quantification and Classification framework (IQCF) developed within this research and presented to the industry was considered to be an innovative and accepted tool that was able to fill the gap in managing project risks and compliment current practices in terms of risk identification, quantification and classification. It was seen to be of benefit to firms in assisting with training of employees and helping junior employees understand and use the JBCC (PBA). Investigating the validity and reliability of the developed framework is of prime importance to ensure its suitability to manage risks associated with the JBCC (PBA). This paper analyses contractor's responses and feedback based on the practical application of the framework which ultimately increases its value and contribution to the construction industry. The application of the developed framework will enable contractors to identify, quantify and classify risks associated with the JBCC (PBA) which ultimately enhance the risk management process in South Africa.

Keywords: Contractors, JBCC (PBA), identification, quantification and classification framework, risk management, South Africa

1. INTRODUCTION

The construction industry is subject to more risk and uncertainty than many other industries. This is because the process of taking a project from initial investment appraisal to completion and into use is complex and entails time-consuming design and production processes. It requires a multitude of people with different skills and interests and the co-ordination of a wide range of disparate, yet interrelated, activities. Such complexity is also compounded by many external and uncontrollable factors (Edwards and Bowen, 2005; Flanagan and Norman, 1993).

As one of the biggest industries worldwide, there are hundreds of contracts signed every day (Sawczuk, 1996) and as soon as two parties, the employer and the contractor, have signed a contract they have taken on board risks. Their awareness of the risk, and the steps they have taken to minimise their share of the risk, will determine the likelihood of a problem occurring. Clough (1975) stated that contract articles have to be read carefully by engaged parties before signing the contract to avoid any disputes and conflicts during the execution of the contract.

Risks need to be identified, analysed and apportioned much more openly and professionally. The

ISSN 1675-5022

nature of risk and its perception by the role players in the construction industry determines how it is treated or managed (Edwards and Bowen, 2005). Contractors have to be aware of their obligations and the risks associated with their contracts (Smith, 1998). A framework was developed by the authors to identify, quantify and classify risks associated with the Joint Building Contractors Committee Principal Building Agreement Series 2000 (JBCC PBA) (Othman and Harinarain, 2009). In order to evaluate the developed framework and ensure its validity and reliability, this paper analyses the responses and feedback gained from contractors through the application of developed framework.

2. EVALUATION OF THE IDENTIFICATION, QUANTIFICATION AND CLASSIFICATION FRAMEWORK

In order to ensure that the developed framework is valid and reliable, it has to be evaluated. Evaluation is used to appraise the whole value of the framework. Verification and validation are formal methods for testing a computer programme or framework. Verification is the process of ensuring that the framework does not contain any technical errors, i.e. that the framework has been formulated correctly. Validation is the process, which determines whether or not the framework meets the required specification and is suitable for its intended purpose, thereby ensuring that the framework has been formulated in the intended manner (Miles et al., 2000). In other words, verification determines if the framework was built right and validation determines if the right framework was built. There are three basic questions for framework verification and validation have to be asked: (1) what to evaluate?, (2) how to evaluate?, and (3) when to evaluate? (Ng and Smith, 1998).

- ***What to Evaluate?***

The aim of evaluating the identification, quantification and classification framework was to determine how well the developed system achieved its objectives. This was achieved by assessing how well the developed framework enabled contractors to:

- Identify risks associated with the JBCC (PBA) edition 5.0.
- Quantify risks associated with the JBCC (PBA) edition 5.0.
- Classify risks associated with the JBCC (PBA) edition 5.0.
- Encourage contractors to write down their comments, feedback and suggestions to improve the developed framework.

- ***How to Evaluate?***

Generally, there are two methods that are used for evaluating frameworks. In the first method, users are provided with a working version of the framework under evaluation and allowed to make use of it over a prolonged time period. This method gives evaluators an opportunity to get used to the framework and form an opinion on whether the stated benefits are actually achieved. On the other hand, this is not an easy task as there are many difficulties which are magnified when the trial framework must be integrated with existing systems. Another approach is where a relatively large number of evaluators are available for a short period of time. An evaluation session is held in a single location with all the evaluators participating simultaneously. The session consists of a hands-on usage portion, where the evaluators are guided through a usage scenario with the use of appropriate notes. This is followed by the distribution and completion of questionnaire by each evaluator (Miles et al., 2000; Ren, 2002). During the course of evaluating the IQCF, the second method was adopted. In this approach, the major characteristics of the IQCF, its development process, and the use of the framework were explained to the evaluation groups. A number of interviews were carried out with a representative and non-biased sample of contractors who were asked to respond to an evaluation questionnaire where their feedback and suggestions were obtained.

- ***When to Evaluate?***

The development of the IQCF was done in an iterative process. Regular revision and evaluation of the developed framework was carried out by the authors with the collaboration of contractors to assess how well the developed framework covered the requirements to identify, quantify and classify the risks associated with the JBCC (PBA). When a satisfactory version was produced, it was applied with a series of interviews carried out with a selected sample of contractors. During each interview, the participants were asked to fill a tabulated format designed by the authors to evaluate the suggested framework. Evaluators' comments and suggestions were considered and applied to enhance the performance of the designed framework.

3. RESEARCH SAMPLING

The aim of sampling was to select a representative and non-biased sample to allow for valid and reliable findings. The list of contractors registered as members of the Master Builders Association, KwaZulu-Natal chapter was obtained. This resulted in a sample size of 62. The authors, then, telephonically contacted all the listed contractors to enquire if they utilise the JBCC (PBA) so that the scope of the study could be sent to them and get contact details of the appropriate person to help ensure increasing the response rate. Out of the 62 contractors contacted, 23respondents mentioned that they do in fact use the JBCC (PBA). The researchers tried to contact all 23 companies but 4 of them responded that they were too busy to assist. Out of the 19 companies contacted, 9 respondents agreed to be interviewed providing a response rate of 47%.

4. RESEARCH RELIABILITY AND VALIDITY

Because of their importance, the reliability and validity of the framework was escalated through: increasing the reliability and validity of the research methods and escalating the reliability and validity of the findings of the research.

In order to increase the reliability and validity of the interview:

- Content validity was ensured by guaranteeing that the interview represents the underlying concept of the study topic.
- Contacting the construction industry specialists to assess and evaluate the developed framework.
- Selecting a representative and non-biased sample.
- Designing the questions to be easy to read, understand and answer.
- Coding all closed questions and checking all open questions for themes and patterns before summarising the responses.
- Ensuring the confidentiality of interviewees' responses and using it for academic research only.

5. BRIEF DESCRIPTION OF THE IDENTIFICATION, QUANTIFICATION AND CLASSIFICATION FRAMEWORK

Because of the uncertainty of the future, most business decisions are based on expectations and forecasts. Inevitably, making decisions on these bases involves risks. If not managed, these risks will affect the project success and lead to disputes and adversarial relationships. Therefore, contractors have to be aware of their obligations and the risks associated with their contracts (Smith, 1998). The aim of this framework is to enable contractors to identify, quantify and classify the risks associated with the Joint Building Contractors Committee Principal Building Agreement Series 2000 (JBCC PBA).

- ***Identification of the JBCC (PBA)***

In order to establish the criteria used to state the risks associated with JBCC (PBA) clauses, it is essential to initiate a link between risks and the factors that lead to organisation success or failure. The SWOT Analysis which is a strategic planning tool used to evaluate the strengths, weaknesses, opportunities, and threats involved in a project or in a business venture, was used as risk identification criteria. Businesses of all sizes and types run SWOT analysis to examine the internal working environment of a company and the external market in which that company operates. Strengths and weaknesses are internal factors, while opportunities and threats are external factors (Shutt, 2007). Within this research, the criteria established to identify the risks associated with the JBCC (PBA) from the contractor's perspective are:

- Reducing Organisations Strengths.
- Increasing Organisations Weakness.
- Reducing Organisations Opportunities.
- Increasing Organisation Threats (Othman and Harinarain, 2009).

- ***Quantification of the JBCC (PBA) Risks***

After the identification criteria are established, the next step of the framework development was to quantify the risk associated with the JBCC (PBA) clauses from the contractor's perspective to identify

the most influential ones. Risks will be quantified based on the probability of occurrence (P) and its severity (S), where the result is (R= P * S). This quantification was carried out through an interview with a selected number of managers of construction companies. The Likert scale of 1 to 5 was used to quantify the probability and severity of these risks. The numerical scores from the interview provided an indication of the varying degree of influence that each risk had on the contractor. To further investigate the data, a relative importance index (RII) was used to rank the risks according to their influences (Olomolaiye et. al 1987). The calculation was carried out using the following formula:

Relative Importance Index (RII) = $\sum w / AN$

Where:

w = weighting given to each clause by the respondents and range from 1 to 5, where 1 = very low probability or severity and 5 = very high influence.

A = highest weight (5 in this case) and

N = total number of the sample (Kometa and Olomolaiye, 1997)

The RII ranges from zero to one. The full list of RIIs and ranking of clauses is provided in table (2) which shows that some clauses have very high influences of risk to the contractor while others do not. Due to the fact that some clauses have similar RIIs, for example clauses 25 and 27, a sequential ranking had to be presented as numbers in brackets in the "rank" column.

- ***Classification of the JBCC (PBA) Risks***

The last step of the framework was the classification of the identified and quantified risks. Classifying risks enables the contractor to consider them within a more coherent framework. It provides the construction professionals generally and the contractor in particular with a more uniform risk language, specifically in fields where risk needs to be communicated to a wide variety of project stakeholders. It allows one to establish a common understanding of different risks, and provides an essential basis for effective knowledge transfer, within an organisation and from one project to another (Edwards and Bowen, 2005).

In order to be in line with the internal and external perspective adopted in developing the risk identification criteria, this research classifies risks that affect the contractor as: internal risks and external risks.

- **Internal risks** are the ones which emerge from within the contractor's organisation or those risks that are within the control of the team members, and
- **External risks** are the ones which emerge from outside the contractor's organisation, or those risks that are out of the control of the contractor.

The developed framework was sent out to the contractors to get their feedback, suggestions for improvement and ensure its compatibility with the industry requirements. Their feedback was then considered and the criteria revised. The updated criteria was then used in an interview process to apply the framework, see table (1).

Table 1: The Identification, Quantification and Classification Framework

JBCC (PBA) Clause	Risk Identification Criteria				Risk Quantification			Risk Classification	
	Reducing Contractor's Strength	Increasing Contractor's Weakness	Reducing Contractor's Opportunities	Increasing Contractor's Threats	Probability (P)	Severity (S)	Result (P*S)	Internal Risk	External Risk
Clause 1									
Clause n									

(Harinarain and Othman, 2007a)

6. ANALYSIS OF CONTRACTOR'S RESPONSES EVALUATION APPLICATION OF THE FRAMEWORK

Interviews were carried out with 9 construction companies, providing a response rate of 47%. According to Babbies (1992) as a rule of thumb 50% is adequate while, Mcneil and Chapman (2005); Saunders *et. al*. (2003); Gillham (2000); Tashakkori *et al.* (1998) and Fellows and Liu (1997) state that 30-40 per cent is acceptable because of the fact that few people respond to survey. Both quantitative and qualitative data analysis approaches were applied to interpret the data collected from the interviews. Quantitative analysis was used to assess closed-ended questions using Microsoft Excel spreadsheets by utilising tables and graphs. Qualitative analysis was employed to analyse open-ended questions in order to gain an understanding from the respondents' point of view. Although the firms identify risks in the JBCC when tendering, they do not do this often enough because it was too time consuming and there is a lack of training.

- ***Analysis of Contractors' Risk Identification***

The respondents were asked to identify risks according to 4 categories, the risk could reduce the company's strengths, increase the companies weaknesses, reduce its opportunities or increasing its threats.

- All the respondents stated that C**40** (Dispute Settlement) and C**17** (Contract instructions) fall under all the risk identification criteria. Disputes are considered a risk to the contractor because they can reduce a company's strength due to the fact that they can be a long drawn out process which involves key personnel. In addition, disputed could increase the company's weakness because of the time, cost and resources involved. Furthermore, disputes reduce a company's opportunities because of the bad name that the company obtains and the capital that is tied up. Finally, disputes increase the company's threats by reducing the number of potential new jobs as clients would not want to hire a contractor that they believe will rush into a dispute.
- Although contractors are compensated for work carried out in terms of contract instruction, contractors still consider contract instructions to be risky because they can reduce a company's strength due to the time, cost, quality and resources that are tied up. In addition, they increase the weakness by obtaining a poor reputation should the company fail to carry out the instruction as required. Furthermore, contract instructions reduce a company's opportunities by making it unable to free resources for other jobs. Finally, they increase threats because a poor reputation will lead to lack of new opportunities.
- C**29** (Revision to date for practical completion) and C**30** (Penalty) were seen by the respondents as totally affecting a company's strength because an extension of time means that the resources (both manpower and plant) are not available for other jobs and new projects, even though they are paid for due extension. By paying hefty penalties that clients are now insisting on, the company can go into a negative cash flow situation.
- C**20** (Nominated subcontractors) and C**21** (Selected subcontractors) were seen by the respondents as totally increasing a company's weakness because of their negative impact on the main contractor's performance due to their non-compliance to job requirements and delay to complete their jobs as specified. Even though the main contractor will get an extension of time if the nominated sub-contractor defaults, it will still mean he has to wait to complete the job and the main contractor is still ultimately liable for the quality of the work. Selected subcontractor poses an even bigger risk due to the fact that the main contractor is part of the selection process there is very little recourse available to him should the sub-contractor default.
- C**4** (Design Responsibility) was seen by the respondents as totally reducing a company's opportunities because contractors felt that they could have a valuable input into the design process in terms of constructability. Although the contractors liked the fact that they were not responsible for the architects/engineers design, they could have a good opportunity to improve their performance and produce a better product if their feedback is reflected in the design decision making process.
- C**7** (Regulations), C**15** (Works execution) and C**31** (Interim payment) were seen by the respondents as totally increasing a company's threats. The contractor could face serious problems should the regulations and laws of the local or other authorities suddenly changed.

The execution and completion of work is at risk if the employer does not hand over site on time. The contractor's cash flow is at great risk when the interim payments are delayed. It can be seen that these threats are external to the contractor.

- The effects of the remaining clauses on contractor's strengths, weakness, opportunities and threats are depicted in table (2).

All respondents considered the method developed to identify risks as acceptable with rate of 67% (very good), while 33% gave it a rating of good. None of the respondents made any suggestions as to how this part of the framework could be improved.

Table 2: Risk Identification Criteria

Risk Identification Criteria					
CLAUSES		**Reducing Strength**	**Increasing Weakness**	**Reducing Opportunities**	**Increasing Threats**
40.0	DISPUTE SETTLEMENT	100%			
17.0	CONTRACT INSTRUCTIONS	100%			
29.0	REVISION OF DATE FOR PRACTICAL COMPLETION	100%			
30.0	PENALTY	100%			
20.0	NOMINATED SUBCONTRACTORS		100%		
21.0	SELECTED SUBCONTRACTORS		100%		
4.0	DESIGN RESPONSIBILITY			100%	
7.0	REGULATIONS				100%
15.0	WORKS EXECUTION				100%
31.0	INTERIM PAYMENT				100%
16.0	ACCESS TO THE WORKS	50%	50%		
18.0	SETTING OUT OF THE WORKS	50%	50%		
33.0	RECOVERY OF EXPENSE AND LOSS	50%	50%		
34.0	FINAL ACCOUNT AND FINAL PAYMENT	50%	50%		
10.0	GENERAL INSURANCES	50%			50%
11.0	SPECIAL INSURANCES	50%			50%
12.0	EFFECTING INSURANCES	50%			50%
22.0	DIRECT CONTRACTORS	50%			50%
32.0	ADJUSTMENT TO THE CONTRACT VALUE	50%			50%
6.0	SITE REPRESENTATIVE		50%	50%	
23.0	DOMESTIC SUBCONTRACTORS		50%	50%	
28.0	SECTIONAL COMPLETION		50%	50%	
35.0	PAYMENT TO OTHER PARTIES		50%	50%	
5.0	EMPLOYER'S AGENTS		50%		50%
36.0	TERMINATION -EMPLOYER - CONTRACTOR'S DEFAULT		50%		50%
9.0	INDEMNITIES			50%	50%
13.0	ASSIGNMENT			50%	50%
19.0	TEMPORARY WORKS & PLANT			50%	50%
24.0	PRACTICAL COMPLETION			50%	50%
25.0	WORKS COMPLETION			50%	50%
26.0	FINAL COMPLETION			50%	50%
37.0	CANCELLATION BY EMPLOYER-LOSS & DAMAGE			50%	50%
39.0	CANCELLATION-CESSATION OF WORKS			50%	50%
27.0	LATENT DEFECTS	25%	50%	25%	
3.0	DOCUMENTS	25%	50%		25%
38.0	CANCELLATION - EMPLOYER'S DEFAULT	25%		50%	25%
8.0	WORKS RISK	25%		25%	50%
14.0	SECURITY		25%	50%	25%
1.0	DEFINITIONS	N/A			
2.0	OFFER, ACCEPTANCE AND PERFORMANCE	N/A			

- ***Analysis of Contractors' Risk Quantification***

In order to accurately quantify risks, it is broken down into 2 categories, the probability of the risks occurring and the severity of the risk. By multiplying the probability and severity the quantification was obtained. The maximum quantification that could be achieved is 25.

A two stage approach was utilised for quantitative data analysis in this research. The first stage involved the measure of the central tendency to get an overview of the typical value for each variable by calculating the mean, median and mode. The second stage involved the use of the relative importance index as all the clauses in the JBCC (PBA) do not have the same influence on the contractor.

- C**17** (Contract instructions) had the highest result of 20 out of 25. The respondents mentioned that this clause had the highest probability of occurrence (with a mean of 4.5, median of 4.5 and mode of 4) and the greatest severity (with a mean of 4.5, median of 4.5 and mode of 4) once it occurs. Contract instructions affect the projects duration, cost and sometimes even quality.
- C**5** (Employers agent) and C**29** (Revision to date of practical completion) had a result of 17. The probability of occurrence for C**5** was 4 (with a mean of 4, median of 4 and mode of 4) and a severity of 4.3 (with a mean of 4.3, median of 4 and mode of 4) once it occurs. The probability of occurrence for C**29** was 4.3 (with a mean of 4.3, median of 4.5 and mode of 5) and a severity of 4 (with a mean of 4, median of 4 and mode of 3) once it occurs. Poor choice of agents can seriously hinder the project completion and quality, while extensions of time require resources that the contractors felt could be utilised elsewhere even though they are paid for this.
- C**25** (Works completion) had the third highest score of 15. The probability of occurrence for C**25** was 3.5 (with a mean of 3.5, median of 3.5 and mode of 3) and a severity of 4.3 (with a mean of 4.3, median of 4.5 and mode of 5) once it occurs. The respondents felt that sometimes clients were unreasonable in terms of the site handover date and insisted that damages whether caused by the contractor or not were remedied.
- The remainder of the responses to this section is represented in table (3), and they are rounded off to the nearest whole number. It is noteworthy to mention that the close results of the mean, median and mode shows homogeneity of the collected data.

The risk quantification system employed in the framework was rated as been very good by 45%, good by 44% and average by 11%. The group of the respondents that rated the quantification method as average, did not however provide suggestions on improvement.

- ***Relative importance of the JBCC (PBA) clauses***

To allow for further analysis of the data, a relative importance index (RII) was utilised to rank the clauses according to their influences. Investigation of the results showed that the clauses could be classified into three categories as shown in Table (4) and figure (1).

- The first category contains clauses with a very high influence with an RII above (0.70). This includes C**17** (Contract instructions), C**29** (Revision of date for practical completion), C**5** (Employers agents), C**27** (Latent defects), C**25** (Works completion) and C**3** (Documents).
- The second category contains clauses with an average to high influence, with RII's lying between (0.45) and (0.70). This includes C**30** (Penalty), C**26** (Final completion), C**24** (Practical completion), C**23** (Domestic subcontractors), C**14** (Security), C**34** (Final account and final payment), C**22** (Direct contractors), C**40** (Dispute settlement), C**35** (Payment to other parties), C**28** (Sectional completion), C**21** (Selected subcontractors), C**38** (Cancellation by contractor - employer's default), C**31** (Interim payment), C**37** (Cancellation by employer-Loss and damage), C**33** (Recovery of expense and loss), C**20** (Nominated subcontractors), C**18** (Setting out of the works), C**15** (Works execution), C**11** (Liability insurances), C**10** (Works insurances) and C**8** (Works risk).
- The final category contains clauses with very low to low influences with RII's less than (0.45). This includes C**36** (Cancellation - contractor's default), C**12** (Effecting insurances), C**16** (Access to the works), C**7 (**Regulations), C**32** (Adjustment to the contract value), C**39** (Cancellation-cessation of works0, C**19** (Temporary works & plant), C**13** (Assignment), C**9** (Indemnities), C**6** (Site representative), C**4** (Design responsibility), C**1** (Definitions), C**2** (Offer, acceptance and performance).

Table 3: Risk Quantification Criteria

Risk Quantification		Probability (P)			Severity (S)			Result
CLAUSES		Mean	Median	Mode	Mean	Median	Mode	=(P*S)
17.0	CONTRACT INSTRUCTIONS	4.5	4.5	4	4.5	4.5	4	**20**
5.0	EMPLOYER'S AGENTS	4.0	4	4	4.3	4	4	**17**
29.0	REVISION - DATE FOR PRACTICAL COMPLETION	4.3	4.5	5	4.0	4	3	**17**
25.0	WORKS COMPLETION	3.5	3.5	3	4.3	4.5	5	**15**
3.0	DOCUMENTS	3.5	3	3	4.0	4	4	**14**
27.0	LATENT DEFECTS	3.5	4	4	4.0	4	4	**14**
24.0	PRACTICAL COMPLETION	3.3	3.5	4	4.0	4	4	**13**
26.0	FINAL COMPLETION	3.3	3.5	4	3.8	4	4	**12**
30.0	PENALTY	3.3	3.5	4	3.8	4	4	**12**
14.0	SECURITY	3.3	3	2	3.3	3	2	**11**
23.0	DOMESTIC SUBCONTRACTORS	3.3	3	2	3.3	3	2	**11**
32.0	ADJUSTMENT TO THE CONTRACT VALUE	3.5	3.5	3	3.0	3	3	**11**
34.0	FINAL ACCOUNT AND FINAL PAYMENT	3.0	3.5	4	3.8	4	4	**11**
21.0	SELECTED SUBCONTRACTORS	2.8	2.5	2	3.3	3.5	4	**9**
22.0	DIRECT CONTRACTORS	3.0	2.5	2	3.0	2.5	2	**9**
40.0	DISPUTE SETTLEMENT	2.8	3	3	3.3	3	3	**9**
28.0	SECTIONAL COMPLETION	2.8	2.5	2	2.8	2.5	2	**8**
31.0	INTERIM PAYMENT	2.5	2.5	3	3.3	3	3	**8**
35.0	PAYMENT TO OTHER PARTIES	2.8	2.5	2	2.8	2.5	2	**8**
38.0	CANCELLATION - EMPLOYER'S DEFAULT	2.5	2	2	3.3	3	2	**8**
10.0	GENERAL INSURANCES	2.3	2.5	3	3.3	3	3	**7**
11.0	SPECIAL INSURANCES	2.3	2.5	3	3.3	3	3	**7**
15.0	WORKS EXECUTION	2.3	2	2	3.0	3	3	**7**
37.0	CANCELLATION - LOSS AND DAMAGE	2.3	2	2	3.0	2.5	2	**7**
8.0	WORKS RISK	2.3	2.5	3	2.8	3	3	**6**
9.0	INDEMNITIES	2.0	2	2	3.0	2.5	2	**6**
12.0	EFFECTING INSURANCES	2.0	2	2	3.0	2.5	2	**6**
20.0	NOMINATED SUBCONTRACTORS	2.3	2	2	2.8	2.5	2	**6**
36.0	TERMINATION - CONTRACTOR'S DEFAULT	2.0	2	2	2.8	2.5	3	**6**
7.0	REGULATIONS	1.8	2	2	2.8	2	2	**5**
18.0	SETTING OUT OF THE WORKS	2.3	2.5	3	2.3	2.5	3	**5**
33.0	RECOVERY OF EXPENSE AND LOSS	2.3	2.5	3	2.3	2.5	3	**5**
39.0	CANCELLATION- CESSATION OF WORKS	1.8	2	2	2.5	2	2	**4**
16.0	ACCESS TO THE WORKS	1.8	2	2	1.8	2	2	**3**
4.0	DESIGN RESPONSIBILITY	1.3	1	1	1.3	1	1	**2**
6.0	SITE REPRESENTATIVE	1.3	1	1	1.3	1	1	**2**
13.0	ASSIGNMENT	1.3	1	1	1.5	1.5	2	**2**
19.0	TEMPORARY WORKS & PLANT	1.3	1	1	1.5	1.5	2	**2**
1.0	DEFINITIONS	N/A			N/A			**0**
2.0	OFFER, ACCEPTANCE AND PERFORMANCE	N/A			N/A			**0**

- Sixty seven percent of the respondents rated the risk classification system applied in the framework as very good while 33% rated it as good. Suggestions for further improvement were not made by any of the respondents.

Table 4: Relative Importance Index of the risks associated with the JBCC (PBA) clauses

Risk Quantification				
	CLAUSES	**RII**	**Rank**	
17.0	CONTRACT INSTRUCTIONS	0.90	1	[1]
29.0	REVISION OF DATE FOR PRACTICAL COMPLETION	0.85	2	[2]
5.0	EMPLOYER'S AGENTS	0.80	3	[3]
27.0	LATENT DEFECTS	0.70	4	[4]
25.0	WORKS COMPLETION	0.70	4	[5]
3.0	DOCUMENTS	0.70	4	[6]
30.0	PENALTY	0.65	5	[7]
26.0	FINAL COMPLETION	0.65	5	[8]
24.0	PRACTICAL COMPLETION	0.65	5	[9]
23.0	DOMESTIC SUBCONTRACTORS	0.65	5	[10]
14.0	SECURITY	0.65	5	[11]
34.0	FINAL ACCOUNT AND FINAL PAYMENT	0.60	6	[12]
22.0	DIRECT CONTRACTORS	0.60	6	[13]
40.0	DISPUTE SETTLEMENT	0.55	7	[14]
35.0	PAYMENT TO OTHER PARTIES	0.55	7	[15]
28.0	SECTIONAL COMPLETION	0.55	7	[16]
21.0	SELECTED SUBCONTRACTORS	0.55	7	[17]
38.0	CANCELLATION - EMPLOYER'S DEFAULT	0.50	8	[18]
31.0	INTERIM PAYMENT	0.50	8	[19]
37.0	CANCELLATION BY EMPLOYER. LOSS AND DAMAGE	0.45	9	[20]
33.0	RECOVERY OF EXPENSE AND LOSS	0.45	9	[21]
20.0	NOMINATED SUBCONTRACTORS	0.45	9	[22]
18.0	SETTING OUT OF THE WORKS	0.45	9	[23]
15.0	WORKS EXECUTION	0.45	9	[24]
11.0	SPECIAL INSURANCES	0.45	9	[25]
10.0	GENERAL INSURANCES	0.45	9	[26]
8.0	WORKS RISK	0.45	9	[27]
36.0	TERMINATION BY EMPLOYER - CONTRACTOR'S DEFAULT	0.40	10	[28]
12.0	EFFECTING INSURANCES	0.40	10	[29]
16.0	ACCESS TO THE WORKS	0.35	11	[30]
7.0	REGULATIONS	0.35	11	[31]
32.0	ADJUSTMENT TO THE CONTRACT VALUE	0.35	11	[32]
39.0	CANCELLATION-CESSATION OF WORKS	0.35	11	[33]
19.0	TEMPORARY WORKS & PLANT	0.25	12	[34]
13.0	ASSIGNMENT	0.25	13	[35]
9.0	INDEMNITIES	0.25	12	[36]
6.0	SITE REPRESENTATIVE	0.25	12	[37]
4.0	DESIGN RESPONSIBILITY	0.25	12	[38]
1.0	DEFINITIONS	0	13	[39]
2.0	OFFER, ACCEPTANCE AND PERFORMANCE	0	13	[40]

- ***Analysis of Contractors' Risk Classification***

Risk in this framework was classified as either internal or external. Internal risks are the ones which emerge from within the contractor's organisation, whereas the external risks are the ones which emerge from outside the contractor's organization.

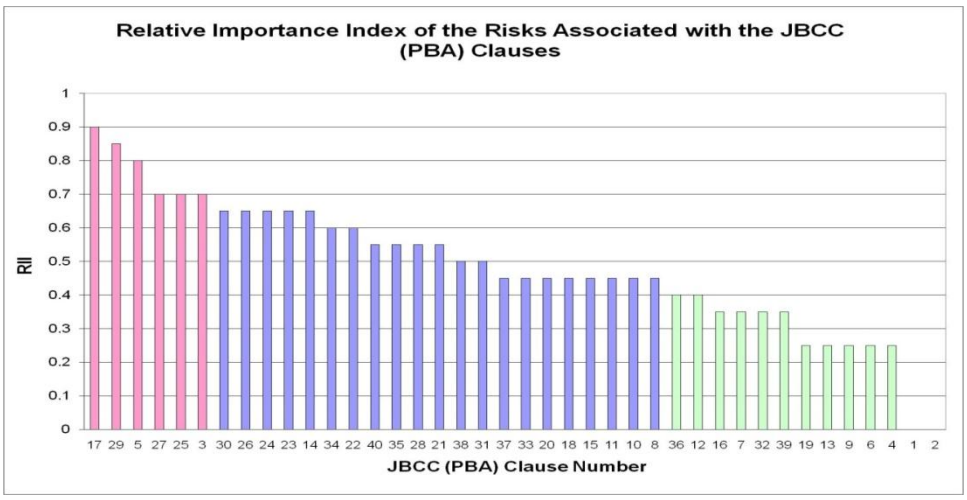

Figure 1: Relative Importance Index of the risks associated with the JBCC (PBA) clauses

- Twenty percent of the risks are internal, that is, they emerge from within the contractor's organisation. Internal risk clauses are C**6** (Site representative), C**14** (Security), C**15** (Works execution), C**18** (Setting out of the works), C**21** (Selected subcontractors), C**23 (**Domestic subcontractors), C**27** (Latent defects) and C**30** (Penalty).
- Twenty three percent of the risks according to the respondents are external, that is, they emerge from outside the contractor's organisation. External risk clauses are, C**5** (Employers agents), C**7** (Regulations), C**20** (Nominated subcontractors), C**22** (Direct contractors), C**29** (Revision of date for practical completion), C**35** (Payment to other parties), C**36** (Cancellation - contractor's default), C**37** (Cancellation by employer-loss and damage), Clause **38** (Cancellation by contractor - employer's default).

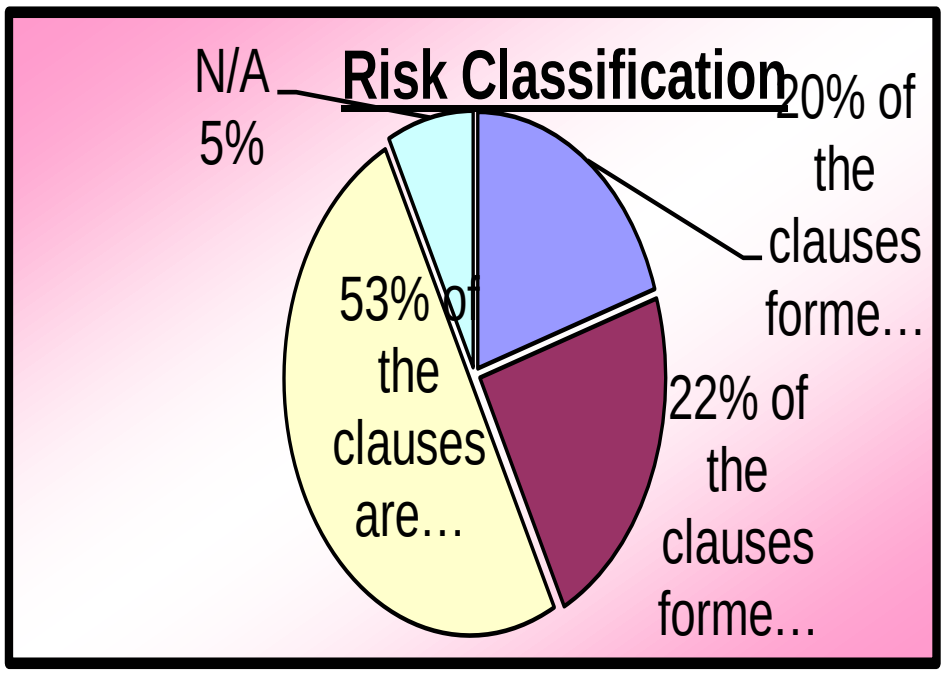

Figure 2: Risk Classification Analysis

- Forty nine percent of the risks are classified as both internal and external risks. They are C**3** (Documents), C**4 (**Design responsibility), C**8** (Works risk), C**9** (Indemnities), C**10** (Works insurances), C**11** (Liability insurances), C**12** (Effecting insurances), C**16** (Access to the works), C**17** (Contract instructions), C**19** (Assignment), C**24** (Practical completion), C**25** (Works completion), C**26** (Final completion), C**28** (Sectional completion), C**31** (Interim

payment), C**32** (Adjustment to the contract value), C**33** (Recovery of expense and loss), Clause **34** (Final account and final payment), C**39 (**Cancellation-cessation of works), C**40** (Dispute settlement).

- Five percent of the clauses, namely C**1** (Definitions) and C**2** (Offer, acceptance and performance), were not analyzed because they contain explanations of various aspects of the contract as depicted in figure (2).

7. CONCLUSIONS AND RECOMMENDATIONS

Being one of the biggest industries worldwide, the construction industry is subject to more risk than any other industry. This highlighted the importance of having proper understanding of the risks associated with construction contracts. Towards addressing this issue, an innovative framework aimed to identify, quantify and classify risks associated with the JBCC (Principal Building Agreement) in South Africa had been developed by the authors. Towards ensuring its validity and reliability, this paper aimed to analyse the contractors' responses and feedback gained through the application of the developed framework.

Most firms admitted that they quantified risk by looking at the impact of the clauses on the contract, the preliminaries and general structure, the profitability, duration, the buildability of the project and value engineering and it is believed that the IQCF can greatly aid in improving risk quantification.

The techniques employed by the respondents to manage risk were contingence measures, meetings, identifying and quantifying risks, probability of occurrence, profiling risks, crisis management and post tender - value engineering. The use of the IQCF and its detailed analysis aided and helped improving current practices in place.

All of the respondents stated that the framework adequately covered all areas of risk when applied. Seventy five percent of the respondents rated the framework as very good, while 25% rate it as good. All of the respondents believed that the framework could be of benefit to their firms by either assisting junior employees, as an aid in training employees to use the JBCC contract or to fill in and compliment their current systems. It was suggested that further studies could include sections on health and safety, quality and cost, which was not included here as it did not fall within the scope of this study.

The framework presented to industry was considered to be an innovative and accepted tool that was able to fill the gap in managing project risks and compliment current practices in terms of risk identification, quantification and classification. It was seen to be of benefit to firms in assisting with training of employees and helping junior employees understands and uses the JBCC (PBA).

REFERENCES

Babbies, E. (1992). The practice of social research. Wadsworth Publishing.

Clough, R. (1975). Construction contracting. New York: John Wiley & Sons.

Edwards, P.J., Bowen, P.A. (2005). Risk management in project organisations. University of New South Wales Press ltd.

Fellows R., Liu, A. (1997). Research methods for construction. Blackwell Publisher Ltd.

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

Gillham, B. (2000). Developing a questionnaire. London: Continuum.

Joint Building Contracts Committee. (2007). Principal building agreement, Series 2000. Joint Building Contracts Committee, South Africa.

Kometa, S. T. and Olomolaiye, P. O. (1997). Evaluation of Factors Influencing Construction Clients' Decision to Build. Journal of Management in Engineering, ASCE, 3(2), 77-86.

McNeil, P. & Chapman, S. (2005). Research methods. 3rd Edition. Routledge: Taylor & Francis Group.

Miles, J. C., Moore, C. J., Kotb, A.S.M. and Hamedani, A. J. (2000). End User Evaluation of Engineering Knowledge Based Systems. Civil Engineering & Environmental Systems, 17 (4): 293-317.

Ng, S. T., and Smith, N. (1998). Verification and Validation of Case-Based Prequalification Systems,

Journal of Computing in Civil Engineering, ASCE, 12(4), 215-225.

Olomolaiye, P. O., Price, A. D. F., and Wahab, K. A. (1987). Problems influencing craftsmen's productivity in Nigeria. Build Environment, 22(4), 317-323.

Othman, A.A.E. and Harinarain, N. (2009). Managing Risks Associated with the JBCC (Principal Building Agreement) from the South African contractor's Perspective. Acta Stuctilia, Journal for the Physical and Development Sciences, Vol. 16, No. 1, pp. 83-119.

Ren, Z. (2002) A Multi–Agent Systems Approach to Construction Claims Negotiation. Ph.D. These. Loughborough University.

Saunders, M., Lewis, P., Thornhill, A. (2003). Research methods for business students. Prentice Hall.

Sawczuk, B. (1996). Risk avoidance for the building team. London: Spon.

Shutt, C.A. (2007) Assess strengths, weaknesses, opportunities and threats to keep your company focused on success. [Online] Available from: http://forpros.lowes.com (Accessed: 23 April 2010).

Smith, N.J. (1998). Managing risk in construction projects. Blackwell Scientific Publications, Great Britain.

Tashakkori, A. and Teddlie, C. (1998) Mixed Methodology, combining qualitative & Quantitative approaches. Sage Publications.