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Managing risks associated with the JBCC(principal building agreement) from theSouth African contractor's perspective

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Peer review

Abstract

Construction is a complex and risky business. It is a time-consuming process involving a multitude of organisations with different objectives and skills. In addition, increasing client expectations coupled with the technological development of materials and equipment made the construction industry subject to more risks than any other industry. Contracts are essential tools for organising the relationship between involved parties and managing associated risk. For years the South African construction industry had a very poor reputation in managing construction risks. In order to improve the image of the South African construction industry and to assist contractors to develop their proper risk management strategy, this article aims to manage the risks associated with the Joint Building Contracts Committees (JBCC) Principal Building Agreement (PBA). A research methodology, consisting of literature review, questionnaires and interviews, is designed to achieve four objectives. First, to review the topics of contacts and risks in construction projects and the JBCC (PBA). Secondly, to develop an innovative framework to enable contractors to identify, quantify and classify risks associated with the JBCC (PBA). Thirdly, to evaluate the developed framework from industry's feedback in order to improve its performance. Finally, to create a correlation matrix of contractor's risk sources.

Keywords: Contracts, risk, JBCC (PBA), construction, framework, correlation matrix, contractor's risk source, South Africa.

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Abstrak

Konstruksie is 'n komplekse en riskante bedryf. Dit is 'n tydrowende proses en sluit in 'n reeks organisasies met verskillende doelwitte en vaardighede. Hoër kliëntvereistes, gekoppeld aan die tegnologiese ontwikkeling van materiale en toerusting, het die konstruksiebedryf meer blootgestel aan risikos as enige ander bedryf. Kontrakte is die middele wat gebruik word om die regte en verpligtinge tussen die betrokke partye te bepaal en om die verwante risikos te bestuur. Die Suid-Afrikaanse konstruksiebedryf het vir 'n hele aantal jare 'n swak reputasie gehad rakende risiko-bestuur. Die doel van hierdie artikel is om die reputasie van die konstruksienywerheid te verbeter en om kontrakteurs by te staan met die ontwikkeling van hul vaardighede om die risikos soos uiteengesit in die Gesamentlike Boukontraktekomitee (GBK) se Hoofbouooreenkoms (HBO) beter te bestuur. Die navorsingsmetodologie bestaande uit 'n literatuurstudie, vraelys en onderhoude het vier doelwitte. Eerstens, om 'n oorsig te gee van die kontrak- en risiko-aspekte van konstruksie-projekte in die GBK HBO. Tweedens, om 'n innoverende raamwerk te ontwikkel om kontrakteurs te help om risikos in die GBK HBO te identifiseer, kwantifiseer en klassifiseer. Derdens, om die ontwikkelde raamwerk te evalueer deur middel van bedryfterugvoering om sodoende prestasie daarvan te bevorder. Laastens, om 'n korrelasie-matriks van die oorsprong van kontrakteursrisikos op te stel.

Sleutelwoorde: GBK PBA, konstruksie, kontrakte, kontrakteursrisikos-oorsprong, korrelasie-matriks, raamwerk, risikos, Suid-Afrika

1. Research background and rationale

Numerous contracts are signed daily in construction, which is one of the largest global industries and an integral part of economic growth and social development (Mthalane, Othman & Pearl, 2007; Anaman & Amponsah, 2007 cited in Khan, 2008). These contracts range from new construction, refurbishment to maintenance. Some projects are simple and worth a few thousands of Rands whereas others are complex and may cost hundreds of millions of Rands. Some projects may involve just two organisations, whereas others may involve a multitude of suppliers, subcontractors and consultants. Irrespective of how simple or complex the project is, all projects have something in common: they are exposed to risk and can go wrong (Edwards & Bowen, 2005).

In his report entitled "*Construction the Team*" Sir Michael Latham considered that no construction project is risk free. Risk can be managed, minimized, shared, transferred or accepted. It cannot be ignored (Latham, 1994). According to Smith (1999); Finley, Deborah & Fisher (1994); Flanagan & Norman (1993) and Papageorge (1988), risk is a natural part of any construction project. The reason for this is that construction is a multifaceted process that has a wide variety of complex processes. In addition, construction projects involve hundreds if not thousands of interacting activities that have time, cost and quality constraints. These constraints inevitably cause the risks of delay, inflation, cost overruns, natural or physical damages on site, potential harm and/or loss to people, property, reputation, business and reduction in qualified personnel, bankruptcy as well as client dissatisfaction.

At present, the construction industry is facing a more challenging environment than previously. The increasing expectations of clients, the need to deliver higher quality products and services at tight-time scale and lowest cost; the development of new construction methods, procedures, materials and new types of buildings resulted in project stakeholders facing high risks towards attaining high standards of efficiency. It is therefore important to plan and make the right decisions, which will reduce risk on cost, time and quality of the building projects (Edwards & Bowen, 2005; Carter, Hancock, Morin & Robins, 1997; Flanagan & Norman, 1993).

Construction contracts organise the relationship between parties once the offer is accepted (Finsen, 2005). They are the tools for managing risks (Uff & Odams, 1995) and establishing the rights, duties, obligations, and responsibilities of the various contracting parties in order to allocate risk.

For years the South African construction industry had a poor reputation due to the lack of application of risk management. Currently, a contractor is often given a mass of information and data at the time of bidding, which may or may not be well coordinated and organised. The contractor is expected to assimilate all the information in a relatively short period of time and to provide the client with an intelligent but profitable bid (Smith, 1998; Harinarain & Othman, 2007).

Because of the importance to improve the image of the South African construction industry, coupled with the necessity to enable contractors to understand and develop their risk management strategy as well as the significance to overcome the limitation and the scant attention paid to this topic in construction literature, particularly in the South African context, this paper aims to manage the risks associated with the Joint Building Contracts Committee (JBCC) Principal Building Agreement (PBA).

2. Research methodology

In order to achieve the abovementioned aim, a research methodology, consisting of literature review, questionnaires and interviews, was designed to achieve the following objectives:

- Reviewing the topics of contracts and risks in construction projects and the JBCC (PBA).
- Developing an innovative framework to enable contractors to better understand and develop their risk management strategy.
- Evaluating the developed framework by means of the industry's feedback to improve its performance.
- Creating a correlation matrix of risk sources to the contractor.

A representative and non-biased sample of Durban-based construction companies was selected. This helped increase the validity and reliability of collected data and research findings. The Master Builders Association website (Master Builder Association, 2008) was accessed to obtain a list of Durban-based registered construction companies. The result was a list of 62 companies ranging from small, medium to large enterprises. All these companies were contacted to enquire whether they utilise the JBCC (PBA). Out of the 62 companies contacted, 23 stated that they utilise the JBCC (PBA). These companies were contacted and the scope of the study was introduced to them. Only 9 companies agreed to participate in the study. The survey questionnaires were faxed to these companies and respondents were then interviewed to gain thorough insight and feedback.

3. Contracts in construction

3.1 Definition and obligations

A contract is an exchange relationship created by oral or written agreement between two or more persons, containing at least one promise, and recognised in law as enforceable (Blum, 2007). Such an agreement gives rise to personal rights and corresponding obligations. For a contract to be legally enforceable, an agreement should have legal purpose and form, offer and acceptance, consideration and competent parties (Athearn & Pritchett, 1984). In construction, a building contract is an agreement between two parties, the contractor who agrees to erect a building and the employer who agrees to pay for it. This agreement creates personal rights and obligations, and the right of one party is the obligation of the other. The contractor has the obligation to erect the building and the right to be paid for it, while the employer has the right to have the building erected and the obligation to pay for it. A contract comes into existence on the acceptance of an offer. If either party defaults on his/her obligation, the other party may invoke the assistance of the law to enforce his rights (Finsen, 2005).

3.2 The contract documents

Construction contracts differ substantially from the usual commercial ones. The commodity concerned is not a standard one but a structure that is unique in its nature and involves considerable time, cost, and risk. The usual construction contract consists of a number of different documents such as general conditions, supplementary conditions, drawings, bills of quantities and addendums. All contract articles should be carefully read before rather than after the contract is signed. After execution of the contract, the contractor is bound by all its provisions, whether one has read them or not (Finsen, 2005; Clough, 1975). A building contract is a trade-off between the contractor's price for undertaking the work and his willingness to accept both controllable and uncontrollable risks. Hence, the price for doing the work partly reflects the contractor's perception of the risk involved (Flanagan & Norman, 1993).

3.3 The Joint Building Contracts Committee (Principal Building Agreement)

The Joint Building Contracts Committee (JBCC) represents the variety of interests in the South African construction industry. It has six constituent member organisations: the Association of South African Quantity Surveyors; the South African Institute of Architects; the South African Association of Consulting Engineers; the South African Property Owners' Association; the Specialist Engineering Contractors Committee, and the Building Industries Federation of South Africa (Van Deventer, 1993). The JBCC Series 2000 is a suite of documents comprising the Principal Building Agreement, the Nominated/ Selected Subcontract Agreement and the Preliminaries, which together constitute the terms and conditions of the agreement between the parties. In addition, there are sundry documents that do not add to the rights and obligations of the parties but merely facilitate the administration of the contract. These include the Contract Price Adjustment Provisions, the Construction Guarantee, the Payment Guarantee, the Payment Certificate, the Completion Certificate, *etc*. (Finsen, 2005).

3.3.1 Parties to the JBCC contract

The parties to a building contract are the employer and the contractor. In the JBCC Series 2000 edition no mention is made either of the architect or of the quantity surveyor or of any of the engineers. Instead, a principal agent assumes all these roles. He may be an architect, a quantity surveyor, an engineer or a project manager. He is not expected to fulfil all of these roles as provision is made for the employer to appoint other agents to play their traditional roles. However, only the principal agent can issue instructions, receive notices on behalf of the employer and bind to him. The principal agent is not a party to the contract and does not acquire any contractual rights and obligations. He acts on behalf of the employer in respect of a great number of his obligations which, for lack of training and expertise, the employer cannot perform himself. The duties of the principal agent and the other agents to the employer under a construction contract are: carrying out their duties with reasonable skill and care, independently exercising reasonable professional judgment, and protecting the employer's interests (Finsen, 2005; Murdoch, 1996; Van Deventer, 1993).

4. Risks in construction

4.1 Overview and definition

The future is largely unknown and most business decisions are taken on the basis of expectation, assumption, estimates and forecasts which involve taking risks. Due to its nature, the construction industry is considered to be subject to more risk than any other industry. The reason is that getting the project from the initial investment appraisal stage through to completion and into use involves a complex and time-consuming design and construction process. The construction process involves a large number of people, from different organisations, with different skills and interests, and a great deal of effort is required to co-ordinate the wide range of activities undertaken. In addition, the increasing expectations of clients, technological advancement and development of complex facilities that involve multiple interacting systems increase the probability of occurrence of unexpected events during the process of building procurement (Murdoch, 1996). Such events are called risks (Shen, 1999). Risk can travel in two directions: the outcome may be better or worse than expected. Taking this into account, risk could be defined as the exposure to the possibility of economic or financial loss or gain, physical danger or injury, or delay as a consequence of the uncertainty associated with pursuing a particular course of action (Chapman, 1995; Raftery, 1994).

4.2 Types of risk in construction projects

Risks in construction projects can be classified under many categories:

- According to the events, outcome risk can be classified as (a) upside risk when the outcome of the event is better than the original forecast and (b) downside risk when the outcome of the event is worse than the original forecast.
- According to the possibility of occurrence, there are two kinds of risks: (a) pure risk, which arises from the possibility of accident or technical failure and (b) speculative risk, possibility of loss and gain, which may be financial, or physical.
- According to the possibility of reduction, there are two kinds of risk: (a) diversifiable risk, if it is possible to reduce risk through pooling or risk-sharing agreement, and (b) non-diversifiable risk, if pooling agreement is ineffective in reducing risk for the participants in the pool (Williams, Smith & Young, 1995).
- Flanagan & Norman (1993) classified construction risks as political, economic, technical, external relations, management, design, environmental, legal and operational.
- Perry & Hayes (1985 cited in Shen, 1999) classified risks in construction projects as physical, construction, design, political, financial, legal-contractual, and environmental.
- Santoso, Ogunlana & Minato (2003) classified risk as physical, personal, technical, safety-accident, construction design causes, political and regulation, financial, contractual, and environmental regulations risks.

4.3 Risk management process

Risk management is the process of identifying, analysing and responding to project risks. It includes maximising the results of positive events and minimising the consequences of adverse ones (PMBOK, 2004). It is the process of protecting the organisation, its people, assets, and profits, against the physical and financial consequences of risk. It involves planning, co-ordinating and directing the risk control and the risk financing activities in the organisation (Greene & Serbein, 1983; Valsamakis, Vivian & du Toit, 1999). Edwards & Bowen (2005) stated that risk is important for most project stakeholders as it affects their business and success. Hence, risk cannot be disregarded or dealt with haphazardly. Modern society's expectations of corporate behaviour and public accountability demand that organisations consider the risks they face or create for others. The process of Risk Management can be classified as follows:

4.3.1 Risk identification

Risk identification is considered to be the most important element of risk management. Many of the major decisions with the greatest impact on the project are made during its early feasibility and design development stages. During these stages changes can be made with the least disruption. In addition, the information, upon which such decisions are made, is most likely to be incomplete or inaccurate. Therefore, to ensure that the right decisions are made, all the important risks and their sources must be identified and assessed at the earliest possible point in the project's life cycle (Valsamakis, *et al*., 1999; Laxtons, 1996). Different tools and techniques can be used for risk identification, including experienced experts' judgement; standard questionnaires and checklists; structured interviews; expert computer-based systems; outside specialists; brainstorming sessions; Delphi technique, and the combined approach (Valsamakis, *et al*., 1999; Laxtons, 1996; Papageorge, 1988)

4.3.2 Risk analysis

Risk analysis is used to evaluate risks and ascertain the importance of each risk to the project, based on an assessment of the probability of occurrence (Likelihood) and the possible consequence of its occurrence (Severity). Risk = Likelihood X Severity Loss/Gain (Balfour Beatty, 2000; Raftery, 1994). Risk analysis assesses both the effects of individual risks and the combined consequences of all risks on the project objectives. Risk analysis enables decision-makers to improve the quality of their judgments by providing more realistic information on which to base decisions. This is clearly summarised by Tony Ryan, Chairman of Guinness Peat Aviation Ltd, as quoted in Raftery (1994) "This is not a speculative game at all. Our objective is not to avoid risk but to recognise it, price it and sell it." There are many techniques used for risk analysis such as sensitivity analysis, probability analysis, simulation techniques, risk premium, expected monetary value (EMV), expected net present value (ENPV), EMV using a Delphi peer group, risk-adjusted discount rate (RADR), detailed analysis and simulation, and stochastic dominance (Shen, 1999; Smith, 1999; Raftery, 1994). There is no 'best' single technique, as every project will almost certainly have individual characteristics, which make it unique (Amos & Dent, 1997).

4.3.3 Risk response and mitigation

Risk response and mitigation is the action that is required to reduce, eradicate or avoid the potential impact of risks on a project. The main aim of any response and mitigation strategy is to initiate and implement the appropriate action to prevent risks from occurring or, at minimum, limit the potential damage they may cause. This should ensure that the overall project objectives of time, cost and quality are not jeopardised. The information gained from the identification and analysis of the risks gives an understanding of their likely impact on the project if they are realised. This, in turn, enables an appropriate response to be chosen (Laxtons, 1996). The general guiding principle of risk response is that the parties to the project should seek a collaborative and mutually beneficial distribution of risk (Raftery, 1994). Furthermore, risks need to be allocated to those parties best placed to influence both the likelihood of the risk occurring and its potential impact should it occur. The methods used for risk response and mitigation are risk avoidance, risk transfer, risk reduction and residual retention, risk retention, combination of two or more of these responses to risk (Shen, 1999; Smith, 1999; Laxtons, 1996; Flanagan & Norman, 1993).

4.4 Benefits of implementing risk management

Raftery (1994); Godfrey (1996); Mootanah (1998) and Hiley & Paliokostas (2001) mentioned that many benefits could be gained from applying systematic risk management process as follows:

- Better understanding of project objectives and uncertainty.
- Better responding to unexpected events.

- Effective team building and better use of skills and experience of project personnel.
- Promoting effective communication.
- Improving project management.
- Improving decision-making.
- Establishing the justification of contingencies.
- Reducing project costs.
- Providing value for money.
- Protecting the balance sheet by transferring or avoiding unaffordable risks.
- Eliminating unnecessary risks.
- Concentrating resources on what matters.

5. The Identification, Quantification and Classification Framework (IQCF)

Framework is defined as the basic and logical structure for classifying and organising complex information (FEAF, 1999). It is a structure for describing a set of concepts, methods and technologies required to complete a product process and design (EDMS, 2007). The Identification, Quantification and Classification Framework (IQCF) (hereinafter referred as 'the framework' or the IQCF) is the set of functions, activities, procedures as well as the tools and techniques required to assist construction contractors to better understand the risks associated with the clauses of the JBCC (PBA). It is a decision-making tool designed to enable contractors to identify, quantify and classify the risks of the JBCC (PBA) clauses. The IQCF will help the contractors draw the appropriate risk management plan to mitigate the adverse effects of these risks (Harinarain & Othman, 2007).

5.1 The need, aim and objectives of the IQCF

The construction industry is one of the largest booming industries in South Africa. It contributes 8% of the total employment of the country with 1,024,000 people in 2006 (South Africa. Department of Housing, 2007). This involves hundreds of consultants, contractors and suppliers, as well as the establishment of contracts, especially since the rise in construction work for the 2010 Soccer Wold Cup. The need for the IQCF stems from the importance to improve the image of the South African construction industry, the necessity to assist contractors to better understand the risks pertaining to the JBCC (PBA) as well as the importance to overcome the scant attention paid to this topic in construction literature. To achieve this aim, the following objectives must be achieved:

- Identifying the risks associated with the JBCC (PBA) contract clauses from the contractor's perspective.
- Quantifying the identified risks to draw a complete picture of the most serious risks.
- Classifying the identified and quantified risks to collect them in groups in order to allow contractors to distinguish those risks that originate from within the contractor's organisation and those that are external to the contractor's organisation.

5.2 The conceptual description of the IQCF

The IQCF was developed in a systematic process consisting of three steps: identification, quantification and classification of the risks associated with the JBCC (PBA).

5.2.1 Identification of the JBCC (PBA) risks

Since the framework adopts the contractor's perspective, the first step of risk identification was to identify all potential risks that could possibly affect the contractor. This entailed carrying out in-depth literature review based on textbooks, academic journals, professional magazines, conference proceedings, seminars, dissertations and theses, organisation and government publications as well as internet and related web sites. First, literature review resulted in identifying (270) risks. Secondly, these risks were reviewed and refined on a regular basis to omit repeated risks and merge similar ones. The end result was a list of 136 risks. Thirdly, these risks were then compared with the clauses of the JBCC (PBA) in order to ensure that the most important risks were covered in the JBCC (PBA). Finally, the criteria that will be used to state the risks associated with JBCC (PBA) clauses were developed. In order to establish these criteria, it is essential to initiate a link between the identified risks and the factors that lead to an organisation's success or failure. Corporate analysis shows that every organisation has internal and external environments. Each one of them has its effect on the success or failure of the organisation. Internal environment consists of strength factors and weakness factors, whereas external environment consists of opportunities factors and threat factors. These factors are adopted to design the criteria for identifying the risks associated with the clauses of the JBCC (PBA). Within this research, the following criteria are established in order to identify the risks associated with the JBCC (PBA) from the contractor's perspective: reducing organisations' strengths, increasing organisations' weakness, reducing organisations' opportunities and increasing organisations' threats, see Figure 1.

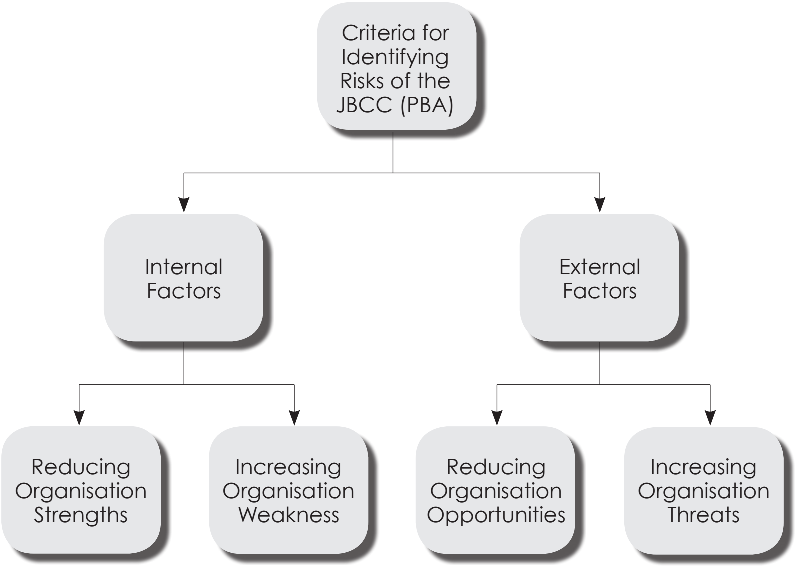

Figure 1: Risk identification criteria.
Source: Harinarain & Othman, 2007: 147

5.2.2 Quantification of the JBCC (PBA) risks

Once the identification criteria were established, the next step of the framework development was to quantify the risk associated with the JBCC (PBA) clauses from the contractor's perspective in order to identify the most influential ones. Risks were quantified based on the probability of occurrence (P) and its severity (S), where the result is (R= P * S). This quantification was carried out by interviewing 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 has on the contractor. To further investigate the data, the relative importance index (RII) was used to rank the risks according to their influences using the following equation: RII = ∑W / AN, where W=weighting given to each driver by the respondents and range from 1 to 5, A= highest weight (5 in our case); and N= total number of sample (Kometa & Olomolaiye, 1997; Olomolaiye, Price, & Wahab, 1987; Shash, 1993).

5.2.3 Classification of the JBCC (PBA) risks

The last step of the framework development was the classification of the risks identified and quantified. Classifying risks enables the contractor to consider them within a more coherent framework. It provides the construction professionals, in general, 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 the contractor 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 & Bowen, 2005). In order to comply with the risk identification criteria developed by the authors, this research classified risks affecting the contractor as internal risks and external risks:

- **Internal risks** emerge from within the contractor's organisation or are within the control of the contractor.
- **External risks** emerge from outside the contractor's organisation, or are out of the control of the contractor.

Table 1 shows the overall format of the IQCF that hosts all the information gleaned in the previous steps.

Table 1: The Identification, Quantification and Classification Framework

JBCC (PBA) Clause	*Risk Identification Criteria*				*Risk Quantification*			*Risk Classification*	
Description of clause	Reducing organisation strengths	Increasing organisation weakness	Reducing organisation opportunities	Increasing organisation threats	Probability (P)	Severity (S)	Result = P*S	Internal risk	External risk

Source: Harinarain & Othman, 2007: 148

5.3 Models and the modelling process

5.3.1 Modelling the IQCF

Modelling is the process of developing an accurate description of a system. As technology grows, accurate system description becomes more vital. Modelling helps to regulate the unplanned day-to-day administrative procedures and it is therefore a powerful framework for solving problems (Marca & McGowan, 1988). The IQCF is designed to be performed in a series of interrelated steps in order to enable contractors to adopt the appropriate risk management strategy when utilising the JBCC (PBA). When the procedures to identify, quantify and classify risk cannot be reduced to the activities of a simple model, they could lead to complications. In general, modelling the IQCF will facilitate effective management and risk identification, quantification and classification, diminish confusion, enhance building contractors' reputation, maintain focus on project completion and achieve better decisions. Modelling requires determining the sequence of events and their relationship to each other so that this information can be presented in a network (Othman, 2005). Based on the properties of the IQCF, the process model was selected to be the appropriate model to represent the activities of the IQCF because it is concerned with representing consecutive steps or activities with the delivery of an end product or service.

5.3.2 Reviewing the modelling tools

A number of modelling tools were reviewed in order to select the most appropriate one to represent the IQCF. The criteria for representing the framework included the ability to analyse each clause of the JBCC (PBA) in terms of risk identification, quantification and classification; ease of use and understanding by contractors, as well as applicability and relevance to the construction industry. Some of these models were not suitable for representing the IQCF either because they are still in their infancy and are not widely used in construction like the Unified Modelling Language (Noran, 2005) and Role Activity Diagrams (Abeysinghe & Phalp, 1997) or because they are difficult to read like the Data Flow Diagrams (Chung, 1989; Ranky, 1994; Anumba, Cutting-Decelle, Baldwin, Dufau, Mommessin & Bouchlaghem, 1998) as well as the Hierarchy plus Input-Process-Output which has limited ability to show detailed information about a system (Chung, 1989).

5.3.3 The Integrated DEFinition (IDEF-0)

This is a requirement specification tool based on the concept of system modelling of Input, Control, Output and Mechanism (see Figure 2). It uses natural and graphic languages to convey meaning about a system. This methodology defines functions and their interfaces, and facilitates hierarchy decomposition of detail in a system (Chung, 1989). The two primary modelling components are functions (represented on the diagram by boxes) and the data and objects that interrelate those functions (represented by arrows) (National Institute of Standards and Technology, 1993).

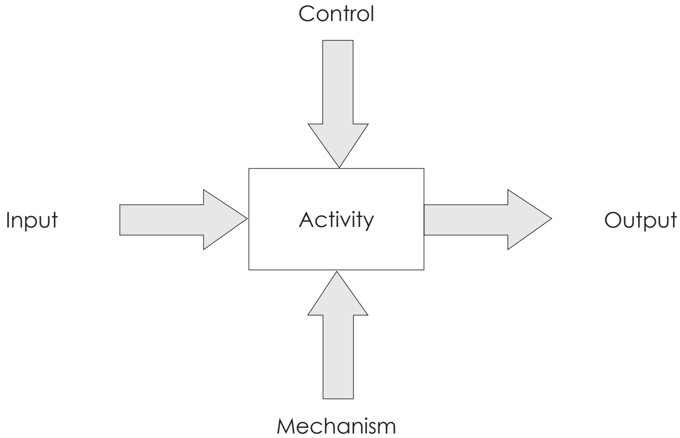

Figure 2: IDEF-0 Diagram
Source: Renssen, 2001: online

IDEF-0 was chosen as the most appropriate method to represent the IQCF because it:

- uses function and activity modelling which is ideal to model the IQCF by describing its functions and activities step-by-step;
- is comprehensive (due to the elaborated information required);
- is generic (for analysis of systems and subject areas of varying purpose);

- is rigorous and precise (for production of correct, usable models);
- is concise (to facilitate identifying, quantifying and classifying risks in the JBCC [PBA]);
- is conceptual (for representation of functional requirements);
- allows for decomposition of a function into a number of smaller sub-functions, and
- is flexible (to support several phases of the life cycle of a project) (National Institute of Standards and Technology, 1993: ii).

5.3.4 The functional representation of the IQCF

Table 2 shows the contents of the IQCF. A top level (IQCF/A-0) presentation of the framework is presented in Figure 3. They are: Identifying risk associated with the JBCC (PBA) (IQCF/A1), Quantifying risk associated with the JBCC (PBA) (IQCF/A2), and Classifying risk associated with the JBCC (PBA) (IQCF/A3), shown in Figure 4.

Table 2: Table of contents for the IQCF

Diagram Reference		*Description*
IQCF/A0		Investigating risks associated with the JBCC (PBA) from the contractor's perspective.
	IQCF/A1	Identifying risks associated with the JBCC (PBA) from the contractor's perspective.
	IQCF/A2	Quantifying risks associated with the JBCC (PBA) from the contractor's perspective.
	IQCF/A3	Classifying risks associated with the JBCC (PBA) from the contractor's perspective.

Source: Harinarain, 2008: 85

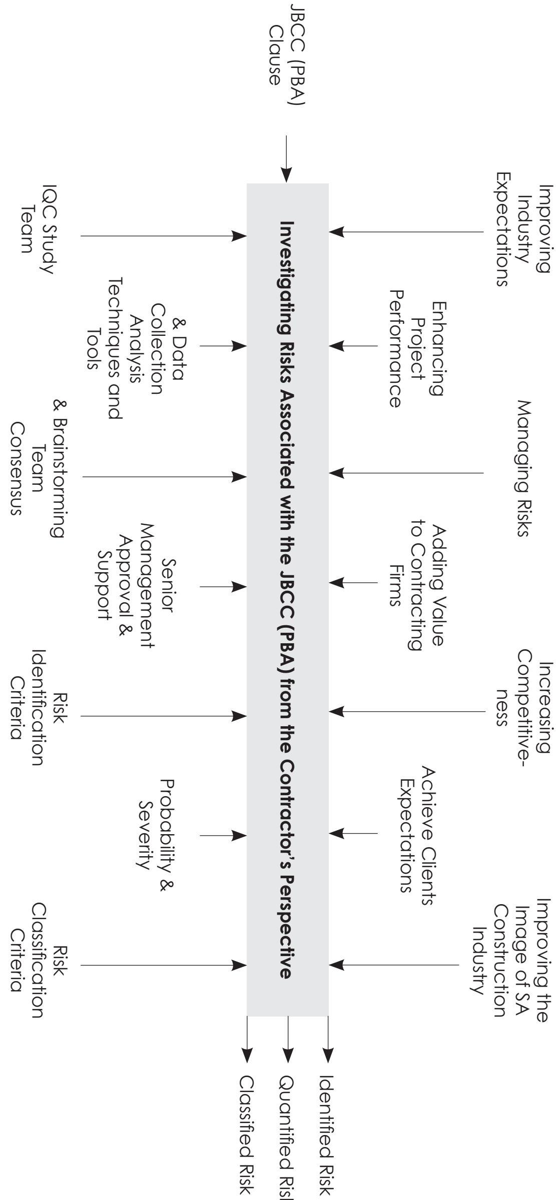

Figure 3: Investigating risks associated with the JBCC (PBA) from the contractor's perspective
Source: Harinarain, 2008: 87

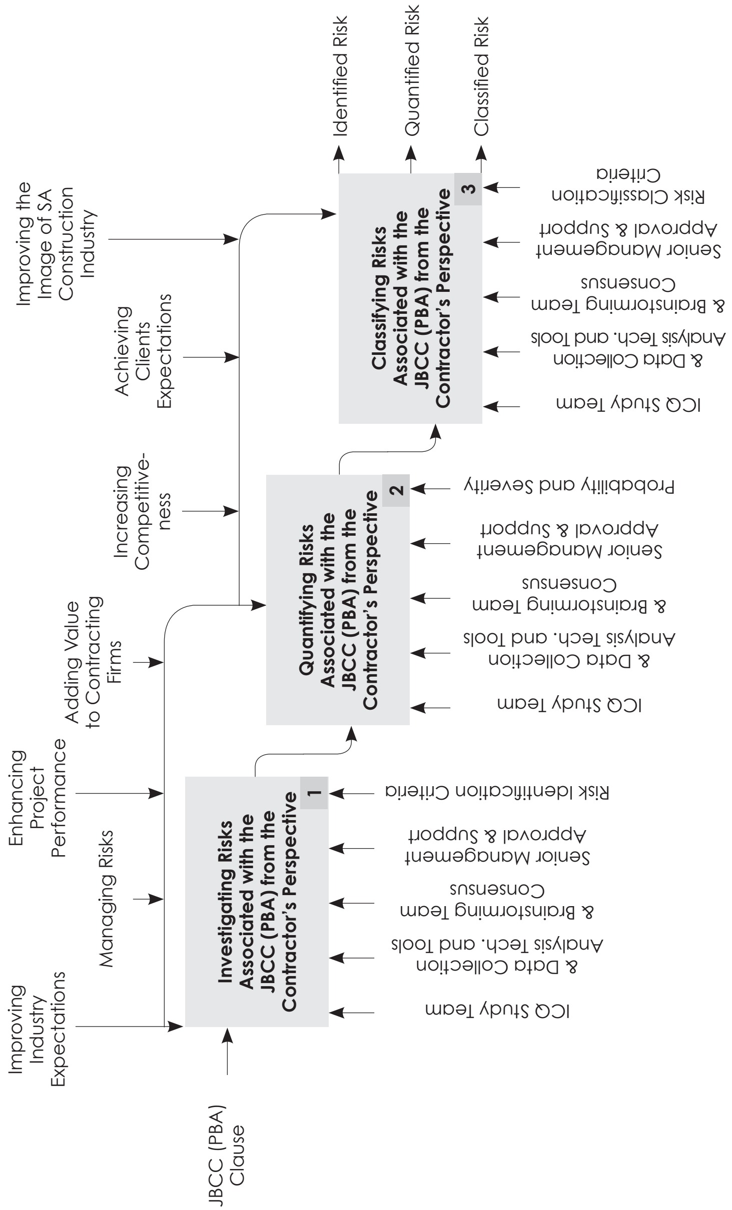

Figure 4: Investigating risks associated with the JBCC (PBA) - The three levels of the IQCF
Source: Harinarain, 2008: 88

5.3.4.a Identifying risks associated with the JBCC (PBA) from the contractor's perspective

This function aims to identify the risks associated with the JBCC (PBA) from the contractor's perspective (Figure 5). It is a decomposition of box (1) in the IQCF/A0 diagram (Figure 4). The input to this function is the JBCC (PBA) clauses. The identification function has to be carried out in an endeavour to improve the industry expectations, enhance project performance, manage risks, add value to contracting firms and increase their compositeness, achieve client expectations as well as improve the image of the South African industry. Hence, gaining the approval and support of senior management is required to facilitate the acceptance and implementation of the study results. A study team has to be formulated to conduct the study. In addition, an orientation meeting prior to the study is essential to plan for the study and state its objectives, location and duration. Selecting the right team members is crucial to the success of the identification study. The criteria developed by the authors for risk identification must be utilised. Different data collection and analysis techniques and tools have to be used for risk identification. Furthermore, team members have to be encouraged to generate as many risks as possible during the brainstorming session. The output of this process is the identified risks. Once the risks have been identified and approved, the team can proceed to the next step.

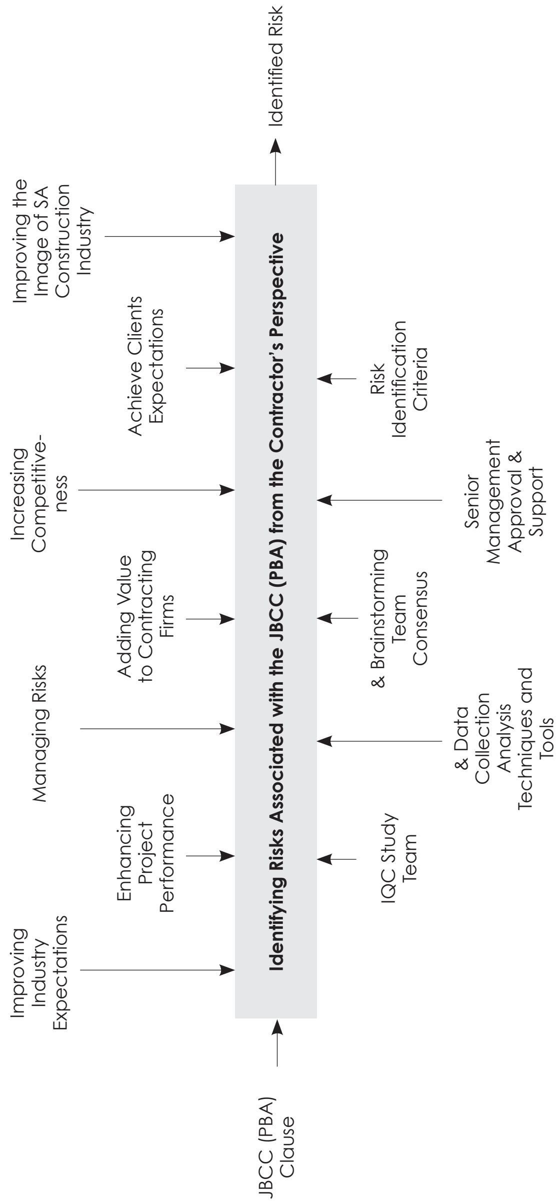

Figure 5: Identifying risks associated with the JBCC (PBA)
Source: Harinarain, 2008: 89

5.3.4.b Quantifying risks associated with the JBCC (PBA) from the contractor's perspective

This function aims to quantify the risks associated with the JBCC (PBA) from the contractor's perspective (Figure 6). It is a decomposition of box (2) in the IQCF/A0 diagram (Figure 4). The Input to this function is the risks identified in the previous function. The quantification function has to be carried out in order to improve the industry expectations, enhance project performance, manage risks, add value to contracting firms and increase their compositeness, achieve client expectations as well as improve the image of the South African industry. In addition to the mechanisms used to carry out this function such as approval and support of senior management, study team, data collection techniques and tools, the probability and severity analysis must be used to quantify identified risks through brainstorming and team consensus. Furthermore, the Relative Importance Index (RII) is vital for ranking risks according to their influences. The output of this stage is the quantified risk.

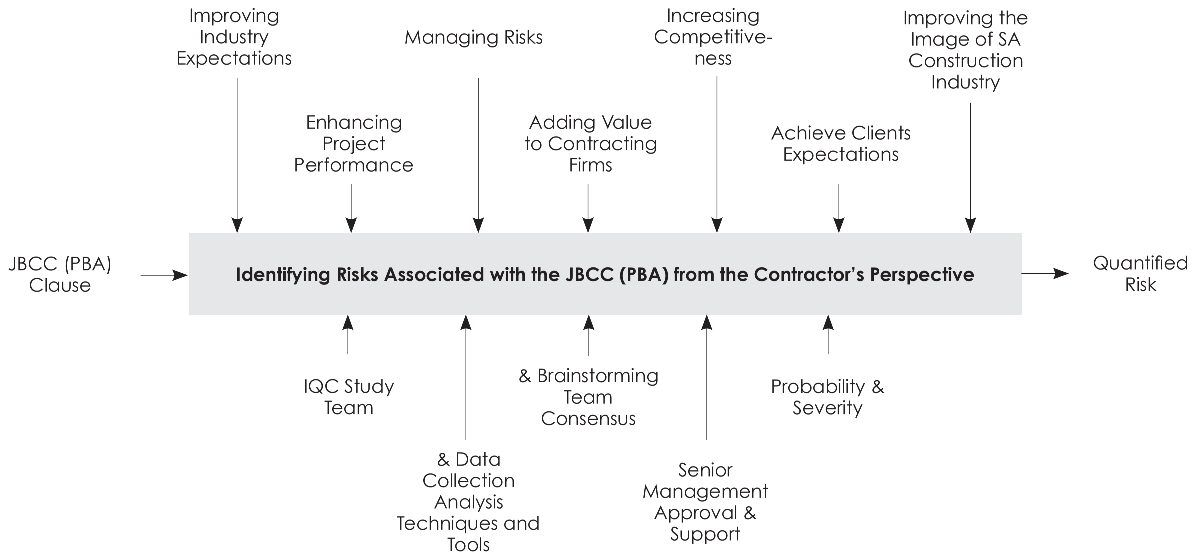

Figure 6: Quantifying risks associated with the JBCC (PBA)
Source: Harinarain, 2008: 90

5.3.4.c Classifying risks associated with the JBCC (PBA) from the contractor's perspective

Within this function the risks identified and quantified in the previous two functions will be classified from the contractors' perspective (Figure 7). This function is a decomposition of box (3) in the IQCF/A0 diagram (Figure 4). The input to this process is the output of the previous function. Classifying risks will help improve the industry expectations, enhance project performance, manage risks, add value to contracting firms and increase their compositeness, achieve client expectations as well as improve the image of the South African industry. The developed criteria for risk classification developed by the author which classify risks as internal and external risks will be applied. Other mechanisms such as approval and support of senior management, study team, data collection and analysis techniques and tools, brainstorming and team consensus have to be used to achieve the function objectives. The output of this stage is the classified risk.

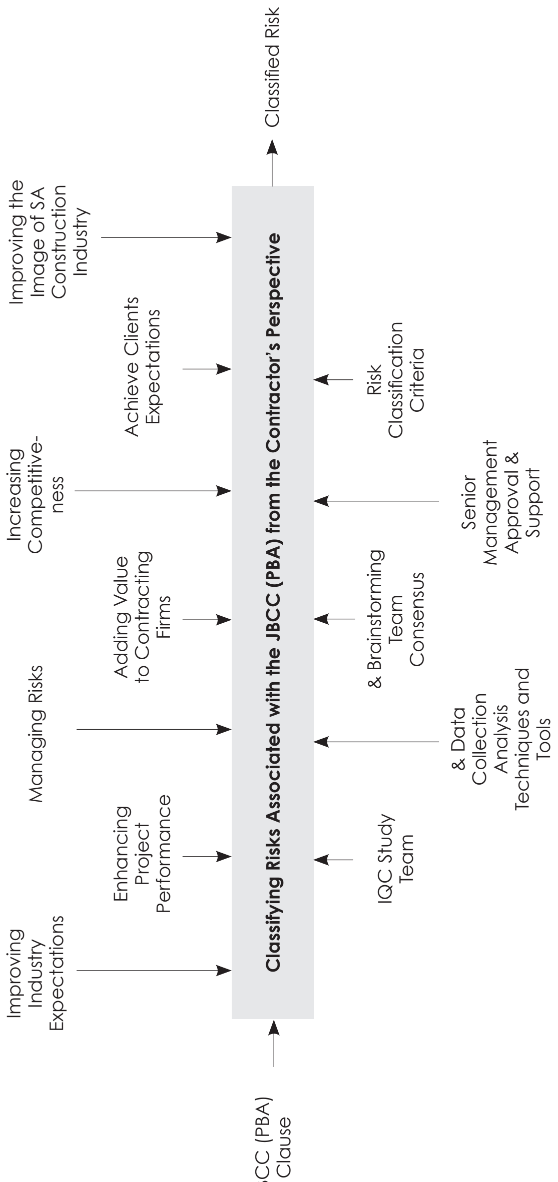

Figure 7: Classifying risks associated with the JBCC (PBA)
Source: Harinarain, 2008: 91

5.3.5 Evaluation of the IQCF

In order to evaluate the framework and to get feedback from the industry, 26 survey questionnaires were sent to construction firms. Out of these, 9 were completed and returned, providing a response rate of 47%. According to Babbie (1992), as a rule of thumb 50% is adequate while Mcneil & Chapman (2005); Saunders, Lewis & Thornhill. (2003); Gillham (2000); Tashakkori & Teddlie (1998) and Fellows & Liu (1997) state that 30-40% is acceptable because few people respond to questionnaires. The questionnaire was divided into three sections based on the three components of the framework. The questions asked the construction company to rate the suitability and acceptance of the identification, quantification and classification criteria developed by the authors in the framework on a scale of 1 to 5 (where 1=Poor and 5 =Excellent). Room for suggestion of improvement is provided. For the first section 67% of the respondents rated the risk identification criteria of reducing the company's strengths, increasing its weaknesses, reducing its opportunities or increasing its threats as 4 out of 5, while 33% rated it 3 out of 5. For the second section, 45% of the respondents rated the quantification method of probability and severity 4 out of 5, where 44% rated it 3 out of 5 and 11% rated it 2 out of 5. For the third section, 67% of the respondents rated the risk classification system of internal and external risks 4 out of 4, while 33% rated it as 3 out of 5. None of the respondents made any suggestions as to how these three areas could be improved. As general comments of the respondents, 56% of the respondents considered the framework a very good tool, while 44% rated it as good. One respondent did suggest that the framework could be elaborated on in further studies, by incorporating health and safety as well as quality aspects.

5.3.6 Benefits of the IQCF

The IQCF developed by this research is an innovative decision-making tool designed to enable contractors to identify, quantify and classify the risks of the JBCC (PBA) clauses. The IQCF will help the contractors draw the appropriate risk management plan to mitigate the adverse effects of these risks. Proper implementation and understanding of the IQCF will provide the following benefits:

- Enhance risk identification;
- Improve risk quantification;
- Advance risk classification;

- Reduce disputes and disagreements as well as improve project performance;
- Increase contractors' reputation and their competitiveness;
- Improve the image of the South African construction industry and achieve client expectations;
- Make decisions on an informed basis, and
- Develop better risk management plans.

5.3.7 Limitations of the IQCF

Due to the current boom in the South African industry because of the Soccer World Cup 2010, there are some limitations that impede the adoption and application of the IQCF: time constraints, work commitment as well as lack of qualified and trained personnel. To overcome these obstacles and facilitate the use of the IQCF, the benefits of the framework have to be clearly presented to the senior management of contracting companies in order to win over their confidence and ensure their commitment to adopt the framework and offer the training necessary to the successful application of the framework.

5.4 The correlation matrix of contractor's risk sources associated with the JBCC (PBA)

5.4.1 Identification of contractor's risk sources associated with the JBCC (PBA)

Based on the criteria of identifying risks associated with the JBCC (PBA) developed by the authors, risk sources to the contractor could be defined as the person, authority or event that either reduces the strength of the company, increases its weakness, reduces its opportunities and increases its threats, thus ultimately affecting the achievement of the project objectives and client satisfaction (Harinarain, Othman & Pearl, 2008). In this research, survey questionnaires and interviews were utilised to identify and quantify the contractor's risk sources associated with the JBCC (PBA). Respondents to the questionnaires and interviews were asked to select the risk source from a list of project participants. These were (1) client, (2) principal agent, (3) architect, (4) quantity surveyor, (5) engineer, (6) supplier, (7) subcontractor and (8) government authority. The outcome of the questionnaires and the interviews is described below.

5.4.1.a The client as a risk source to the contractor

Data analysis showed that clients are the risk source to the contractor in 72.5% of the JBCC (PBA) clauses. All respondents stated that the client is the main risk source to the contractor in clauses 3, 9, 10, 11, 12, 19, 31, 37, 38 & 39. The client represents a considerable risk source because s/he makes the decision to build, specifies the design requirements, states the ultimate budget, commencement and completion dates and if there are to be any variations. Clients are risk sources to the contractor with varying degrees with regard to other clauses (see Table 3).

5.4.1.b The principal agent as a risk source to the contractor

Analysis of responses showed that the principal agent represents the risk source to the contractor in 25% of the JBCC (PBA) clauses with varying degrees. Lack of leadership and experience of the principal agent to issue instructions to project teams, receive notices on behalf of the employer or represent him may cause many decisions to be suspended which, in turn, affect the daily work of the project and the contractor's progress.

5.4.1.c The architect as a risk source to the contractor

Data analysis showed that architects are the risk source to the contractor in 25% of the JBCC (PBA) clauses with varying degrees. Design errors, unco-ordinated tender documents, design changes due to, for instance, incomplete project brief, lack of understanding client requirements, lack of design experience are risks the contractor confronts during the construction process.

5.4.1.d The quantity surveyor as a risk source to the contractor

Respondents mentioned that quantity surveyors are the risk source to the contractor in 32.5% of the JBCC (PBA) clauses. 50% of the respondents mentioned that incorrect and late completion of the contract account (clauses 33 and 34) delays the contractor's cash flow and impedes him from starting new projects. Other risks that the quantity surveyors can cause to the contractor are adjustment to the contract value, delaying payment and dispute settlement (see Table 3).

5.4.1.e The engineer as a risk source to the contractor

Respondents mentioned that in 10 out of 40 clauses of the JBCC (PBA) the engineer is considered the risk source to the contractor. Complexity of building design, lack of expertise, design error, missing information, unco-ordinated documents and resolving disputes represent risk sources to the contractor. Engineers are risk sources to contractors with varying degrees in other clauses (see Table 3).

5.4.1.f The supplier as a risk source to the contractor

In 3 out of 40 clauses of the JBCC (PBA) suppliers represent risk to the contractors. Lack of access of the supplier to the work, revising the completion date and dispute settlement will hinder the supplier from delivering requirement materials and equipment on time which delays the contractor and prevents him from meeting the project requirements.

5.4.1.g The subcontractor as a risk source to the contractor

In 37.5% of the JBCC (PBA) clauses, subcontractors represent the risk source to the contractor. 22.2% of the respondents stated that in clauses 21 and 23, subcontractors were the main source of risk to contractors. This is because any delay caused by the subcontractor due to incompletion of his job will hinder the contractor to meet the project deadline and could cause penalties and client dissatisfaction. Subcontractors are risk sources to contractors with varying degrees in other clauses (see Table 3).

5.4.1.h The government authority as a risk source to the contractor

In 12.5% of the JBCC (PBA) clauses, government authorities represent the risk source to the contractor. 83% of the respondents stated that changing government regulations during the construction process are considered a risk that affects the contractor's progress on site. Government authorities are risk sources to contractors with varying degrees in other clauses (see Table 3).

It is worth mentioning that 21% of the clauses are not applicable because they either do not contain any words or are explaining various aspects of the contract.

Table 3: Correlation matrix of risk sources to the contractor

Clauses		*Sources of Risk to the Contractor*							
		Client	*Principal Agent*	*Architect*	*Quantity Surveyor*	*Engineer*	*Supplier*	*Sub-contractor*	*Government Authority*
3.0	Documents	100%							
9.0	Indemnities	100%							
10.0	Works insurances	100%							
11.0	Liability insurances	100%							
12.0	Effecting insurances	100%							
19.0	Assignment	100%							
31.0	Interim payment	100%							
37.0	Cancellation by employer - loss and damage	100%							
38.0	Cancellation by contractor - employer's default	100%							
39.0	Cancellation - cessation of works	100%							
21.0	Selected subcontractors							100%	
23.0	Domestic subcontractors							100%	
22.0	Direct contractors	67%						33%	
27.0	Latent defects	67%						33%	
20.0	Nominated subcontractors	50%						50%	
33.0	Recovery of expense and loss	50%			50%				
34.0	Final account and final payment	50%			50%				
7.0	Regulations	17%							83%

Clauses		Sources of Risk to the Contractor							
		Client	*Principal Agent*	*Architect*	*Quantity Surveyor*	*Engineer*	*Supplier*	*Sub-contractor*	*Government Authority*
32.0	Adjustment to the contract value	44.44%		11.1%	44.44%				
15.0	Works execution	44.44%			44.44%			11.11%	
35.0	Payment to other parties	33%	17%		33%			17%	
18.0	Setting out of the works	33%				50%			17%
4.0	Design responsibility	8%	8%	42%		42%			
17.0	Contract instructions	18.89%	18.89%	18.89%	18.89%	18.89%		5.56%	
5.0	Employers agents	17.78%	17.78%	17.78%	17.78%	17.78%		11.11%	
24.0	Practical completion	17.78%	17.78%	17.78%	11.11%	17.78%		17.78%	
25.0	Works completion	17.78%	17.78%	17.78%	11.11%	17.78%		17.78%	
26.0	Final completion	17.78%	17.78%	17.78%	11.11%	17.78%		17.78%	
16.0	Access to the works	12.50%	12.50%	12.50%	12.50%	12.50%	12.50%	12.50%	12.50%
29.0	Revision of date for practical completion	12.50%	12.50%	12.50%	12.50%	12.50%	12.50%	12.50%	12.50%
40.0	Dispute settlement	12.50%	12.50%	12.50%	12.50%	12.50%	12.50%	12.50%	12.50%
1.0	Definitions	N/A							
2.0	Offer, acceptance and performance	N/A							
6.0	Site representative	N/A							
8.0	Works risk	N/A							
13.0	No clause	N/A							
14.0	Security	N/A							
30.0	Penalty	N/A							
36.0	Cancellation - contractor's default	N/A							

Source: Harinarain, 2008: 133

5.4.2 Quantification of contractor's risk sources associated with the JBCC (PBA)

Data analysis showed that clients are ranked the highest risk source facing contractors when using the JBCC (PBA) with (mean 4.8, median 4.7 and mode 4.8 out of 5). Subcontractors were ranked the second risk source to the contractor with (mean 4.5, median 4.4 and mode of 4.3 out of 5). Suppliers were ranked the least risk source to the contractor with (mean of 2.7, median 2.6 and mode 2.5 out of 5). Figure 8 shows the quantification of the contractor's risk sources.

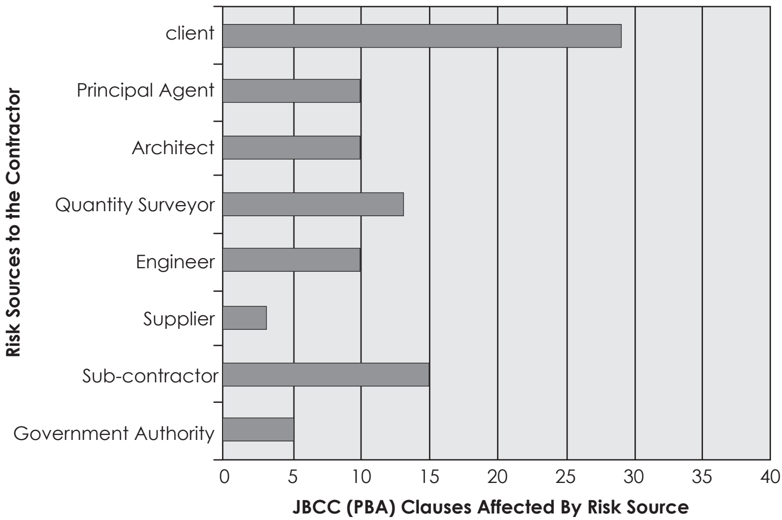

Figure 8: Risk sources to contractor using the JBCC (PBA).

6. Conclusions and recommendations

Having reviewed the topics of contracts and risks in construction and bearing in mind the developed framework and the contractor's risk source correlation matrix, the research may reach the following conclusions and recommendations:

- The construction industry is facing a more challenging environment than previously. Client expectations have increased and clients are in need of better quality products and services that use new developed materials and equipment at lower cost and tight time scales, which eventually leads to risk.

- Contracts are essential tools for organising the relationship between different parties involved in the construction project and managing associated risks. The JBCC is a committee consisting of six constituent organisations that represent the variety of interests in the South African Construction industry. The Principal Building Agreement records the terms of agreement between the employer and contract. For many years the South African building industry had a very bad reputation due to the lack of implementing risk management in construction projects.
- In order to improve the image of the industry, this research developed an innovative framework to enable contractors to identify, quantify and classify risks associated with the JBCC (PBA). This will help contractors improve their performance, increase their competitiveness, add more value and achieve the industry's and client's expectations. In addition, the research developed a correlation matrix that identifies and quantifies the risk sources to contractors. Clients, subcontractors and quantity surveyors were ranked the highest risk sources to contractors, respectively.
- Benefits of the developed framework and the correlation matrix must be presented to senior management in construction companies to facilitate their adoption and application as an approach for improving the global construction industry and, in particular, in South Africa.

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