Resilient Structures and Sustainable Construction
Edited by Pellicer, E., Adam, J. M., Yepes, V., Singh, A., and Yazdani, S.

ISBN: 978-0-9960437-4-8

RISK ALLOCATION MECHANISM FOR BUILDING PROJECTS BASED ON THE RIBA PLAN OF WORK

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The Zambian construction industry, like many other construction industries in developing countries, is characterized with frequent project failure evidenced by quality shortfalls, cost overruns, time overruns and, on occasion, abandonment of projects. Various construction industries, particularly developed ones, have mechanisms in place to alleviate the aforementioned risks. Moreover, it has been reported that construction organizations in developing countries, approach risk management implied risk allocation in construction projects by using a set of practices that are normally insufficient, often produce poor results, and limit the success of project outcome. It is from this background that a risk allocation mechanism tailored to the Zambian building sector is proposed, based on the RIBA plan of work for new large to medium sized projects. Various mechanisms and processes are documented in the existing literature, all developed for particular jurisdictions, project types and modes of procurement. Though beneficial, the crafting of most of these mechanisms does not focus on curtailing sources of inappropriate risk allocation, but rather focuses on who, between the client and contractor, should be allocated a particular risk. This paper documents a mechanism for risk allocation after establishing the causes of risk misallocation through a questionnaire survey, interviews, and document analysis. The mechanism integrates contract practice and risk management to make it robust for alleviating both contractual and non-contractual risks. However, its utility, to an extent, is dependent on the risk perceptions of the user as it is driven by decision-making.

Keywords: Zambia, Risk management, Causal factors, Framework.

1 INTRODUCTION

Risks are widespread in the construction industry. The effects of risks are either positive or negative, depending on how favorably the allocation is viewed (Lehtiranta 2014) and the management of the risks is done (Groton and Smith 2010). Risk allocation is the division of responsibility associated with a possible loss or gain and the procedure of assigning identified risks to project participants (Lam *et al.* 2007); while Alsalman and Sillars (2013) define it as the assignment of management responsibility and risk liability. Bedenekoff and Steven (2011) point out that risk allocation is about active risk management within an imposed temporal schedule of changing predation risk(s). Risk allocation in the construction industry has the resultant effects of tensions, disputes, quality shortfall, schedule and over budget, resulting in poor project delivery (Alsalman and Sillars 2013), while it has been argued that the positive effects are rarely seen in projects (Lehtiranta 2014). Various models and frameworks have been formulated in the literature on how risks should be allocated; in this paper, a few are identified, though over 30

frameworks or models are highlighted in the body of knowledge related to risk allocation. While the recorded frameworks are all useful, the proliferation of such frameworks continues to emerge due to the differences in economic, political, social-cultural and organizational structures of where the construction industries operate (Liu *et al.* 2014). Due to these differences, most frameworks or models cannot be utilized outright or without modification. In this research, a framework is documented based on the *Royal Institute of British Architects* (RIBA) plan of work of 2013. This framework was developed to possibly mitigate the resultant effects of inappropriate risk allocation. The focus of most models is the best party to carry a risk; notwithstanding risk allocation is more than who is liable for a risk. The mechanisms and treatment methods used to allocate risk matter, and so do the resources needed to handle risk effectively.

2 FRAMEWORKS OR MODELS FOR RISK ALLOCATION IN PRIOR RESEARCH

Various risk management/allocation frameworks have been formulated in the existing body of knowledge. This review covers a 15 year period from 2000 to 2015. A total of 30 such frameworks and models were identified; only a few are discussed here.

Hastak and Shaked (2000), using a case study, formulated an assessment model for international projects focusing on the calculation of project risk whose limitation was the accuracy of the risk analysis method used. Dey (2001), using Analytical Hierarchy Process (AHP) and decision trees, developed a decision support for the design stage, using case study method. Wang *et al.* (2004) used interviews and a survey to develop a qualitative risk management model for use on international projects in developing countries. Dikmen and Birgnoul (2006), using AHP, developed a risk and opportunity model for international construction projects whose major limitation is its unsuitability for quantification of risk factors. Lam *et al.* (2007) formulated a fuzzy logic model of risk allocation for use by owner and contractor in traditional contracting, which was validated using a case study.

Zhao and Duan (2008) formulated an integrated risk management framework based on literature and validated, using a simulation based on risk transfer as the main mechanism for risk allocation. Fu *et al.* (2009), using literature, formulated an agent construction modelling workflow among participants in a collaborative arrangement for transferable risks only. Xu, Chan and Yeung (2010), using fuzzy logic, developed an allocation mechanism for Public Private Partnerships (PPPs) between government and the private sector using face-to-face interviews and a Delphi Survey. Jin (2011), using neuro-fuzzy techniques, devised a mechanism for risk allocation focusing on design risk in private finance initiatives for public infrastructure whose validation was done on school buildings. Khazaeni *et al.* (2012) developed fuzzy adaptive decision-making logic to balance risk allocation using a Delphi questionnaire while focusing on cost related risks only. Zhao and Li (2013), using the literature and case studies, formulated a risk allocation mechanism for international projects which has inputs, tools, techniques and expected output. Odimabo and Oduoza (2013) devised a risk assessment framework for construction firms in developing countries through a questionnaire survey, interviews, case study. Lehtiranta and Junnonen (2014) modelled risk management in a cooperative approach, focusing on the internal and external risks in the risk management (RM) process in contracting parties. Dawood (2015) developed a risk management tool for the client for design and for monitoring projects.

3 METHODOLOGY

The research followed a pragmatic philosophy with an abductive approach which was mixed-method in nature. The strategies employed for the research, in a sequential manner, were semi-structured interviews, questionnaire survey, use of archival data in the form of contract documents to understand risk misallocation in a cross-sectional manner; while, for the validation of the framework, a questionnaire survey distributed to professionals in the Zambian construction industry (ZCI) was used concurrently with a Delphi expert panel in a longitudinal manner. The sampling for the semi-structured interviews, the questionnaire with professionals (validation) and the Expert Delphi panel were purposive, while the questionnaire survey was random sampling except for clients and projects managers whose population was less than 30 (Saunders *et al*. 2009). The total number of respondent in each category for the questionnaire survey were six Clients, 14 Project managers, 38 Architects, 28 Engineers, and 79 Contractors (Group 1-22, Group 2-30, Group 3-43) giving a response rate of 66%; for the semi-structured interviews, 15 professionals with over 10 years' experience in the building sector were interviewed. This is within 5-25 recommended by Leedy and Ormorod (2014). The professionals validating the questionnaire had 22 participants and nine experts validated the framework. The causes of misallocation were first determined, using personal repository factors and environmental factors that constrain risk allocation. The analysis methods employed were descriptive statistics (use of percentages, modes, means, standard deviations) for the questionnaire survey, document analysis (interpretive and content analysis) for the contract documents and content analysis for the semi-structured interviews.

4 RESULTS AND DISCUSSION

This section presents the results and discussion.

4.1 Respondent Profile

For the semi-structured interviews, the average number of years in experience was 17 with a mode of 10. For the survey, on average, years' experience of respondents was nine years. All the clients, project managers, other consultants; professionals and the expert panel (used in the validation) had a minimum of first-degree qualification. For the contractors, the qualifications varied, though the majority (over 52%) was trained at diploma and first-degree level. The respondents have worked on various types of building projects e.g., residential, office building, banks, fire stations, industrial buildings, health centers, hospitals, clinics, malls, markets, etc.

4.2 Common Misallocations

The common risk misallocations were design related: clarity of designs, omissions and errors in the design and inadequate specification; these were passed to the contractor through the use of contract modification or waiver clauses. Additionally, the risk of unstable exchange rates and unstable material prices were transferred to the contractor using the same mentioned mechanisms. The risk of inadequate site investigation was also avoided by the client using waiver clauses. All these were evidenced in six contracts with a contract period of over 12 months with 5/6 projects using traditional procurement. These findings were according to the document analysis of eight projects using FIDIC red-book (open International bidding contract) (2), Open national bidding contract (2), Joint Liaison committee contract (2) and Small works contract document (2). The findings are affirmed by interview findings. Additionally, the risk of delayed request for information is avoided by the client by not complying with contractual provisions, especially in

the public sector, mostly for compensation events that attract cost as well as time extension. The misallocation of inadequate site investigation is common (Groton and Smith 2010).

4.3 Causes of Risk Misallocations-Personal Repertory Related

Personal repertory factors refer to skills, knowledge, and capacity that professionals/agents bring to the project team. Mu *et al.* (2014) argue that for effective risk allocation capacity in risk identification, analysis and response should be adequate. The survey data revealed that 45.7% of the respondents have had some form of training in risk management during tertiary education, while 54.3% mainly learn how to manage risk through experience. Skills and knowledge are more in risk identification where methods used are site visit (88%), knowledge from past projects (79%) and local knowledge (72%). For risk, response and allocation contracts are relied upon and these are normally modified by the client to transfer risk to the contractor. The interviews and questionnaires revealed that quantitative risk analysis is rarely done, though methods pointed out for risk analysis are qualitative, such as brainstorming (56%), expert judgement (59%) and interviews with more experienced professionals (45%). As highlighted by other research, deficiency in skills is affecting risk management (See Chileshe and Kikwasi 2014, Choudry and Iqbal 2013) and consequently, results in inappropriate risk allocation. Misallocations normally result from clients' attempts to maintain transaction cost from the agreed contract sum in the Zambian building sector, according to the interview data.

4.4 Causes of Risk Misallocation - Environment Related

Environment related factors refer to information and instrumentation in an environment which inhibits risk allocation. The current contract portfolio covers traditional procurement while integrated procurement (52% of interviewees) is used, resulting in massive modifications to contract documents which in turn, results in incomprehensive allocation or inappropriate risk allocation, according to the interview data. For mechanisms used, the preference by the client for contractors is to acquire bonds from banks (at 10% of contract sum) which results in financial and equipment difficulty for the contractor, as collateral is normally required. Bonds from insurance establishments (at 30% of contract sum) are obtained at a higher percentage, therefore are rarely preferred. The majority of respondents (62.1%) do not have an established risk management process yet; for risk management to be beneficial, it has to be systematic and formalized (Lehtiranta and Juunonen 2014, PMI 2008). Additionally, for public sector projects, the level of sub-contracting allowable is 20%; viewed as inadequate by the large scale contractors. Moreover, on building projects subcontracting levels can go up to 90% (Polat *et al.* 2015).

4.5 Proposed Framework

The framework is designed for use by the client on new works that are large to medium in size (See Figure 1). It integrates contract practice and risk management practice. The proposed framework was validated using professionals in the ZCI and an expert panel with experts from New Zealand, South Africa, UK, India and Zambia. Questions posed included sequencing of activities, resources and requirements and the actual decisions to be made at each phase (See Table 1 for details). The proposed framework has 17 active steps. Most of the activities are to be carried-out in the design stage. The steps should be carried-out and managed by professionals with the appropriate skill and knowledge that should be availed the necessary resources. The work environment should be organized in a such a matter as to enable the smooth progression of work flow as outlined in the framework. Additionally, mechanisms constraining risk allocation should be identified and better mechanisms implemented. Decisions have to be closely

monitored and controlled for in the construction phase and a knowledge management approach implemented to improve risk allocation on future projects at the renewal phase, in addition to identifying skill needs for project teams and additional measures for risk mitigation.

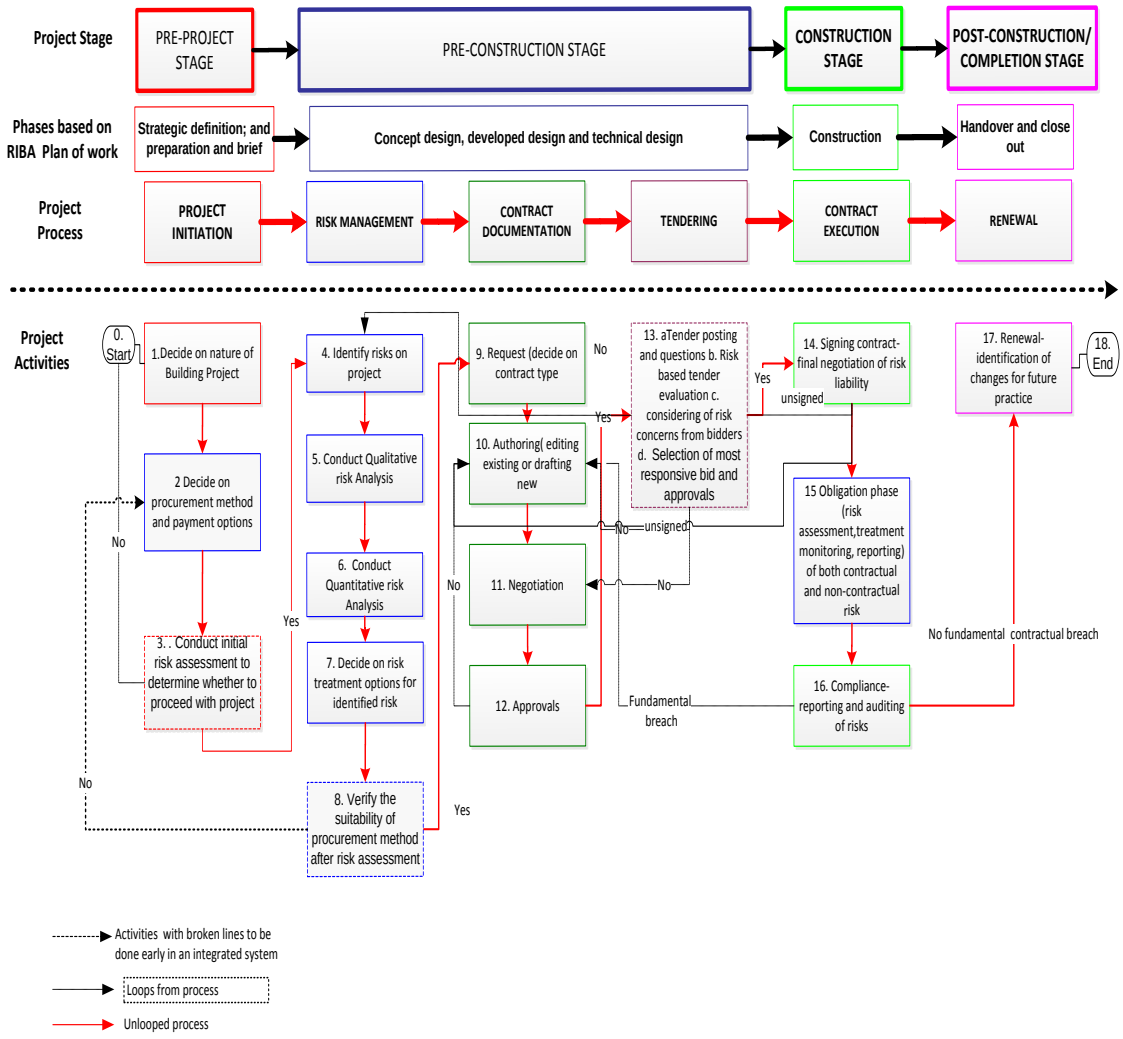

Figure 1. Proposed risk allocation framework.

5 CONCLUSIONS

This research demonstrates that various risk allocation/management systems exist mostly based on the stage(s) in the project lifecycle, procurement method or a process in the risk allocation or management process. A similar framework is proposed here based on the RIBA plan of work project life cycle with the exception of the operation phase for the Zambian building sector. This framework, once implemented, would be a basis for systematic risk allocation. However, just a synopsis has been given here. A detailed account of decisions and activities to be carried out will be given in future publications with the hope of automating the whole process.

References

Alsalman, A. and Sillars, D., *Modelling the Effects of Sub-optimal Risk Allocation in the Construction Industry*, s.l., Oregon State University Press., 2013.

Bedenekoff, A. P. and Steven, L. L., . Risk Allocation is a General Phenomenon: A Reply to Beauchamp and Raxton, *The American Naturalist*, 177(1), pp. 147-151, 2011.

Choudhry, R. and Iqbal, K.,. Identification of Risk Management System in the Construction Industry in Parkistan, *Journal of Management in Engineering*, 29(1), pp. 42-49, 2013.

Dawood, A. A. n., Development of a Client-based Risk Management Methodology for the Early Stage of Construction Processes, *ECAM*, 22(5), pp. 493-515, 2015.

Dikmen, I. and Birgnoul, M. T., Analytical Hierarchy Process Based Model for Risk and Opportunity Assessment of International Construction Projects, *CJCE*, pp. 58-68, 2006.

Fu, C. and Li, B, Risk Allocation Framework in Agency Construction in China. *IEEE*,DOI: 10.1109/ICMSS.2009.5303822, 2009.

Groton, J. and Smith, R. J., *Realistic Risk Allocation: Allocating Rach Risk to the Party Best Able to Handle the Risk*, s.l.: CPR international instutite for conflict prevention & resolution, 2010.

Hastak, M. and Shaked, A., ICRAM-1 Model of International Construction Risk Assessment, *Journal of Management in Engineering*, pp. 59-69, 2000.

Jin, X.-H. and Zhang, G., Modelling Optimal Risk Allocation in PPP Projects using Artificial Neural Networks, *IJPM*, pp. 591-603, 2011.

Khazaeni, G., Khanzadi, M., and Afshar, A., Fuzzy Adaptive Decision Making Model for Selection Balanced Risk Allocation, *International Journal of Project Management*, 30, pp. 511-522, 2012.

Lam, K., Wang, P., Lee, T. K., and Tsang, Y. T., Modelling Risk Allocation Decision in Construction Contracts, *IJPM*, 25, pp. 485-493, 2007.

Leedy, P. D. and Ormrod, J. E., *Practical Research Planning and Design*, 10th Edition ed. New York: Pearson, 2014.

Lehtiranta, L., Risk Perceptions and Approaches in Multi-organisations: A Critical Review 2000-2012. *IJPM*, 32, pp. 640-653, 2014.

Lehtiranta, L. and Juunonen, J.-M., Stretching Risk Management Standards: Multi-organisational Perspectives, *Built Environment Project and Asset Management*, pp. 128-145, 2014.

Mu, S., Chen, H., Chohr, M., and Peng, W., Assessing Risk Management Capabilities of Contractors in Subway Projects in Mainland China, *IJPM*,32(3), pp. 452-460, 2014.

Odimabo, O. and Oduoza, C., Risk Assessment Framwwork for Building Construction Projects in Developing Countries, *International Journal of Construction Engineering and Management*, pp. 143-154, 2013.

Project Management Institute, *A Guide to the Project Management Body of Knowledge.* 4th ed. PA: The Institutes.n., 2008.

Saunders, M., Lewis, M., and Thornhill, A., *Research Methods for Business Students*, 5th ed., Prentice-Hall Upper Saddle River, NJ, 2009.

Xu, Y., Chan, A., and Yeung, J., Developing a Fuzzy Risk Allocation Model for PPP Projects in China, *Journal of Construction Eng. Manage*, 136, pp. 894-903, 2010.