



## Assessment of the Effect of Materials Procurement Risks Factors on Time, Cost and Quality Performance of Building Projects in Abuja, Nigeria

Muhammad, M. C.<sup>1a</sup>, & Saidu, I.<sup>1b</sup>

<sup>1</sup>Department of Quantity Surveying, Federal University of Technology, Minna

<sup>a</sup>[muzycocool20@gmail.com](mailto:muzycocool20@gmail.com); <sup>b</sup>[saidu.ibr@futminna.edu.ng](mailto:saidu.ibr@futminna.edu.ng)

*Corresponding author:* [muzycocool20@gmail.com](mailto:muzycocool20@gmail.com)

### Abstract:

*The challenges involved in materials procurement in building projects, risks still remain a serious problem requiring urgent attention in the Nigerian building construction industry. This problem could be attributed to little understanding of materials procurement risk management strategies by procurement officers, project managers and contractors who are affecting the performance of building projects. This research assessed the effect of materials procurement risk factors on time, cost and quality performance of building projects in Abuja, Nigeria. The study adopted a survey design approach using quantitative data. Data were collected through well-structured questionnaire administered to 159 respondents who are project managers, contractors, heads of waste management departments, and consultants of 61 active building construction sites that are practicing lean within Abuja using judgemental sampling method. A total of 139 questionnaires were retrieved from 159 distributed. The collected data were analysed using descriptive methods, including frequencies, percentages and Mean Item Score (MIS). The study revealed that the materials procurement risk factors that have high effect on time performance of building project are: inflexible design; new and existing competitors; and unexpected changes in demand with MIS values of 3.99, 3.95, and 3.92. It was also found that the materials procurement risk factors that have high effect on cost performance of building project are: inflation; and quality control and assurance with MIS values of 3.99 and 3.90. The research also found that the materials procurement risk factors that have high effect on the quality performance of building project are: differing site condition; and changes in interest rates with MIS values of 3.96 and 3.95. Based on these findings it can be concluded that the building materials procurement risks identified in this paper are relevant in building construction projects. This will help professionals in identifying and taking necessary measures in preventing risks in building construction projects in Nigeria.*

**Keywords:** Materials procurement, Risk, Risk management, and Building construction project

### INTRODUCTION

The construction industry contributes to the socio-economic growth of any nation by improving the quality of life, generating employments and providing the infrastructure, such as roads, hospitals, schools, and other basic facilities. Hence, it is imperative that construction projects are completed within the scheduled period of time, within the budgeted cost, and meet the anticipated quality (Saidu and Shakantu, 2016).

Materials procurement are significantly influenced by various factors such as: improper materials handling and management on site during construction production processes (Khyomesh and Vyas, 2011). As a result, materials procurement strategies have been observed to influence the quality, time and socio-economic sustainability of the project. However, challenges arising from poor materials procurement on construction sites still persists including errors in ordering materials, difficulties in ordering materials in small materials; delays in material delivery, problems associated with material transportations, handling and storage, production of defective materials and general poor resource control on site (Glass *et al.*, 2014; Aibinu and Odeyinka, 2016; Bossink and Brouwers, 2015; Poon *et al.*, 2014; Formoso *et al.*, 2012). Material in particular covers about 60% of total construction cost (Kasim *et al.*, 2016; Gulghane and Khandve, 2015; Patil *et al.*, 2013 and Ibronke, 2013). Moreover, the rising price of building materials and the escalating cost of construction have become topical in many

countries (Amusan *et al.*, 2017; Tunji-Olayeni and Omuh, 2013). Hence, efficient material procurement holds great potentials for significant cost savings for construction projects (Amusan, *et al.*, 2017). Kolenko (2016) states that risk in procurement is measured from a transactional point of view where risk management is dedicated to things that can go wrong in the procurement process. Risk identification is widely accepted to be the first and the key step of material procurement risk management process, because of the fact that all the succeeding steps and actions will be based on it.

Research has shown that delays in project deliveries have resulted in client and contractor disputes, litigations and project abandonment, cost and time over-run. Kasim *et al.* (2016) in their individual studies, stated that the adoption of effective procurement strategy – especially in acquiring materials - will ensure project success and clients' satisfaction. However, Linden and Josephson (2013) posited that the process of selecting the most appropriate procurement strategy for materials acquisition in a project primarily been a source of concern to the contractor. Consequently, understanding the main categories of risk faced in the materials procurement process will assist in risk assessment and planning, and devising the management and operational measures that will be taken to mitigate those risks (United Nations Procurement Practitioners Handbook, 2012).

The aforementioned challenges have become enormous problems faced by Nigerian construction companies in the management of materials procurement which is the bane of successful project delivery. It is against these backdrops that this study assesses the effect of building materials procurement risks in Abuja, with a view to recommending the endemic problems of materials procurement risks in building construction projects in Nigeria.

## **MATERIAL PROCUREMENT RISKS IN BUILDING CONSTRUCTION**

Procurement risk is defined as the possibility of failures in a procurement process (Harland *et al.*, 2013). Procurement risk includes; cost, quality, fraud, and delivery (Hatush and Skitmore, 2012). Kolenko (2016) states that risk in procurement is measured from a transactional point of view where risk management is dedicated to things that can go wrong in the procurement process. This transactional point of view is concerned with actions that may contribute towards failure to comply with the required procurement process, inadequacy of the procurement process to achieve the commercial outcome, and a break down in the procurement process (Sim and Pabala, 2012). Companies often overlook procurement decisions, and this may lead to major difficulties in completing the project (Martindale, 2015).

A construction company faces many challenges, which include discontinuity and disruption in the procurement of essential materials, unavoidable increases in project costs and in unit costs of purchased materials, both immediate and long-term loss of power and impact on relationships with essential suppliers, inability to meet customer demand, procurement functions that do not support organisational objectives, factors that weaken a company's ability to respond with speed and agility to meet changing circumstances, opportunity for fraud and corruption during the tendering process, and negative impact on reputation in the market place (Ritchie *et al.*, 2012). Fundamental challenges during procurement in the construction industry comprises of external factors such as labour, safety or other laws, nuclear pollution, supersonic bangs damage due to war, government policy on taxes, industrial disputes, and malicious damage to property (Teresa *et al.*, 2015). These challenges often give rise to procurement risk in the company (Muelbrook, 2012). Speculative risk is something which can be allocated in advance as decided by the parties in the contract (Seifbarghy, 2014). This may involve loss of

time and money, as a consequence of exceptionally adverse weather, unforeseeable shortages of labour or materials, unexpected ground conditions, and other similar difficulties beyond the control of the contractor (Zsidisin and Smith 2015). Ho *et al.*, 2015 have identified five categories of material procurement risks: macro, demand, manufacturing, supply and infrastructural (information, transportation, and financial) factors. Other external risks include floods, terrorism, strikes, natural disasters (Chacon *et al.*, 2011).

Rao and Goldsby (2015) expressed the need for a typology that explicitly identifies the potential sources of risk in the material procurement. They provided a comprehensive literature review on material procurement risk management and developed a typology of risk sources for the material procurement, comprising of industry factors (for instance new and existing competitors, fluctuations in users' demand and shifts in market supply), environmental factors (like war, changes in government policy or regulations, price fluctuations, and changes in interest rates), decision-maker related factors (like knowledge of decision makers), organizational factors (for instance raw materials shortages, machine failure, and labour uncertainties) and problem-specific factors (like complexity of decision tasks) (Saha, 2015). Given the comprehensiveness of Rao and Goldsby's (2015) literature review, it would be inappropriate to repeat similar details here and hence, their work can be adopted and tested in a new context (construction). Such analysis will provide valuable insights for researchers and practitioners who are interested in construction material procurement management. Hence, risk factors that may suit construction Material procurement in the Nigerian setting were identified. Table 1 shows the potential risks factors that are likely to occur in construction material procurement of building in Nigeria identified from literature.

## RESEARCH METHODOLOGY

This study adopted a survey design approach using quantitative data. Survey design was suitable for this study because the factors considered are those identified from the literature to which their applicability in construction project is to be verified. Data was collected through structured questionnaire administered to respondents within Abuja, the Federal Capital Territory (FCT) of Nigeria. Abuja was selected because it is one of the epicentre of construction activities in Nigeria. The targeted population for this research constitutes the major construction participants within Abuja. The population of this research constitutes 62 active building construction projects sites in Abuja, gotten from Federation of Construction Industry in Nigeria (FOCI directory, 2019).

Table 1: Potential Risks in Construction Material Procurement

S/N	RISK FACTORS
1.	Policy changes
2.	Fluctuations in prices
3.	Natural occurrences for instance fire
4.	Shortage of raw materials
5.	Unexpected changes in demand
6.	New and existing competitors
7.	Bad debt
8.	Changes in interest rates
9.	Uncertain research and development results
10.	Labour uncertainties (for instance strikes)
11.	Frequent changes in supply chain inputs

12. Fragmented decision-making
13. Quality/excessive snagging
14. Inappropriate design for scheme
15. Site impact on local community
16. Incompetency of site management
17. Volatility of supply chain workflow
18. Ineffectiveness of arrangements
19. New technology or technique
20. Inconsistency of suppliers
21. Inflexible design
22. Experience of subcontractors
23. Incompetency of project team
24. Security
25. Responsiveness of suppliers
26. Changes in quantity/scope of work
27. Inflation
28. Quality control and assurance
29. Difficulties/delays in availability of materials, equipment and labour
30. Bureaucratic problems
31. Inadequate specifications
32. Permit and approval
33. Owner and contractor experience
34. Site access/right of ways
35. Design changes
36. Third party delay and default
37. Financial failure-any party
38. Differing site conditions (unforeseen site conditions)
39. Delay in design/redesign if over budget
40. Exceptionally inclement weather

The population of 62 active construction sites were broken into sample frame constituting one each of the following respondents: procurement officers; project managers; site managers and contractors, making a total of 248 respondents within the study area. These respondents were selected because they are the key players in managing materials procurement risks in building projects. The value of 248 gotten from sample frame was subjected to Taro Yamane (Yamane, 1973) formula for finite population for determining sample size at 5% limit of error and at 95% confidence level. 248 was reduced to 153, which is the minimum sample size for this research. Therefore, a total of 139 questionnaires were retrieved out of the 153 distributed. 139 were found valid for the analysis, as 14 (14) were deemed invalid, because of poor responses. The 153 represents an effective response rate of 96.83% and this was considered suitable for analysis (Alreck and Settle, 1985).

This study adopted stratified random sampling method, because respondents were first categorized into different strata/groups, that is: procurement officers, project managers, site managers and contractors and they were selected and randomly sampled accordingly. Hence, Laerd Dissertation (2012) noted that probability sample require that every member of the population has a known and non-zero chance of being selected in the sample. A multi-choice type questionnaire was designed for this research. The questionnaire contains tables and check-boxes for easy selection of options by respondents. The questionnaires were structured in a

manner that allows respondents to select from the answer choices provided. The questionnaire reflects the major areas of the study interest, thereby, providing information relevant to the study objectives and answering the research questions. The questionnaire asked questions on a 5-point Likert scale.

The questionnaire was divided into two (2) main parts. Part A - is related to demographic information of the respondents and their companies. Part B- asked questions on the effect of the materials procurement risks on time, cost and quality performance of building projects.

Some of the questionnaires were collected same day of their administering, while others were collected from the respondents after some days. This is due to the level of engagement of most of the respondents who were too busy with site works to attend to the questionnaires immediately. In addition, the distances separating one construction sites to the other, contributed to the inability of the researcher to get all the questionnaires on same day. However, with a repeated visit and follow-up calls on the need for the questionnaires to be attended to, a good number of the respondents did give their responses and the questionnaires collected. In order to achieve the aim of this research, the descriptive method of analysing data was employed and this included the use of percentile and Mean Item Score (MIS).

## RESULTS AND DISCUSSION

This section presents and discusses the results of this study by linking the results to existing findings in the literature.

Demographic information of the respondents

Result in Table 2 shows that most of the respondents sampled (77.59%) are males while 22.41 % are females.

Table 21: Demographic information of the respondents

Category	Variables	Frequency	Valid percent
Gender	Male	107	77.59
	Female	32	22.41
	Total	139	100
Profession	Contractors	56	40.07
	Procurement officers	33	23.15
	Site managers	31	22.89
	Project managers	19	13.89
	Total	139	100
Years of Experience	Less than 5years	21	15.74
	5-10years	39	27.78
	11-20years	46	33.33
	21-30years	25	17.59
	Above 30	8	5.56
	Total	139	100
Academic qualification	ND	8	5.56
	HND	30	21.30
	BSc/Btech	75	53.70
	MSc/Mtech	17	12.96
	Others	9	6.48
	Total	139	100%

**Source:** Researcher's analysis (2020).

In terms of professionals' representation, the result revealed that contractors (40.07%) are more, followed by procurement officers (23.15%), then site managers (13.89%) and lastly project managers (13.89%). A look at the year of work experience of the respondents shows that only 15.74% of them have their year of working experience to fall within less than 5 years range, while 27.78% and 33.33% falls between the range of 5 to 10 and 11 to 20 years respectively. Also 17.59% and 5.56% of the population falls between the ranges of 21 to 30 years and above 30 years respectively. However, the average years of working experience of the respondents is calculated as approximately 10.75 years. This implies that they are experienced enough to give a valid response.

In terms of academic qualification, the highest is BSc/MTech (53.70%), followed by HND (21.30%), then MSc./MTech (12.96%), ND and Others are 5.56% and 6.48% respectively.

Based on the result on the respondents' background information, it was concluded that the respondents are well equipped professionally and in terms of experience to give reasonable insight in the subject under consideration.

Effect of the materials procurement risks on time, cost and quality performance of building projects

Table 3 shows the materials procurement risk factors that have high effect on time performance of building project are: inflexible design; new and existing competitors; unexpected changes in demand; inappropriate design for scheme; bad debt; design changes; inadequate specification; shortage of raw materials; force majeure; and delay in design/redesign if over budgeted.

Table 3: Effect of the materials procurement risks on time performance of building projects

S/No	Time performance risk factors	MIS	Rank	Decision
1	Inflexible design	3.99	1	Very High
2	New and existing competitors	3.95	2	Very High
3	Unexpected changes in demand	3.92	3	Very High
4	Inappropriate design for scheme	3.83	4	Very High
5	Bad debt	3.80	5	Very High
6	Design changes	3.71	6	Very High
7	Inadequate specification	3.66	7	Very High
8	Shortage of raw materials	3.65	8	Very High
9	Force majeure	3.64	9	Very High
10	Delay in design/redesign if over budget	3.54	10	Very High
11	Responsiveness of suppliers	3.53	11	Very High
12	Volatility of supply chain workflow	3.53	11	Very High
13	Exceptionally inclement weather	3.51	13	Very High
14	Incompetency of project team	3.49	14	High
15	Policy changes	3.46	15	High
16	Permit and approval	3.45	16	High
17	Ineffectiveness of arrangements	3.39	17	High

18	Bureaucratic problems	3.36	18	High
19	Incompetency of site management	3.32	19	High
20	Inconsistency of suppliers	3.18	20	High
21	Difficulties/delays in availability of materials, equipment and labour	3.14	21	High
22	Site access/right of ways	3.00	22	High
23	Financial failure-any party	3.00	23	High
24	Differing site conditions (unforeseen site conditions)	3.00	24	High
25	Experience of subcontractors	2.96	25	High
26	Third party delay and default	2.71	26	High
27	Owner and contractor experience	2.57	27	High
28	Changes in quantity/scope of work	2.36	28	Moderate

Source: Researcher’s Field Survey (2020).

The MIS values are 3.99, 3.95, 3.92, 3.83, 3.80, 3.71, 3. 3.66, 3. 3.65, 3. 3.64, 3. 3.54 respectively. These findings are in line with the conclusion of Helbing *et al.* (2016) that the risks have high effect on materials procurement of building projects. However, differing site conditions (unforeseen site conditions); experience of subcontractors; third party delay and default; owner and contractor experience; changes in quantity/scope of work with MIS values of 3.00, 2.96, 2.71, 2.57, 2.36 has the least effect on time performance of building project.

#### Effect of the materials procurement risks on cost performance of building projects

Table 3 indicates that the materials procurement risk factors that have high effect on cost performance of building project are: inflation; quality control and assurance; new technology or technique; difficulties/delays in availability of materials, equipment and labour; security; labour unrest; bureaucratic problems; fluctuations in prices; owner and contractor experience; and changes in quantity/scope of work with MIS values of 3.99, 3.90, 3.89, 3.87, 3.80, 3.79, 3.76, 3.75, 3.74, 3.73 respectively. The least effect on cost performance of building project are: shortage of raw materials; site impact on local community; unexpected changes in demand; inadequate specifications; financial failure-any party with MIS values of 3.24, 3.19, 3.14, 3.09, 2.99 respectively.

Table 3: Effect of the materials procurement risks on cost performance of building projects

S/N	Cost performance risk factors	MIS	Rank	Decision
1	Inflation	3.99	1	Very High
2	Quality control and assurance	3.90	2	Very High
3	New technology or technique	3.89	3	Very High
4	Difficulties/delays in availability of materials, Equipment and labour	3.87	4	Very High
5	Security	3.80	5	Very High
6	Labour uncertainties (for instance strikes)	3.79	6	Very High
7	Bureaucratic problems	3.76	7	Very High
8	Fluctuations in prices	3.75	8	Very High

9	Owner and contractor experience	3.74	9	Very High
10	Changes in quantity/scope of work	3.73	10	Very High
11	Changes in interest rates	3.71	11	Very High
12	Bad debt	3.67	12	Very High
13	Frequent changes in supply chain inputs	3.51	13	Very High
14	Policy changes	3.47	14	High
15	Force majeure	3.41	15	High
16	Design changes	3.38	15	High
17	New and existing competitors	3.38	17	High
18	Uncertain research and development results	3.37	17	High
19	Differing site conditions (unforeseen site conditions)	3.37	19	High
20	Changes in quantity/scope of work	3.27	20	High
21	Shortage of raw materials	3.24	21	High
22	Site impact on local community	3.19	22	High
23	Unexpected changes in demand	3.14	23	High
24	Inadequate specifications	3.09	24	High
25	Financial failure-any party	2.99	25	High

Source: Researcher's Field Survey (2020).

#### Effect of the materials procurement risks on quality performance of building projects

Table 4 shows that the materials procurement risk factors that have high effect on the quality performance of building project are: differing site condition (unforeseen ground conditions); changes in interest rates; incompetency of site management; responsiveness of suppliers; quality control and assurance; inflexible design; inconsistency of supplies; bad debt; changes in quantity/scope of work; force majeure with MIS values of 3.96, 3.95, 3.91, 3.91, 3.87, 3.82, 3.81, 3.75, 3.75, 3.74 respectively. The least effect on Quality performance of building project are: quality/excessive snagging; labour uncertainties (for instance strikes); frequent changes in supply chain inputs; inadequate specifications; owner and contract experience with MIS values of 3.67, 3.66, 3.65, 3.60, 3.58 respectively.

Table 4: Effect of the materials procurement risks on quality performance of building projects

S/No	Quality performance risk factors	MIS	Rank	Decision
1	Differing site condition (unforeseen ground conditions)	3.96	1	Very High
2	Changes in interest rates	3.95	2	Very High
3	Incompetency of site management	3.91	3	Very High
4	Responsiveness of suppliers	3.91	3	Very High
5	Quality control and assurance	3.87	5	Very High
6	Inflexible design	3.82	6	Very High



7	Inconsistency of suppliers	3.81	7	Very High
8	Bad debt	3.75	8	Very High
9	Changes in quantity/scope of work	3.75	8	Very High
10	Force majeure	3.74	10	Very High
11	Incompetency of project team	3.71	11	Very High
12	Shortage of raw materials	3.69	12	Very High
13	Experience of subcontractors	3.69	12	Very High
14	Unexpected changes in demand	3.67	14	Very High
15	Quality/excessive snagging	3.67	14	Very High
16	Labour uncertainties (for instance strikes)	3.66	16	Very High
17	Frequent changes in supply chain inputs	3.65	17	Very High
18	Inadequate specifications	3.60	18	Very High
19	Owner and contract experience	3.58	19	Very High

Source: Researcher's Field Survey (2020).

## CONCLUSION AND RECOMMENDATIONS

The challenges involved in materials procurement in building projects, risks still remains a serious problem requiring urgent attention in the Nigerian building construction industry. This problem could be attributed to little understanding of materials procurement risk management strategies by procurement officers, project managers and contractors which is affecting the performance of building projects. This research assessed the effect of materials procurement risks factors on time, cost and quality performance of building projects in Abuja, Nigeria. The study concludes that the inherent building materials procurement risks in building projects are: inflation; third party delay and default; uncertain research and development results; ineffectiveness of arrangements; shortage of raw materials and quality/excessive snagging.

The study concludes that the building materials procurement risks that impact more on cost, time and quality performance of building project are: Inflexible design; unexpected changes in demand; bad debt; inflation; quality control and assurance; security; differing site condition; responsiveness of suppliers; and quality control and assurance.

Based on this conclusion, it can be recommended that a competent procurement officers having good pricing and negotiation skills be appointed for building material procurement on construction sites and to also prevent risks due to time, the contractor ought to create contract provisions and project processes to create a clear expectation of the temporal requirements for planning, producing, and managing the project.

## REFERENCES

- Aibinu, A. A., & Odeyinka, H.A. (2016). Construction delays and their causative factors in Nigeria. *Journal of Construction and Management*, 132(7):667-677.
- Alreck, P.L., & Settle, R.B. (1995). *The Survey Research Handbook*, 2<sup>nd</sup> edition. Chicago: Irwin
- Amusan, L. M., Dosunmu, D., & Joshua, O. (2017). Cost and time performance information of building projects in developing economy. *International Journal of Mechanical Engineering and Technology*, 8(10): 918-927
- Bossink, B., & Brouwers, H. (2015). Construction Waste: Quantification and Source Evaluation. *Journal of Construction Engineering and Management*. Retrieved from <http://www.tue.nl/en/publication/ep/p/d/ep-uid/231803>.
- Chacon, N., Doherty, S., Hayashi, C., & Green, R. (2011). New models for addressing supply chain and transport risk. Risk Response Network.
- Formoso, C. T., Soibelman, L. M., Cesare, C. D., & Isatto, E. L. (2012) Materials Waste in Building Industry: Main causes and prevention. *Journal of Construction Engineering and Management*, 128(4): 316-325.
- Glass, J., Osmani, M., & Price, A. (2014). Architect's Perspective on Construction Waste Reduction by Design. Retrieved from [www.lib.purdue.edu](http://www.lib.purdue.edu).
- Gulghane, A. A., & Khandve, P. V. (2015). Management for Construction Materials and Control of Construction Waste in Construction Industry: A Review. *International Journal of Engineering Research and Applications*, 5(4): 59-64
- Harland, C., Brenchley, R., & Mulde, H. (2013). Risk in supply networks. [Internet:<https://www.researchgate.net/publication/223757629> Risk in Supply Network 21 (8):18-25
- Hatush, Z., & Skitmore, M. (2012). Contractor selection using multicriteria utility theory: An additive model. *Building and Environment*, 7(33):105-115.
- Helbing, E. I., Kusterer, D. J., & Schmitz, P. W. (2016). Public-private partnerships versus traditional procurement: An experimental investigation. *Journal of Economic Behaviour & Organization*, 89(14):145-166.
- Ho, W., Zheng, T., Yildiz, H., & Talluri, S. (2015). Supply chain risk management: a literature review. *International Journal of Production Research*, 53(16):5031-5069.
- Ibironke, O. T. (2013). Analysis of Non-Excusable Delay Factors Influencing Contractors' Performance in Lagos State, Nigeria, *Journal of Construction in Developing Countries*, 18(1): 53-72
- Kasim, N., Liwan, S. R., Shamsuddin, A., Zainal, R., & Che Kamaruddin, N. (2016). Improving on-site materials tracking for inventory management in construction projects. Proceeding *International Conference of Technology Management, Business and Entrepreneurship*: 447-452.
- Khyomesh, V. P., & Vyas, C. M. (2011). Construction material management on project sites. National conference on recent trends in engineering and technology.
- Kolenko, S. (2016). Supply chain management. [Internet:<https://www.crs.org/sites/default/files/crsfiles/institutional-strengthening-supply-chain-management>, 13(7):23-42
- Laerd Dissertation (2012). Total Population Sampling. Retrieved June 2019 from <http://dissertation.laerd.com/total-population-sampling.php>
- Martindale, N. (2015). Rising risks in supply chain. [Internet:[http://www.scrlic.com/articles/ Supply Chain Risk Management](http://www.scrlic.com/articles/Supply%20Chain%20Risk%20Management). A Compilation of Best Practices, 21(1):47-55.
- Muelbrook. (2012). Managing risk in virtual enterprise networks: implementing supply chain strategy, 22(6):101-109.)
- Patil, A. R., & Pataskar, S. V. (2013). Analysing Material Management Techniques on Construction Project, *International Journal of Engineering and Innovative Technology*, 3(4): 96-100

- Rao, S., & Goldsby, T. J. (2015). Supply Chain Risks: A Review and Typology. *The International Journal of Logistics Management*, 20 (1):97-123.
- Poon, C. S., Yu, A. T. W., & Jaillon, L. (2014). Reducing building waste at construction sites in Hong Kong. *Construction Management and Economics*, 22 (6): 461–470.
- Ritchie, B., & Brindley, C. (2012). Supply chain risk management and performance: A guiding framework for future development. *International Journal of Operations and Production Management*, 27(3):303-322.
- Saha, P. M. (2015). Asia-Pacific Supply Chain Management: Weak Links in Bangladesh, *The Ethical Corporation Magazine*, available at: [www.ethicalcorp.com/content.asp?ContentID.4865](http://www.ethicalcorp.com/content.asp?ContentID.4865).
- Saidu, I., & Shakantu, W. (2016). The contributions of construction material waste to project cost overruns in Abuja, Nigeria. *Acta Structilia*, 23(1):99-113.
- Seifbarghy, M. (2014). Measurement of Supply Risk and Determining Supply Strategy, 8(40):1-5
- Sim, B., & Pabala, L. (2012). Reconceptualizing the Determinants of Risk Behavior. *The Academy of Management Review* 15-21. [Internet:<http://www.jstor.org/stable/258646?seq=1>;
- Teresa, P., Blackhurst, B., & Vellayappan, C. (2015). A Model for Inbound Supply Risk Analysis.
- Tunji-Olayeni, P. F & Omuh, I. O. (2013). Strategies for improving indigenous contractors' participation in research and development in Nigeria. Retrieved from [www.eprints.covenantuniversity.edu.ng](http://www.eprints.covenantuniversity.edu.ng)
- United Nations Procurement Practitioners Handbook. (2012). *Risk Management, risk types and effects*. Retrieved from <https://www.ungm.org/Areas/Public/pph/ch04s01.html>
- Zsidsin, G., & Smith, M. (2015). Managing supply risk with early supplier involvement: A case study and research propositions, 221(18):3-5.