E-ISSN:2250-0758
P-ISSN:2394-6962
Research Article
Risk Analysis

International Journal of Engineering and Management Research

2026 Volume 16 Number 3 June

Publisher
Vandana Publications
www.vandanapublications.com

Risk Analysis and Mitigation for a Concrete manufacturing Company in Port Harcourt, Nigeria

Oba KM[1*]

DOI:10.31033/IJEMR/16.3.2026.1918

[1*] Kenneth Miebaka Oba, Department of Civil Engineering, Rivers State University, Port Harcourt, Nigeria.

Risk is a likelihood of an adverse event to occur, thereby causing a negative impact. This paper studies a case of Okonto Concrete Manufacturing Company, located in Port Harcourt, Nigeria. Flood disaster within and around the company's plant site resulted in a chemical spill, which posed major risks cutting across aquatic life, health of staff and community residents, local authorities, and the company's economic performance. An analysis of Political, Economic, Social, Technological, Legislative, Environmental, and Competitive (PESLEC) risks was carried out. The risks were identified using Ishikawa's (fishbone) diagram. The PESTLEC analysis and mitigation resulted in recommended actions to be taken with those to be responsible for each action, at various timelines. The analysis and mitigation plans were designed for a period of one year, within which the company would be able to recover and address major staff, community, and government concerns. However, this research recommends further studies to address full disaster recovery plan to ensure complete restoration of the company's value chain.

Keywords: Concrete Manufacturing, Flood Disaster, PESLEC Analysis, Risk Analysis, Risk Mitigation

Corresponding Author

Kenneth Miebaka Oba, Department of Civil Engineering, Rivers State University, Port Harcourt, Nigeria.
Email: kenneth.oba@ust.edu.ng

How to Cite this Article

Oba KM, Risk Analysis and Mitigation for a Concrete manufacturing Company in Port Harcourt, Nigeria. Int J Engg Mgmt Res. 2026;16(3):66-70.
Available From
https://ijemr.vandanapublications.com/index.php/j/article/view/1918

To Browse

Manuscript Received	Review Round 1	Review Round 2	Review Round 3	Accepted
2026-05-06	2026-05-21			2026-06-08

Conflict of Interest	Funding	Ethical Approval	Plagiarism X-checker	Note
None	Nil	Yes	4.11	

1. Introduction

Okonto Concrete Manufacturing Company produces concrete in commercial quantities, which are distributed throughout Port Harcourt, the Rivers State capital, in Nigeria. The company has a concrete manufacturing plant situated outside in the Port Harcourt and is relatively close to three housing estates and a small village, which in total have a population of 3,000 people. A major river also passes directly alongside the plant site boundary. The river is a successful habitat for salmon and other species of wildlife. Concrete manufacturing is the central and the most profitable part of the Okonto concrete manufacturing company's business without which it would be difficult to survive. The manufacturing plant has been in its current location for over 20 years and is a prime location because of a major road utilized to transport raw materials such as sand, cement, granite, and chemicals such as admixtures, as well as finished products (concrete).

Recently, unusually heavy rains have caused the river to overflow its banks. This flooded the site and caused a large chemical leak from the company's storage tanks into the river. As a result, a section of the local community has been quite vocal with their objection to the company's continued presence at the site. However, because the company employs approximately 1,250 persons the majority of whom are from the nearby residential areas, there is a general tolerance to the company's business. Whilst the local authority would prefer the company to relocate, they cannot enforce the move through the planning laws as the site carries immunity. They are also acutely aware of the company's contribution to the area as a major employer. This problem of risks from the company's workforce, neighbouring community, and government, can also have an adverse effect on the company's economic performance.

A study carried out by [1] was focused on a comprehensive review of flood management and various approaches to address the risks involved. Their study recommended social and environmental aspects of flood management, and how the flood management factors can be evaluated in terms of risk. [2] also highlighted some international best practices in flood risk management strategies in Nigeria. They recommended stakeholder collaboration, adoption of innovative flood risk adaptation strategies, investment in flood risk research, strengthening of institutional framework, and increased public awareness and education on flood risks in Nigeria. While previous studies have addressed flood related risks, none has addressed them politically, socially, economically, environmentally, competitively, technologically, and legally in a wholistic manner, in any construction related sector of Nigeria. This gap will be addressed by identifying the risks, and qualitatively analysing them using the Political, Economic, Social, Technological, Legislative, Environmental, and Competitive (PESTLEC) analysis. This concept has been used by several researchers [3], [4], [5], [6], [7], [8] to analyse and manage risks.

Risk is an uncertain effect on project performance [9]. It can be defined as the combination of two variables: the probability that an adverse event will occur and the impact it will have on the goals of the business [10]. The significant risks faced by an organization should be reviewed, examining the risks acceptable, the likelihood of their materializing, and the ability to reduce their impact if they do occur, also bearing in mind the costs and benefits of particular controls [11]. Risk Identification (or profiling or perception) is the subjective judgment that people make about the characteristics and severity of a risk [12]. Projects are exposed [13] to both internal risks (financial, design, contractual, construction, personal, involved parties and operational risks) and external risks (economic, social, political, legal, public, logistical and environmental risks). Hence risks should be analysed and mitigated both internally and externally.

2. Methodology

The risk involved in this case study is a fundamental static risk, since it occurred in a society, and is a natural disaster, such that the concerned individuals or firm has little or no control over it. The steps to be taken are: Profiling or identification of the risks; assessment and analysis; and mitigation.

A. Risk Identification and Profiling

To identify the risks the Ishikawa (fishbone) cause – and – effect diagram as shown in Figure 1 was used for the following categories:

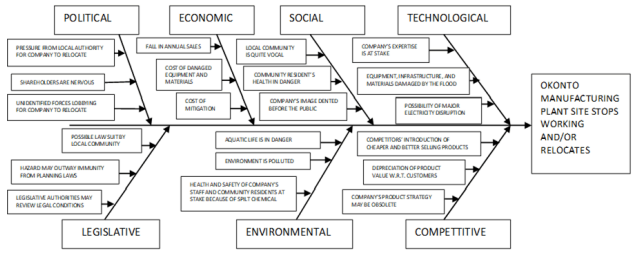

Figure 1: Ishikawa (Fishbone) Diagram

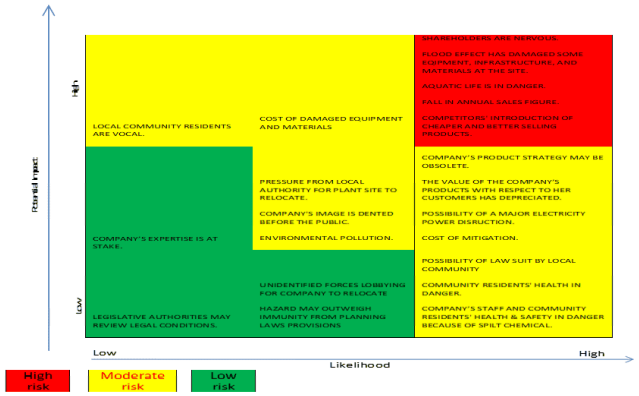

Figure 2: Probability Impact Matrix to Prioritize the Risks

B. Risk Assessment and Analysis

The method of analysis used is the qualitative risk analysis approach. This approach involves considering each risk in a purely descriptive manner to imagine various characteristics and the effect that it might have on the project or organisation. The qualitative analysis approach used is the PESTLEC analysis to tackle the external risks. This is an acronym described as:

Political
Economic
Social
Technological
Legislative
Environmental
Competitive

This analysis shall provide mitigation within one year. Within that period, the company will be able to gradually recover from the disasters and the economic downturn, as well as win more customers.

3. Results

The PESTLEC analysis in Table 1 below gives an analysis of the risks, showing the likelihoods, categories, impacts, and the possible mitigation routes.

Table 1: PESTLEC risk analysis table

RISK SOURCE	TASK	RISK FACTOR	RISK EVALUATION		COMMENT	RISK RESPONSE	ACTION BY (RESPONSIBILITY)
			LIKELIHOOD (L,M,H)	SIVERITY (L,M,H)			
POLITICAL	RELATIONSHIP BETWEEN COMPANY AND POLITICAL LEADERS, AS WELL AS SHAREHOLDERS	SHAREHOLDERS ARE NERVOUS	HIGH (H)	HIGH (H)	SHARE HOLDERS HAVE INVESTED LOTS OF MONEY	MITIGATION	MANAGING DIRECTOR
		PRESSURE FROM LOCAL AUTHORITY FOR PLANT SITE TO RELOCATE	MODERATE (M)	MODERATE (M)	THEY ARE RESTRICTED BY PLANNING LAW	MITIGATION	PUBLIC RELATIONS OFFICER
		UNIDENTIFIED FORCES LOBBYING FOR COMPANY TO RELOCATE	MODERATE (M)	LOW (L)	SOME UNKNOWN INVESTOR MAY WANT TO TAKE OVER	RETENTION	PUBLIC RELATIONS OFFICER
ECONOMIC	COMPANY'S FINANCIAL CAPITAL AND EXPENDITURE	FALL IN ANNUAL SALES FIGURE	HIGH (H)	HIGH (H)	THIS HAS CONTINUED FOR TWO YEARS	MITIGATION	MARKETING MANAGER
		COST OF DAMAGED EQUIPMENT AND MATERIALS	MODERATE (M)	HIGH (H)	THE FLOOD WAS SO INTENSE	TRANSFER	INSURANCE COMPANY
		COST OF MITIGATION	HIGH (H)	MODERATE (M)	MONEY HAS TO BE SPENT TO TREAT THE HAZARDS	TRANSFER	INSURANCE COMPANY
SOCIAL	COMPANY'S RELATIONSHIP AND ACTIVITIES WITH THE COMMUNITY	LOCAL COMMUNITY RESIDENTS ARE VOCAL	LOW (L)	HIGH (H)	THEY CANNOT BE QUIET ANYMORE	MITIGATION	PROJECT MANAGER
		COMMUNITY RESIDENTS' HEALTH IN DANGER	HIGH (H)	LOW (L)	THEY COULD FALL SICK	TRANSFER	INSURANCE COMPANY
		COMPANY'S IMAGE IS DENTED BEFORE THE PUBLIC	MODERATE (M)	MODERATE (M)	THE COMPANY'S IMMAGE SHOULD NOT BE COMPROMISED	MITIGATION	PUBLIC RELATIONS OFFICER
TECHNOLOGICAL	COMPANY'S UTILITY OF EQUIPMENT AND EXPERTISE	FLOOD EFFECT HAS DAMAGED SOME EQIPMENT, INFRASTRUCTURE, AND MATERIALS AT THE SITE	HIGH (H)	HIGH (H)	THIS IS BAD NEWS FOR COMPANY'S PRODUCTION	MITIGATION	PROJECT MANAGER
		POSSIBILITY OF ELECTRICITY POWER FAILURE	HIGH (H)	MODERATE (M)	ELECTRIC POLES AND CABLES MAY HAVE FALLEN	MITIGATION	CONTROL SYSTEMS AND INSULATION/ MANAGER
		COMPANY'S EXPERTISE IS AT STAKE	LOW (L)	MODERATE (M)	THERE MAY BE NEED TO INVOLVE EXPERTS	MITIGATION	COMPANY EXECUTIVES
LEGISLATIVE	COMPANY'S LEGAL AFFAIRS	POSSIBILITY OF LAW SUIT BY LOCAL COMMUNITY	HIGH (H)	LOW (L)	THEY MAY BE MAKING SUCH PLANS, SINCE THERE IS IMMUNITY OF PLANNING LAW	TRANSFER	COMPANY's SOLICITORS
		HAZARD MAY OUTWEIGH IMMUNITY FROM PLANNING LAWS PROVISIONS	MODERATE (M)	LOW (L)	THE HAZARD COULD GET WORSE	TRANSFER	COMPANY's SOLICITORS
		LEGISLATIVE AUTHORITIES MAY REVIEW LEGAL CONDITIONS	LOW (L)	LOW (L)	LAWS DO CHANGE	TRANSFER	COMPANY's SOLICITORS
ENVIRONMENTAL	THE VALUE AND DESIRABLE LOCATION WITH RESPECT OF COMPANY'S PRODUCTS TO THE FLOOD	AQUATIC LIFE IS IN DANGER	HIGH (H)	HIGH (H)	SALMON AND OTHER AQUATIC LIFE COULD BE AFFECTED	TRANSFER	INSURANCE COMPANY
		COMPANY'S STAFF AND COMMUNITY RESIDENTS' HEALTH AND SAFETY IN DANGER BECAUSE OF SPILT CHEMICAL	HIGH (H)	LOW (L)	COMPANY SHOULD BE HEALTH AND SAFETY CONSCIOUS	TRANSFER	INSURANCE COMPANY
		ENVIRONMENTAL POLLUTION	MODERATE (M)	MODERATE (M)	PEOPLE INHALE THE EMMITTED SMELL FROM THE CHEMICAL	TRANSFER	TRANSFER
COMPETITIVE		COMPETITORS' INTRODUCTION OF CHEAPER AND BETTER SELLING PRODUCTS	HIGH (H)	HIGH (H)	THEY MUST HAVE DONE A PRODUCT REVIEW	RETENTION	VALUE ENGINEER OR PROJECT MANAGER
		THE VALUE OF COMPANY'S PRODUCTS WITH RESPECT TO HER CUSTOMERS MAY HAVE DEPRECIATED	HIGH (H)	MODERATE (M)	CUSTOMERS' SATISFACTION IS OF A GREAT ESSENCE	MITIGATION	MARKETING MANAGER
		COMPANY'S PRODUCT STRATEGY MAY BE OBSOLETE	HIGH (H)	MODERATE (M)	THIS WAS LAST MODIFIED TWO YEARS AGO	MITIGATION	PROJECT MANAGER

A. Risk Mitigation

The last step taken in the risk management process is the mitigation. Table 2 gives details of the mitigation actions, as well as, who should be responsible for what action, and at what point should each mitigation process or action take place. This has been [14] as a result of working through each of the threats and opportunities identified and recorded earlier.

Table 2: Risk mitigation and register

RISK SOURCE	TASK	RISK FACTOR (WITH SIVERITY)	RISK RESPONSE	RESPONSE REACTION	RESPONSIBILITY	ACTION DATE	INTERVAL
POLITICAL	RELATIONSHIP BETWEEN COMPANY AND COMMUNITY LEADERS, AS WELL AS SHAREHOLDERS	SHAREHOLDERS ARE NERVOUS (H)	MITIGATION	BRAIN STORM WITH COMPANY EXECUTIVES AND UPDATE SHAREHOLDERS OF THE WAY FORWARD	MANAGING DIRECTOR	IMMEDIATELY	ONCE IN THREE MONTHS
		PRESSURE FROM LOCAL AUTHORITY FOR PLANT SITE TO RELOCATE (M)	MITIGATION	ARRANGE MEETINGS FOR DIALOGUE	PUBLIC RELATIONS OFFICER	IN THREE WEEKS	ONCE IN SIX MONTHS
		UNIDENTIFIED FORCES LOBBYING FOR COMPANY TO RELOCATE (L)	RETENTION	INVESTIGATE THE PEPETRATORS AND RESIST THEM IF FOUND	PUBLIC RELATIONS OFFICER	IMMEDIATELY	THROUGH THE PROJECT'S LIFE CYCLE
ECONOMIC	COMPANY'S FINACIAL OUTLAY TO EXPENDITURE	FALL IN ANNUAL SALES FIGURE (H)	MITIGATION	MORE ADVERTISING AND PROMOTIONS	MARKETING MANAGER	IN ONE WEEK	DAILY
		COST OF DAMAGED EQUIPMENT AND MATERIALS (H)	TRANSFER	TRANSFER TO INSURANCE COMPANY	INSURANCE COMPANY	IMMEDIATELY	THROUGH THE PROJECT'S LIFE CYCLE
		COST OF MITIGATION (H)	TRANSFER	MAKE A PLAN AND BUDGET, AND TRANSFER TO INSURER	INSURANCE COMPANY	IMMEDIATELY	THROUGH A PERIOD OF ONE YEAR
SOCIAL	COMPANY'S RELATIONSHIP AND CONFLICTS WITH THE COMMUNITY	LOCAL COMMUNITY RESIDENTS ARE VOCAL (H)	MITIGATION	COMPENSATE THEM WITH INCENTIVES	PROJECT MANAGER	IN ONE MONTH	ONCE IN FOUR MONTHS
		COMMUNITY RESIDENTS' HEALTH IN DANGER (L)	TRANSFER	THEY COULD FALL SICK	INSURANCE COMPANY	IN ONE WEEK	THROUGH PROJECT'S LIFE CYCLE
		COMPANY'S IMAGE IS DENTED BEFORE THE PUBLIC (M)	MITIGATION	ENLIGHTEN THE PUBLIC OF THE PROBLEM AND POSSIBLE SOLUTIONS	PUBLIC RELATIONS OFFICER	IN THREE MONTHS	ONCE IN TWO MONTHS
TECHNOLOGICAL	COMPANY'S UTILITY OF EQUIPMENT AND EXPERTISE	FLOOD EFFECT HAS DAMAGED SOME EQIPMENT, INFRASTRUCTURE, AND MATERIALS AT THE SITE (H)	MITIGATION	PREPARE A DISASTER RECOVERY PLAN AND INFORM INSURER	PROJECT MANAGER	IMMEDIATELY	ONCE
		POSSIBILITY OF ELECTRICITY POWER FAILURE (M)	MITIGATION	PROVIDE BACKUP ELECTRICITY	CONTROL SYSTEMS AND INSULATION MANAGER	IN ONE WEEK	THROUGH THE PROJECT'S LIFE CYCLE
		COMPANY'S EXPERTISE IS AT STAKE (M)	MITIGATION	INVOLVE FLOOD AND EROSION EXPERTS	COMPANY EXECUTIVES	IN TWO MONTHS	THROUGH A SIX-MONTH PERIOD
LEGISLATIVE	COMPANY'S LEGAL ASPARS	POSSIBILITY OF LAW SUIT BY LOCAL COMMUNITY (L)	TRANSFER	INFORM SOLICITORS ABOUT IT	COMPANY's SOLICITORS	IN TWO MONTHS	THROUGH THE PROJECT'S LIFE CYCLE
		HAZARD MAY OUTWEIGH IMMUNITY FROM PLANNING LAWS PROVISIONS (L)	TRANSFER	INFORM SOLICITORS ABOUT IT	COMPANY's SOLICITORS	IN THREE MONTHS	THROUGH THE PROJECT'S LIFE CYCLE
		LEGISLATIVE AUTHORITIES MAY REVIEW LEGAL CONDITIONS (L)	TRANSFER	INFORM SOLICITORS ABOUT IT	COMPANY's SOLICITORS	IN SIX MONTHS	THROUGH THE PROJECT'S LIFE CYCLE
ENVIRONMENTAL	SITE LOCATION WITH RESPECT TO THE FLOOD	AQUATIC LIFE IS IN DANGER (H)	TRANSFER	TRANSFER TO INSURANCE COMPANY	INSURANCE COMPANY	IMMEDIATELY	THROUGH A SIX-MONTH PERIOD
		COMPANY'S STAFF AND COMMUNITY RESIDENTS' HEALTH AND SAFETY IN DANGER BECAUSE OF SPILT CHEMICAL (M)	TRANSFER	TRANSFER TO INSURANCE COMPANY	INSURANCE COMPANY	IN ONE MONTH	THROUGH THE PROJECT'S LIFE CYCLE
		ENVIRONMENTAL POLLUTION (M)	TRANSFER	TRANSFER TO FLOOD AND ERROSION EXPERTS	TRANSFER	IN ONE MONTH	THROUGH A SIX-MONTH PERIOD
COMPETITIVE	THE VALUE AND DEMAND OF COMPANY'S PRODUCTS	COMPETITORS' INTRODUCTION OF CHEAPER AND BETTER SELLING PRODUCTS (H)	RETENTION	CARRY OUT A VALUE CHAIN ANALYSIS	VALUE ENGINEER OR PROJECT MANAGER	IN ONE WEEK	ONCE IN SIX MONTHS
		THE VALUE OF OUR PRODUCTS WITH RESPECT TO OUR CUSTOMERS MAY HAVE DEPRECIATED (M)	MITIGATION	MAKE A TEMPORARY TRIAL DISCOUNT	MARKETING MANAGER	IN TWO MONTHS	ONCE IN THREE MONTHS
		OUR PRODUCT STRATEGY MAY BE OBSOLETE (M)	MITIGATION	INTRODUCE THE SIX-SIGMA CONCEPT TO IMPROVE PRODUCTION STRATEGY	PROJECT MANAGER	IN ONE MONTH	ONCE IN SIX MONTHS

4. Conclusion

The flood disaster that befell Okonto concrete manufacturing company's plant site encountered risks capable of crumbling the company's business. This study has provided a risk management solution by way of applying the PESTLEC analysis. The risks were identified using Ishikawa's (fishbone) diagram. The assessment and mitigation were carried out with recommended responsible personnel, actions and timelines. These solutions were designed for a period of one year, within which the company is expected to gradually recover as well as settle staff, community and government concerns. However, the value chain of the company is also at a major risk. This was not fully addressed in this study. It is therefore recommended that further studies be carried out to address a comprehensive disaster recovery plan, in order to revitalise the company's value chain.

References

[1] M. A. U. R. Tariq, R. Farooq, & N. Van De Giesen. (2020). A critical review of flood risk management and the selection of suitable measures. *Applied Sciences*, *10*(3), 8752. DOI: 10.3390/app10238752.

[2] S. W. Johnbull, E. Chinem, & T. D. Ikiriko. (2024). Adapting to flood risks in a changing climate: Best practices and innovations. *International Journal of Advances in Engineering and Management (IJAEM)*, *6*, 225. DOI: 10.35629/5252-0601225246.

[3] P. P. Morita, S. Abhari, J. Kaur, M. Lotto, P. A. D. S. E. S. Miranda, & A. Oetomo. (2023). Applying ChatGPT in public health: A SWOT and PESTLE analysis. *Frontiers Media SA*. DOI: 10.3389/fpubh.2023.1225861.

[4] M. Mihailova. (2020). The state of agriculture in Bulgaria-PESTLE analysis. *Bulgarian Journal of Agricultural Science*, *26*(5), 935–943. Accessed: Jun. 07, 2026. [Online]. Available: https://www.lex.bg/laws/

[5] H. V. Belsare. (2025). PESTLE analysis. *Int. J. Adv. Res. (Indore).*, *13*(02), 608–612. DOI: 10.21474/IJAR01/20411.

[6] S. Achinas, J. Horjus, V. Achinas, & G. J. W. Euverink. (2019). A PESTLE analysis of biofuels energy industry in Europe. *Sustainability, 11*(21), 5981. DOI: 10.3390/SU11215981.

[7] J. Song, Y. Sun, & L. Jin. (2017). PESTEL analysis of the development of the waste-to-energy incineration industry in China. *Renewable and Sustainable Energy Reviews*, *80*, 276–289. DOI: 10.1016/j.rser.2017.05.066.

[8] C. Zalengera, R. E. Blanchard, P. C. Eames, A. M. Juma, M. L. Chitawo, & K. T. Gondwe. (2014). Overview of the Malawi energy situation and A PESTLE analysis for sustainable development of renewable energy. *Renewable and Sustainable Energy Reviews, 38*, 335–347. DOI: 10.1016/J.RSER.2014.05.050.

[9] C. Chapman & S. Ward. (2026). *Project risk management. process, techniques and insights.* (2nd ed.). Chichester: John Wiley and Sons. Accessed: Jun. 07, 2026. [Online]. Available: http://www.amazon.com/gp/sitbv3/reader/104-0890916-9048748?%5Fencoding=UTF8&asin=0471958042

[10] S. S. Bonham. (2008). *Actionable strategies through integrated performance, process, project, and risk management*. Artech House.

[11] J. Pickford. (2026). *Mastering risk: Concepts*. Hallow: Financial Times

Prentice Hall, 2001. Accessed: Jun. 07, 2026. [Online]. Available: http://books.google.co.uk/books/about/Mastering_Risk.html?id=GoeOG_iIB00C&pgis=1

[12] R. Singh, & A. Bhowal. (2011). Development of marketing-driven measure of risk perception. *The Journal of Risk Finance*, *12*(2), 140–152. DOI: 10.1108/15265941111112857.

[13] N. Van Thuyet, S. O. Ogunlana, & P. Kumar Dey. (2007). Risk management in oil and gas construction projects in Vietnam. *International Journal of Energy Sector Management*, *1*(2), 175–194. DOI: 10.1108/17506220710761582.

[14] Martin. Loosemore, John. Raftery, Charlie. Reilley, & Dave. Higgon. (2012). *Risk management in projects*. (2nd ed.). Routledge. Accessed: Jun. 07, 2026. [Online]. Available: https://books.google.com/books/about/Risk_Management_in_Projects.html?id=iV4OpqFQiQgC