

# Environmental risk: exploring organisational resilience and robustness

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**Abstract**— This study examines the relevance and practical application of organisational resilience and robustness model within the context of environmental risk and disaster risk management. With a critical review and description of organisational resilience and robustness, as well as presenting a logical précis of its practical application in a real-life disaster risk science and management, the theoretical debates and implications of various perspectives of resilience and robustness have been carefully explored and practical clarification derived. The concepts of resilience and robustness are gaining increasing acceptance within disaster risk science and management given the fact that risks, crises and disasters are not easily eliminated or prevented from human environments. In the present study, an attempt has been made to address such uncertainty through critical phases in organisational resilience and robustness model, which has been applied in the experience of multinational oil companies in the Niger delta region of Nigeria. Significant findings are most critical to overcoming risk homeostasis and resistance hypothesis, the link of both concepts of which have constrained innovation in disaster risk science and management. Arguably, understanding these links and the phases involved in organisational resilience and robustness is vital to effective management of environmental risks and disasters. It is shown that there are 13 indicators of organisational resilience and 7 indicators of organisational robustness. These indicators along with the critical phases in organisational resilience and robustness are fundamental to practical and managerial implications with respect to disaster risk science.

**Index Terms**— Crises, Disaster, Environmental risk, Multinational oil companies, Niger delta, Organisational resilience, Organisational robustness, Resilience, Risk assessment, Robustness, Vulnerability.

## 1 INTRODUCTION

There is a rapid transition within the context of disaster risk management towards two concepts: "green revolution" and "sustainable development" both of which have posed significant challenges for organisations [9, 35, 84, 85]. Already, these challenges and other difficulties that arise in the process of managing risk and crisis amidst concomitant implications seem to have increased the demands for organisational resilience and robustness. The dynamic nature of emergent environmental risks and disasters requires pragmatic and logical framework for dealing with such hyper-turbulent events that are contextualised within the trans-boundary risk society [32, 48, 77]. In perspective, the unpredictability and black swan nature of unconventional risk and crisis potentially generate a set of task demands around the model for human understanding of adequate disaster risk management. This research follows closely (although adaptably) the question posed by [29] – "what are the benefits of the resilience and robustness concepts for disaster risk management?"

From the foregoing, the present research is motivated to explore experiences (in terms of resilience and robustness) of multinational oil companies in responding to environmen-

tal risks in Nigeria. Environmental risks are framed in the context of risk homeostasis theory – a theory which accepts that it is feasible to either reduce or even remove risks altogether, but suggest that this very process will make risk managers increase or accept other risks in return in order to rebalance the total risk [16]. The argument raised here posits that achieving perfect prevention and mitigation of environmental risk is technically invalid because the more efforts organisations make to prevent or contain a given type of environmental risk (e.g. gas flaring), the sightless (or accepting another risk) such organisations become to other risk. This uncertainty describes risk homeostasis within the context of disaster risk management. It is useful to state that extensive coverage of research on risk homeostasis can be found in the work by [1-3, 30, 16, & 85].

However, this research principally frames environmental risk within the context of risk homeostasis mainly to reveal the application and benefits of applying organisational resilience and robustness model since eliminating one type of risk perhaps creates blind spot (or failure mode). Thus the usefulness of organisational resilience and robustness model becomes most evident. It is equally acknowledged that organisations cannot reasonably prepare for each and every dangerous event (crises and disasters). Therefore, the authors argue that when the unthinkable disaster or crisis becomes thinkable and defy both conventional wisdoms and methodologies, there exists a valid reason to conclude that the value of resilience and robustness can never be overstated.

This study queries the benefits of resilience and robustness concepts for disaster risk management in developing countries such as Nigeria, and focuses on analysing the experiences of multinational oil companies in managing environmental risks for example gas flaring and oil spills in Nigeria.

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Drawing on practical experience in the Niger Delta region of Nigeria, the global aim is to pragmatically analyse and discuss the challenges facing multinational oil companies like Shell and Chevron, and how organisational resilience and robustness model can provide effective strategies for addressing the Niger Delta environmental risk and crises. This present work extends ongoing theoretical debates and advances closely towards application of the concepts of organisational resilience and robustness. The research contributes to disaster risk science and organisational disaster risk management with novelty which lies in the application of abstract concepts of resilience and robustness to practical case of organisational risk management.

The oil and gas industry in Nigeria is mostly dominated by large multinational oil companies (e.g. Shell, Chevron, Agip, Exxon-Mobil, and TotalElf). Due to occasional disruption and destruction of oil exploration paraphernalia and asset (oil pipelines, rigs and platforms) through the activities of militants and vandals within in the Niger Delta region of Nigeria, these multinational oil companies have experienced intense and complex working environment within their areas of operations [4, 6, 7, 11, 53]. Although these militants and vandals often use moral justification strategy - which argues that multinational oil companies are polluting the environment - as a mechanism to justify their actions, however, this research explores how organisational resilience and robustness model can help these oil companies thrive in crisis environment in the Niger Delta. To achieve this aim, the authors used practical experience of the environmental risks in Niger Delta and thematic analysis to explore the range of possible solutions.

First, the context of environmental risk using the case of Niger Delta and the role of multinational oil companies are presented. Secondly, a review the literature surrounding the concepts of resilience and robustness, as well as presentation of the authors' conceptual model of organisational resilience and robustness. Then, the results from literature and semi-structured interviews conducted over a period of five months (between May and September 2013) with twenty key stakeholders (oil companies' staffs, government representatives, and local communities) are pragmatically discussed in the context of the authors' organisational resilience and robustness model for practical application. Finally, the research findings which provide useful insights into the application of resilience and robustness concepts to managerial and policy implications are discussed.

## 2 ENVIRONMENTAL RISK: THE NIGER DELTA CASE

More lately, environmental risk has emerged as a form of risk and the term is used in relation to specific environmental activities such as pollution, rise in sea level, flooding, oil spills, gas flaring and climate change [12, 19, 21, 52]. As part of the environmental risk generally, it seems global temperature has heightened concerns in recent times. There is now a substantial body of cumulative evidence to support the view that global temperature has increased, partly due to human activity [42] and this has become issue of concern over the years in

Nigeria [20, 58]. The concerns of environmentalists and local people in Nigeria over constant environmental degradation through gas flaring (as shown in figure 1 below) present practitioners (multinational oil and gas companies) and policy-makers with a wide and challenging range of climate-related discourse [26, 28, 41, 50]. These include the increased risks of flooding, rise in sea level, drought, desertification, melting ice, air pollution, and mass economic migration from severely vulnerable areas. The evidence has increased pressure on multinational oil companies in Nigeria to remain environmentally responsible.

Multinational oil companies in Nigeria are often accused of causing environmental problems and devastation on the local environment [50]. Shell in particular has been subject of many national and international debates and criticisms over its alleged environmental pollution and degradation in Ogoniland (Rivers State, Nigeria) [28]. Past research concluded that Shell practices double standard in Nigeria and that the organisation usually breaches both its internal standards and international standards [75]. Although not a conclusive evidence, the resultant effects are clear manifestation of escalating crises between local communities in the Niger Delta and multinational oil companies [81, 64, 66, 75]. The obvious concern is about how organisations (for example multinational oil companies) can manage and respond to the apparent emotionally charged crisis in the Niger Delta region of Nigeria. The authors argue that the thematic analysis and phases of the organisational resilience and robustness model presented in this research can help provide effective response and sustainable solutions.



Figure 1: Typical case of gas flaring within communities in the Niger delta region of Nigeria. Source: online photos of Niger delta.

There seems to be loss of words to describe the appalling environmental situation and risks in the Niger Delta of Nigeria. However, there are strange evidences of silver frogs blinking from gleaming lakes, dragonflies hovering over cauldrons of tar, oil slick covering the water and polluting the streams. Polluted and contaminated lands are widespread, local indigenes live on waters but such waters are undrinkable, mangroves and wild animals are destroyed, cases of skin cancers and eyes problems are well-known, and oil industry

infrastructures clustered less than five meters away from residential dwelling in most extreme cases (figure 2) [7, 10]. These situations have been controversially refuted by multinational oil companies and blamed on sabotage, bunkering and artisanal local refining [27]. The situation is indeed challenging, but unlike the Gulf of Mexico there are no underwater robots, flotillas of scientists, independent monitoring of spills are sparse and companies themselves disclose virtually inadequate data about their own pollution [28]. The results of environmental risk in the Niger Delta are clear demonstration of emotionally charged crisis but reasonably expected considering the environment and the people who are vulnerable to the environmental effects.



Figure 2: Environmental impacts of oil exploration in the Niger delta region of Nigeria. Source: UNEP 2011

Apparently, the efforts to halt the disaster of the Deepwater Horizon oil spill in the US seem to have triggered concerns among the vulnerable people of the Niger Delta and environmentalists towards investigating environmental disaster in the region. The present study is an attempt towards that direction although the focus and analyses are limited to organisational responses to the crisis and how organisational resilience and robustness model can help provide reliable solutions.

In Nigeria, oil and gas activities are mainly carried out within the Niger Delta region (composed of nine states – Ondo, Edo, Delta, Bayelsa, Rivers, Cross Rivers, Akwa-Ibom, Abia, and Imo) (see figure 3). The Niger Delta region of Nigeria has over estimated 35 million people and over 85 percent of the people of Niger Delta region are predominantly fishermen and farmers [56]. Climate change and land cover changes vividly pose serious threats to agricultural products and trade as evidence in literature [7, 56, 59]. Most of the damages from extreme climate change are borne by industries such as fishing and farming as they require the natural environment for their sustainability.

From the foregoing, it is therefore pertinent to address two critical issues: environmental risks and the challenges they pose to organisations. Environmental risk basically refers to the risks that have adverse and detrimental effects on

the environment with crucial implications on business and stakeholders [52]. The assets (oil pipelines, rigs and oil platforms, etc.) of multinational oil companies in Nigeria have often been destroyed by militants and vandals on account of allegation of environmental risk (pollution, gas flaring, and oil spill, for example). At the extreme, staff of multinational oil companies are abducted for ransom and kept hostage for several hours or days, and sometimes killed in the process. Therefore, the challenges lie in the application of the concepts of resilience and robustness in such crisis and responding appropriately to the environmental risks (or problems). Although previous research concluded that environmental risk has both positive and negative impacts on organisations and other stakeholders [52] but the risk differs significantly across industries [71].

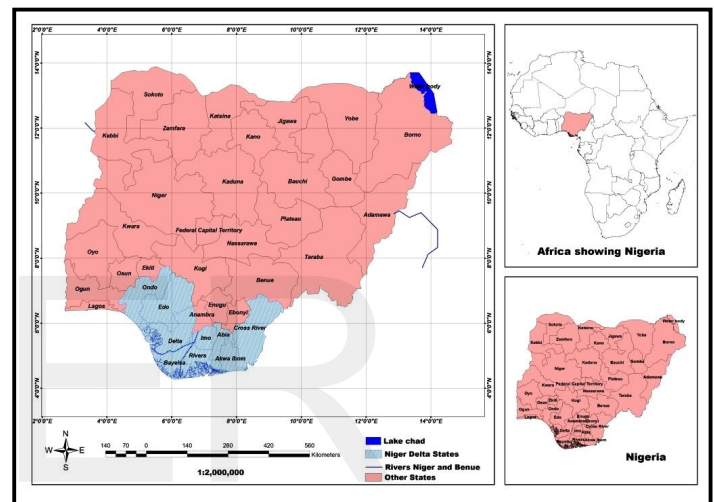


Figure 3: Niger delta region of Nigeria. Source: Authors

A number of studies confirm that environmental risk and implementation of environmental risk management practices are linked with benefits for firms [25, 39]. These studies provide little evidence on how environmental risk can translate into positive impact for organisational benefits. Two issues appear to be problematic with these previous research findings on environmental risk management. First and most notably, the potential range of challenges arising from these new unconventional forms of threat (in which the impacts appear invincible) and the strategic response of different stakeholders remain unclear but arguably require resilience and robustness model for their sustainable management. In another context, the spaces of vulnerability and spaces of susceptibility of unconventional environmental risk within the vulnerable environment demands the application of what we term 'organisational resilience and robustness model'. We argue however that the notion of 'risks without borders' (which imply that the consequence and severity of environmental risk transcends across nations and potentially interconnect the resulting effects of particular hazards which can migrate across these nations) explains much better the idea of associating special consideration to resilience and robustness model. In



the next section we critically discuss the conceptual framework of resilience and robustness for organisational benefits.

### 3 METHODOLOGY

This study employed thematic analysis to practical experience of environmental risks within the Niger Delta region of Nigeria to explain the relationship between organisational resilience and robustness, and to connect with sustainable means of managing emerging environmental risk and disaster. The research is based on a mixture of exploratory research methods, archival data, semi-structured interviews, and media reports. The environmental problems in the Niger Delta were used to provide foundational practical case and secondary data were content analysed. The semi-structured interviews were granted under strict condition of anonymity and consents of the participants were sought. It is a usual practices in research that methods to be use are appropriate to answer and achieve the research aims and objectives. Therefore, to answer the main research question relating to the benefits of organisational resilience and robustness in managing environmental risk and disaster, we used secondary data, archival data, media reports, and semi-structured interviews.

The sensitivity of the environmental problems in the Niger Delta was taken into considerations in the course of the interviews and questions asked were related directly to environmental risks and disasters. Twenty interviews of personnel across four major multinational oil and gas companies, four local oil and gas companies, two environmental regulatory agencies and one non-governmental environmental agency, and two local communities were conducted by the first author. The participants (with knowledge and experience of environmental risks) are key stakeholders within the Nigerian oil and gas industry. The semi-structured interviews were conducted over a period of five month (between May and September 2013) as part of a broader ongoing research. The participants were interviewed based on the prepared interview guides and the information provided audio tape. Prior to the data collection, the participants were contacted and the purposes of the research were pragmatically discussed and concerns of the interested participants were addressed. The ethical implications of the data have been considered to ensure that no harms are done to both the participants and the researchers. The essence of the interview was to explore the activities (in terms of environmental risks and disasters) of the multinational oil companies in Nigeria and how such activities affected the local communities. While conducting content analysis of the interview data, particular attentions were paid to the social and cultural context of environmental problems in the Niger Delta, Nigeria.

Previous studies (for example, [4, 10, 27, 52, 64, 65]) examining environmental problems in the Niger Delta region of Nigeria adopted similar methodological approach. These studies explore the social and legal context of environmental problems in Nigeria. However, the present research differs largely from such work because of the methodological approach adopted and the development of organisational resilience and robustness model. For example, content analyses

were used throughout the research and the study anchored on interpretivism and paradigmatic approach in the analysis, results and discussion. Critically, it might be more useful in future research to include questionnaire data to further enhance the data collected and analysis. Nevertheless, the reliability and validity of the results revealed in this work have not been affected because of the adoption of practical case study which further augments the data and triangulation. Triangulation occurs at theory, method and data level suggesting that research findings are quite reliable and supported.

In conclusion, the fundamental aim of developing the organisational resilience and robustness model was to consider a practical-oriented concept through which the abstract concepts of resilience and robustness can be better understood and applied within organisations. The development of the organisational resilience and robustness framework (Figure 4) was based on extensive literature reviews and through content and thematic analysis. Literature relevant to the concept of resilience, robustness and vulnerability were searched and reviewed as a first step in the process. The authors conducted content analysis of previous data, methods, meanings, and interpretation of the two terms – resilience and robustness. The process of organisational resilience and robustness was recognised in six phases based on the indicators of resilience and robustness mapped from different research fields and perspectives. Although the two concepts of resilience and robustness as extracted from literature appear to be multidisciplinary in nature [23, 49,57, 62, 67], past findings were synthesised to produce a more unifying framework. The organisational resilience and robustness framework and the various phases involved are captured in figure 3. Lastly, the six phases of the model were discussed and applied to the environmental risks experience of the Niger Delta region of Nigeria. This enables abstract concepts to be discussed in the practical context and the results provide useful insights, lessons and implications for organisational policy and managerial practices.

### 4 CONCEPTUAL FRAMEWORK OF RESILIENCE AND ROBUSTNESS

The organisational resilience and robustness model (summarised in Figure 4) presented in this research is discussed as pragmatic indicators of remarkable and measurable components of disaster risk management. The origin of resilience was reportedly rooted in the word 'resilire' mentioned in ancient Rome by Lucius Annaeus Seneca [8]. The term was initially used to describe the capacity of a material or system to return to equilibrium after a displacement [60]. The concept has considerably advanced over the decades and linked to another concept called robustness [9, 22, 32, 35, 77] and used to describe the adaptive capacities of individuals [14,18], human communities [60, 74] and larger society [5, 15, 34], and organisations. Past studies have advanced without special consideration and in-depth discussion of organisational resilience which constitute the primary focus in this research.

The organisational resilience approach queries the vulnerabilities of some organisations to environmental disasters and crises, while other organisations in the same industry

with the same level of exposure continue to adapt and build capacities, enhance reputation, strengthen business continuity, bounce back and effectively manage complex stakeholders with varying concerns. In another perspective, resilience approach is most useful when organisations risk losing the ability to recover from crises and disasters, and perhaps fail to learn from previous similar cases of disasters or environmental crises. A resilient organisation is disciplined yet flexible organisation.

However, robustness method is concerned with the measurement of the organisational ability to maintain flexibility within a restricted range of function during a hyper-turbulent and unconventional crises and disasters that pose significant threats to the organisation survival [34, 37, 83]. The concept of robustness encourages innovative practice of thinking outside the box [17, 48] and applies methods in unusual manners that might defy conventional and analytical approach to problems solving. A robust organisation is not rigid but strategically adapts lessons from previous cases or new innovative thinking in anticipation and response to emerging threats (crises and disasters) and consistently adopts effective feedback controls to understand complex changes within the business environment. The application of resilience and robustness is ideally suited to analysing environmental risks (problems) because of the very complicated and controversial implications of such form of risks.

Environmental risks appear to bring about invincible harms and hazards which are regularly subject to controversial discussions and interpretations but the anticipated risks often become most apparent when self-perceived victims discuss them in the context of what is vulnerable and measurement of that vulnerability in reality. The consequent implication is that issues that initially appear undiscussable then become discussable and unquestionably problematic in practice. The consequences of these unconventional forms of risk often do not yield to conventional risk and crisis management models or indeed to organisational or institutional conventional policies and perhaps illustrate further why it is essential to understand how organisational resilience and robustness model is crucial in the discussion. Pointedly, the emergent risk, crisis and disaster often lack the 'apriori evidence' that would render them predictable to any degree [72]; and the spaces of vulnerability and spaces of susceptibility are extremely large and complex. As a result, such dangerous events often require understanding the nature of their vulnerabilities, mitigation and future impact, how they are defined, understood and communicated and range of different options in addressing them. Likewise, risks and threats have multiple sources and impacts and failure to manage them to satisfactory conclusions can undermine operational and financial stability of organisation. This reveals the salient nature of resilience and robustness model which can be meaningful to address the challenges that face academics and practitioners in risk, crisis and disaster management practice when responding to unconventional risk and crisis. The two concepts; resilience and robustness are summarily explained below:

#### 4.1 Resilience: A risky business

Resilience as a concept has gradually emerged in literature surrounding risk, crisis and disaster management. The notion of resilience denotes stability and continuity in the face of turbulent unexpected disruptive events such as crisis and disaster. Although true resilience is dependent not only on organisational plans but also on the ability of society to look out for and respond to major incidents [79], organisational resilience is the focal point of this present research. For a review of various contexts of resilience, refer to [16]. Two (ecological and engineering) forms of resilience have been identified and defined in the ecological literature [55]. In addition, environmental form of resilience which applies to restoration and remediation of the impacts of environmental problems towards a more sustainable future is identified in this research. There are several definitions of resilience identified in literature and most of the definitions emphasize a capacity for successful adaptation in the face of disturbance, stress, or adversity [16]. However, the IFRC [40] define resilience more broadly as the ability of individuals, communities, organisations, or countries exposed to disasters and crises and underlying vulnerabilities to anticipate, reduce the impact of, cope with, and recover from the effects of adversity without compromising their long term prospects. The concept of resilience relates mostly to the ability of systems to respond and adapt effectively to changing circumstances.

Focusing on the uncertainties in managing crises and risk often poses this critical question about resilience: "*Is resilience a risky business for organisations?*" Resilience is about building a generic capability because resilience is different from risk management or contingency and emergency planning. Findings from past studies suggest that resilience is quantified as the probability that organisation in crisis remains able to exhibit recovery trajectories for a specified period of time given its physical environment and anticipated disturbance epoch [54-55]. The abstract concept of resilience itself can be misnomer and providing false solution to organisational crisis or disaster. The idea that organisations can remain stable or maintain stability to withstand dangerous events (crisis and disaster) without addressing the root cause of the crisis/disaster could be misleading. Within the concept of environmental risks and disaster risk science, the theory that if organisations are able to build capacities in terms of resources and responses without compromising business continuity might be implicitly encouraging the 'do nothing' option in managing environmental risks. This is a risky business because resilience is different from resistance.

Resistance denotes the force required to displace the system from equilibrium (outcome and stability) whereas resilience refers to the time required for the system to return to equilibrium once displaced (process and adaptability) [13]. In fact, in some situations, stability or failure to change could point to lack of resilience [60]. A resilient organisation, for example, depends upon several units of the organisation being able to address the underlying cause of vulnerability and able to change or adapt in response to changes in loss and damage; and thus the organisation would fail or disrupted should any of the units remained stable or unresponsive [24, 35, 46, 87]

Therefore, resilience in organisation context means the organisation's capacity to anticipate disruptions, adapt to events, and create lasting value to the overall objectives of the organisation despite turbulence.

It is impossible to generate a universal checklist of environmental risks and environmental risk management strategies suitable for all dangerous events. The ability of an organisation to generate generic capability for addressing the principal root cause of the problems and adapt to changing circumstances is crucial in disaster risk science. Organisational resilience which refers to the capacities of the several units within organisation to adequately adapt and adjust more robustly to sudden and unexpected disruptive events such as crisis and disaster cannot isolate robustness in the process. If isolated, the entire process becomes more risky and can be classified as "resistance hypothesis".

In conclusion, the resistance hypothesis is inextricable and often embedded within organisation when emerging threats incubate over a long period to become disaster. The issue of environmental disasters in the Niger Delta which emerged over the past five decades where the potential hazards appear invincible can best illustrate the resistance hypothesis. The resistance hypothesis suggests that multinational oil companies (like any other organisations) will attempt to first refute the emerging threats and consequent disasters that follow without understanding how to appropriately tackle or address such environmental risks. The processes that lead to disaster can be better understood in the context of organisational resilience and robustness framework. The framework challenge widely held perspectives in disaster risk science and management, and presents range of different phases leading up to a more resilient and robust organisation. The propensity to succeed in managing environmental disasters and risks depends principally not just on resilience but also on robustness. If policymakers and practitioners are able to understand the functionality of the organisational resilience and robustness model, better management of environmental risks and disasters could emerge and organisational performance will improve. Lastly, there will be high likelihood of maintaining a successful and thriving enterprise once organisations are able to realise the benefits of the concepts of resilience.

#### 4.2 Robustness: Beyond hypothesis

Previously we describe the 'resistance hypothesis' that could impede organisational resilience and robustness as attempt to first refute the emerging threats facing organisations and ensuing disasters that follow without understanding how to appropriately tackle or address such environmental risks and disasters. The fundamental focus for organisation in crisis will be to look beyond resistance hypothesis and take advantage of the mutually concepts of resilience and robustness since neither can be isolated from the other. This leads to another important question which is how robust is organisation to emerging unconventional risks, crises and disasters? The robustness of organisations to environmental disasters and crises is a pertinent issue at present, particularly in the light of frequent oil terrorism and militancy in the Niger Delta region of Nigeria. The recent dramatic shift from kidnapping of mul-

tinational oil companies staffs to blowing up of oil pipelines (oil terrorism) and vandalism, and accompanied by wide-spread disruption to business continuity and drastic reduction in production of crude oil, highlighted the need for organisations to develop greater robustness approach to protect critical infrastructure. However, there is need to address the concerns which border on the benefits of the robustness concept to organisations in crisis.

Robustness measures the ability of an organisation (or a system) to maintain itself within a narrow range of function and is perfectly suited to emerging environmental threats and disasters that require evaluation of the possible permutations of different strategic options that infiltrate the disasters development process and setting priority base on available evidence. Although the concept of robustness has a far-reaching meaning in disaster risk science because it encompasses innovation and strategy, transformation and learning, and functional redundancy and feedback controls to compensate for changes in environment [55]. Carlson and Doyle [22] revealed that the concept of robustness emerged within engineering and control theory.

This concept (robustness) is defined as the capacity of a system to maintain a desired state despite fluctuations in the behaviour of its component parts or its environment [9]. The idea that robustness concerns the maintenance of a system state within a narrow range of performance [55] is not self-evident when matched against objective evidence. Past research which examined robustness, adaptation and innovation of forest-dependent communities in the wake of a devastating 2007 hurricane in Mexico concluded that robustness does not imply rigidity but describes the ability of the system to adapt and innovate in anticipation or in response to a disturbance [24]. In overall, robustness is the degree to which an organisation can insulate itself from changes in the environment. The issue for concerns in this research is the operationalization of the concept of robustness in disaster risk science and management.

The reference threshold of robustness should be modelled by organisation within the risk tolerance level of such organisation. The risk appetite of the organisation must be clear enough for every manager to make a value judgement at acceptance level of variability. The implication is that a robust organisation is one that manages risk, crisis and disaster within set of acceptance risk tolerance level or limit. A good comparison is an organisation involving in oil spill disaster. A robust organisation stops the spill and adapts to the numerous criticisms by providing compelling arguments and evidences that remediation and compensation is anticipated so that such environmental problem does not lead to hostile attacks and business discontinuity. The case of Shell Nigeria over environmental pollution and contamination in Ogoniland (Rivers State, Nigeria) which eventually led to hostile attacks on Shell staffs and eventual withdrawals of Shell business in Ogoniland (in December 1993) demonstrates how lack of robustness can impact businesses. Although a robust system (organisation) cannot tolerate a large fluctuation [43], the combination of the two concepts of resilience and robustness provide a better advantage for organisations desirous of managing envi-



ronmental risks and disasters.

The problems that organisations face in dealing with uncertainty in decision making along with the ways in which organisations function in the wake of extreme environmental shifts [31] have further highlight the importance of resilience and robustness framework in shaping and managing unconventional environmental risks and disasters. What is unconventional about modern environmental risks and disasters is not their very nature alone but the stake in which such events are scrutinized and anticipated whether they are exclusive of their existence or not. This raises some fascinating challenges for disaster risk science and management. One result of this ‘ambiguous reality’ has been the increased efforts to bridge the gaps between what we claim to know and what we actually know. The scientific myths of experts’ elicitation and account of environmental risks and disasters appear to have been out-mooded by laymen offering alternative compelling explanation of how environmental risks and disasters affect them. The contest is now wide open and environmental risks and disasters are often portrayed as becoming ‘disaster in denial’.

The socially constructed contexts of environmental disasters and crises have shifted towards a narrow but fierce competition between organisations and local communities, for example, in Nigeria. There have been other suggestions that, despite increased attempts at control, these new forms of risk have continued to emerge and evolve in ever more complex forms and this has served to erode public confidence in the abilities of organisations to manage risk [31]. The fundamental impact is the double-edged evolutionary process of environmental risks and disasters, previously contextualised within the risk homeostasis theory. The more organisations attempt to eliminate and prevent environmental risks, the bigger the local communities’ concerns about environmental pollution will continue (in the Nigeria perspective). The possible solution to this unsolved complex network of risk is proper and effective application of organisational resilience and robustness model as the authors argue.

**4.3 Organizational resilience and robustness model**

Research confirms that models are needed to project the resilience, vulnerability and robustness of a system into the future [55] and their practical application to organisational problems. To fill this gap, this research presents conceptual model of organisational resilience and robustness as summarised in Figure 4. This framework will provide innovative practical insights relevant to understanding the translation of the abstract concepts of resilience and robustness into a more pragmatic application in disaster risk science and management. Within the framework, there is special consideration to the interconnected pivotal roles of various constituents and determinants factors of resilience towards loss and damage, adaptive capacity, transformation and learning, and the role of unifying both concepts of resilience and robustness within organisation practices. The framework captures complex social and cultural phenomena and their interplay that leads to disaster or to the development of the capacity to cope with extreme dangerous events (crises and disasters) [38].

Organisational resilience depends on effective crisis

and disaster management but would encourage more prominent treatment of crisis management capabilities throughout the organisation than is often the case. Quite controversially and confusingly, some studies have identified four components such as preparedness, protection, response and recovery as facets of organisational resilience. The resilience approach within organisation is based on addressing emerging threats from a perspective of taking reasonable protective and proactive actions but having alternative capabilities as needed or the ability to withstand the disruption. Organisational resilience refers to the positive ability of an organisation to adapt swiftly to the consequences of a catastrophic failure caused by environmental risks and disasters and cope with the resultant change. In organisational resilience and robustness model, there are number of indicators that make some organisations able to survive and thrive despite adversity. There are thirteen (13) resilience indicators and seven (7) robustness indicators (Table 1) identified from general literature on risk, crisis and disaster management (For example, [23, 47]). These indicators of organisational resilience and robustness as applied in our framework altogether differentiate a resilient and robust organisation from other organisations. These indicators can be used to critically assess the resilience capacity of an organisation and provide useful suggestions on where resources might need to be improved and strengthened.

Table 1: Indicators of organisational resilience and organisational robustness

Indicators of Organizational Resilience	Indicators of Organizational Robustness
1. Leadership	1. Roles and responsibility
2. Employee and engagement	2. Alignment
3. Risk culture and governance	3. Execution and implementation
4. Risk awareness	4. Prioritization
5. Risk and decision making	5. Interaction and synergies
6. Innovation and creativity	6. Leadership and management
7. Risk communication	7. Gaps in action
8. Stress testing plan	
9. Leveraging knowledge	
10. Business community plan	
11. Planning strategy	
12. Stakeholders’ engagement	
13. Risk perception	

Past researches suggest that organisations that are quick to close the gap between what the management wants and what the organisation can deliver can be classified as robust organisation. In critical context, to be a robust organization means to have the flexibility capacities to be able to turn things around, make changes, and to swiftly take up business opportunities and address challenges. In fact, there is evidence to suggest that companies that have organizational robustness

are often better at rolling out strategies, quicker to adapt and more able to deliver results. However, organisational robustness cannot be executed along without consideration of organisational resilience. This is why organisational resilience and robustness framework has been developed in this research. The implementation of the phases in the model can lead to better management of emerging threats and enhance better decision makings in dangerous situation. These phases of organisational resilience and robustness model are discussed in the next section.

### 4.3 Phases in organizational resilience and robustness model

The critical six phases identified in organisational resilience and robustness framework (Figure 4) include: addressing the underlying cause of vulnerability, identify and understand the resilient to what issue, evaluate and benchmark loss and damage, understand how to build adaptive capacity, address organisational belief and risk culture, and initiate and apply learning and transformation. These phases are not linear process but interconnected and interactive strategies that organisations can use to assess performance and strength to effectively deal with potential emerging threats of dangerous events (crisis and disaster) at any of the phase. This is not a one-off process unlike some methodologies for dealing with unconventional cases of risk, crisis and disaster facing organisations. These phases in the model are carefully constructed from the practical case of environmental risk in the Niger Delta region of Nigeria.

The case involves unconventional environmental risks and disasters where agitations of local community members have resulted into vandalism and terrorism-related activities to disrupt oil infrastructure assets of multinational oil companies in Nigeria for polluting and degrading the environment and sources of livelihood. The framework as discussed below based on secondary data and findings from the semi-structured interviews conducted with key stakeholders in Nigeria oil and gas industry represent significant practical ways of ensuring sustainable solutions to emerging threats of dangerous events (crisis and disaster). It provides the avenues to revisit the problems and re-evaluate the organisation itself, and create options appraisal process before making choices and dealing with emerging crises and disasters. These phases are:

#### a. Address Underlying Cause of Vulnerability:

In managing unconventional crises and disasters, the ability of organisations to plan, respond and address the underlying cause of vulnerability is critical to success and long term survival of the organisation. Interviews findings show that local communities where multinational oil companies operate in the Niger Delta are vulnerable to extreme and transboundary pollution. Key informants believed that addressing this root cause is panacea for sustainable business operations of multinational oil companies in Nigeria. These findings as well as previous research confirm that environmental risks have wider consequences on human health, safety and environment, security and livelihood, biodiversity loss [7, 11, 61, 76, 68].

Findings suggest the difficulty in attracting board level support for investment in vulnerability reduction and management should be resolved. The complex and interconnected nature of environmental risks and disasters provide the justification for understanding what areas the organisation could be vulnerable and to address them without hesitation. What is exposed or the areas of the business that could be damaged must be identified and quickly fixed. For example, multinational oil companies in Nigeria are vulnerable to frequently oil terrorism and vandalism of their critical infrastructure (the question of 'vulnerability to what') [6, 27, 65, 61]. Vulnerability assessments have become a key resource to develop measures and pathways for reducing risk and vulnerability, and a key instrument to manage vulnerability over time [44]. The defining characteristic of organisational resilience and robustness is the ability to address underlying cause of vulnerability and their consequences. In the Niger Delta environmental risks and disasters, the ability of multinational oil companies to significantly reduce frequent oil spills for example is paramount to sustainable management of vandalism.

#### b. Identify and Understand the Resilient To What Issue:

The identification and understanding of the resilient to what issue is critical to effective organisational resilience and robustness. Each organisation has their own 'perfect storm' – a combination of events or circumstances that has the potential to bring that organisation to its knees [23]. For example, for Shell in Nigeria, the worst nightmare is the sudden withdrawal of operational area from Ogoniland (in Niger Delta region) following massive protest over environmental pollution and degradation problems caused by its activities in Nigeria. Shell lost its reputation, is confronted with several court cases and is battling to return to Ogoniland since December, 1993. Organisational resilience is a strategic capability and it is not just about getting through crises. Two other important capabilities – the foresight and situation awareness to prevent potential emerging crises; and an ability to turn crises into a source of strategic opportunity are identified.

However, the resilience and robustness of an organisation is directly related to the resilience of other organisations or stakeholders (local communities, customers, suppliers, regulators, and even competitors) on which it depends. Clarity on the resilient to what issue is fundamental for effective organisational resilience and robustness. Key informants confirm that the disaster-stricken communities in the Niger Delta region of Nigeria are at greater risk of high mortality and morbidity from petroleum-related pollution and contamination.

This has been attributed to the source of frequent agitations and attacks on oil infrastructures in Nigeria. Identifying and understanding resilient to what issue is critical because organisation is dependent on and contributes to the individual resilience of its staff, and the communities' resilience where they operate. In another context, an organisational resilience and robustness is directly related to its sectorial resilience, and the sectorial resilience is entangled with the resilience of the nation. Therefore, there must be general understanding and awareness of emerging threats and that catastrophe may strike and disrupts the business operations and



continuity of the organisation.

*c. Evaluate and Benchmark Loss and Damage:*

The emphasis in organisational resilience and robustness has shift from vulnerability alone to a simpler concept of loss and damage. Losses and damage represent the benchmarks of disaster evidence embedded in a long-term holistic risk management or governance process [29]. Loss and damage has been conceptualised as the negative outcomes of exposure to environmental hazards and the lack of capacity to manage them [29-30]. The evaluation and benchmarking of loss and damage will depend on the kinds of impacts that are measurable or quantifiable. However, even if the impacts from potential emerging disasters are unmeasurable, the concept of loss and damage which literally denotes what can be lost (reputation, financial resources, sudden business disruption, and reduction in profit) provides fundamental avenues to increase organisational resilience and robustness.

The argument is that it may be difficult to stimulate organisation to think about resilience unless members of staff understand the extent of loss and damage. In the Niger Delta case, findings confirm that loss and damage to multinational oil companies manifest through kidnapping of staffs, vandalism and oil terrorism (intentional blowing up of oil pipelines), hostile attacks on oil platforms and wells. Therefore, the challenge is to cultivate a climate in which people (members of staff) receive realistic assessments of potential risks, without creating undue stress and anxiety [15]. Critically, the evaluation and benchmarking of loss and damage can provide the framing to better understanding of organisational resilience.

*d. Understand How to Build Adaptive Capacity:*

To understand organisational resilience and robustness, deliberate attempts to understand how adaptive capacity can be built for the organisation is essential. The concept of adaptive capacity has generated vast interest in disaster and crisis management literature and controversially used in different perspective (for examples, [5, 21, 49, 69, 73]), to denote how organisation can be more resilient and robust in turbulent period. Generally, this relates to being quick to respond when things change and ability to recognise potential crisis emerging, and respond appropriately. The adaptive capacity building process involves challenging widely held views within the organisation to promote competitiveness. The likelihood of organisational leaders to be persuaded to re-evaluate current approach and evaluate alternative approach is critical to adaptive capacity building [62, 67, 87].

Environmental risk decisions can be complex basically because of the in-built trade-off between perception, cultural, social, legal, economic and environmental factors. The organisation strength equally lies in ability to balance stability and change. In the case of environmental crises of the Niger Delta in Nigeria, organisations like Shell appear to have been slow in adapting to the emerging threats especially in Ogoniland. Although much of the environmental crises are equally societal problem that requires Nigerian government solutions, adaptive behaviour that was not dependent on societal resilience could have provided a more robust response (Key in-

formants' observation). What is needed is the understanding of how to build adaptive capacity in responding to the environmental disasters and crises. The organisational risk culture and governance, capabilities of their staff, encouraging innovative solutions, as opposed to organisational structures and depending on technology, can help to develop adaptive responses to emerging crises. This is necessary for organisational resilience and robustness because adaptive capacity is organisational ability to continuously design and develop solutions to match or exceed the needs of their environment as changes in that environment emerge [47].

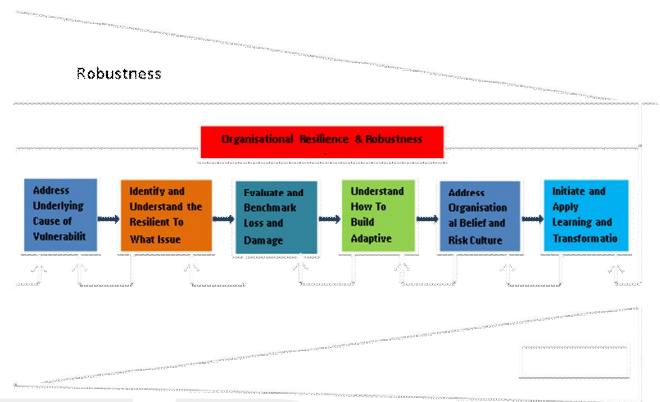


Figure 4: Organisational resilience and robustness model  
Source: Authors

*e. Address Organisational Belief and Risk Culture:*

Organisation belief and risk culture is a key factor in effective organisation resilience and robustness. The belief and risk culture of organisations is integral to effective crisis and disaster management. Risk culture present both opportunity and threat to organisational resilience and robustness. More clearly, a significant characteristic of crisis-prone organisations is the tendency toward denial and bad risk culture. As a general proposition it is fair to argue that there are no simple, unproblematic solutions to complex and unprecedented problems (crises and disasters) and what is prerequisite is a change to our attitudes, values and behaviours, all features of an organisation's risk culture. The fundamental change that will improve organisational resilience and robustness is the willingness for organisation's leaders to own the problems and develop approaches that promote adaptive capabilities.

In another perspective, the belief that emerging threats within or outside the organisation is someone else job should be avoided. All employees must own the risk and promote adequate risk and disaster management programme to simulate situational awareness and contingency response. Findings from the interviews suggest that multinational oil companies often use disengagement approach to isolate environmental risks from their operations. Although relative number (n = 5) of the participants noted that collective approach through the active involvement of local communities could have helped to address some of the challenges and reduce tension. Our results likewise indicate that poor people

are most vulnerable to environmental risks and suggest that the level of adaptation to live with the consequences of environmental risks vary among different stakeholders. Previous studies [12, 19, 58, 58, 70, 80] reveal how environmental risk for example, gas flaring and climate change, affect local communities and the different challenges posed to organisations in dealing with emerging crisis and disaster.

*f. Initiate and Apply Learning and Transformation:*

Resilience and robustness appear to be the answers to the issue of complexity because both concepts can help organisations swiftly adapt to rapidly evolving complex crisis and disaster. There is often incomplete and objective evidence on which to base decision during dangerous events and decision makers are forced to act under great stress. However, the initiation and application of learning from previous cases of crises and disasters, and lessons within or outside the organisation is crucial for effective organisational resilience and robustness. A resilient and robust organisation moves outside and beyond the originally developed plan to deal with the unexpected and deal with unknown through transformation and adjusting existing processes.

The destructive landscapes of emerging environmental threats and consequent impacts would require reframing as new information becomes available for crisis leaders. Evidence suggests that the strategies for enhanced organisational resilience and robustness include preparing first responders, business continuity planning, constituting crisis management team, working with communities, working with other organisations (private firms, civil society groups, media, government agencies, etc.), joint preparation, joint training and training leaders [15]. The research findings clearly demonstrate that recognising early warning signals and quickly engaged to tackle the emerging threats of crisis and disasters is crucial to pre-crisis era, while mobilisation, evacuation and remediation, sheltering and care, and stakeholders' engagement are vital during the crisis/disaster and post-disaster phase.

## 5 KEY LESSONS AND IMPLICATIONS

This study has important implications for policymakers, managers and local people in Nigeria. First, the findings suggest that organisations should adopt the concept of organisational resilience and robustness in handling environmental risks in Nigeria. The principles to strengthen organisational resilience and robustness include accepting and putting people first, respect local ownership, comprehensive cross sector assessments, planning and implementation, working in partnership, long term perspective, know the limits, and reinforce risk and crisis management policies [40]. When organisational resilience and robustness is framed as panacea to emerging organisational crisis and disaster, the business case for investment in crisis engagement and collaboration will be justified.

The research indicates that multinational oil companies in Nigeria need to voluntarily report on the impact of their operations, policies, and products on the local people and the environment. This implies that organisations must take reasonable steps to reduce environmental impacts from

their activities and operations in the Niger Delta region of Nigeria. Second, our findings revealed the difficulty and complexity involved in environmental risk management and such could significantly affect selection of options available to manage emerging risks and impact. In this context, multi-criteria decision analysis (MCDA) would enable the development of practical ways to compare environmental risk decision options when multiple realities exist. The MCDA has the capability to draw consideration to conflicting areas between stakeholders and decision-makers. While this significantly has implication on crisis and disaster management practice; agreeing on the criteria, weighting, and risk tolerance among relevant stakeholders can hinder effective MCDA. How would policymakers and stakeholders decide what best practice to be used remain the most critical issue? The study demonstrates the need for strengthening the organisational capabilities and environmental regulatory agencies at both national and local levels to handle environmental risks and their associated consequences.

Another implication is that, the lack of vulnerability and hazard assessment, community-based early warning signals, adaptation economic assessment, and crisis management plan which incorporate environmental risk assessment contribute to ineffective management of environmental risk in the Niger delta region and indeed in Nigeria. These assessments are necessary for the understanding of organisational resilience and robustness, and towards clarification on where and how resources should be directed.

## 6. CONCLUSION

Resilience programming involves sustained engagement that is explicitly accountable, participatory and inclusive [40]. The beginning of organisational resilience and robustness is the identification, recognition and appreciation from the board level (or senior management) to acknowledge the staffs efforts and capacities to strengthen their own resilience. Maintaining a critical balance between business goals and environmental concerns particularly in eliminating or reducing risky activities (such as gas flaring) that potentially increase global warming and climate change is considered imperative for sustainable environmental development and achieving the Millennium Development Goals (MDGs) in Nigeria. In clear term, public engagement and environmental reporting on gas flaring and climate change impact on vulnerable local people, the environment, organisations and nations will help to build deeper commitment and benefit for every relevant stakeholders. Another important issue is to carryout critical assessment of how vulnerable people living close to gas flaring stations, for example, might be affected. We hope that policymakers, organisational leaders and managers would recognise the contribution of all of the above critical issues raised when taking decisions affecting the environment, health and safety.

This study provides important contributions by highlighting the importance of organisational resilience and robustness, collective response and engagement of all stakeholders, and contextualising vulnerability in alternative paradigms

of loss and damage that could enhance effective environmental risk decisions. Although not a final statement on the subject, this research contribute significantly to the growing body of evidence that environmental risks can be meaningfully reduce while stakeholders must adapt with the consequences through resilience and robustness. In addition, the findings suggest that preparing main responders (leaders and decision makers), addressing underlying cause of vulnerability, understand the resilient to what issue, evaluate and benchmark loss and damage, address organisational belief and risk culture, initiate and apply learning and transformation are critical to provision of sustainable solutions. In conclusion, the study confirms that achieving perfect prevention and mitigation of environmental risk is technically invalid because the more organisations make efforts to prevent or contain a certain type of environmental risks, the more blind such organisations becomes to others. Looking at the experience of the multinational oil companies in the Niger delta region of Nigeria, the research has revealed how organisational resilience and robustness can be applied to solve emerging environmental risks and disasters. The organisational resilience and robustness approach becomes a more useful ways to pragmatically address and encourage multiple stakeholders' involvement in managing environmental risks and disasters in Nigeria.

Although the authos present strong arguments in support of organizational resilience and robustness model, there are other relevant poorly explored approaches which can be used to good effects. For future research, we recommend investigation of these relevant approaches and how a multicriteria decision analysis (MCDA) can inform stakeholders' choice of an approach the range of environmental risk, crises and disaters from organizational point of view.

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