Hyogo Framework for Action (HFA): A Case Study of Nigeria

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Abstract: Objective: This paper uses the Analytic Hierarchy Process (AHP) to rank main actions and their associated task areas outlined in the Hyogo Framework for Action (HFA) in the case of Nigeria. The focus is on three major challenges namely (1) stakeholder inclusiveness, (2) capacity building and communication and (3) local adaptation.

Methods: The perceptions of a sample of 26 field disaster management experts on the HFA were studied and analyzed using AHP. The study found that "Disaster Preparedness" is the most important expected goal followed by "Risk Assessment and Early Warning."

Results: Their priority indices are 0.258 and 0.219, respectively. "Local/City Governance" however, shows poor performance with a priority index of 0.085. Monte Carlo simulation was further applied to examine the robustness of the AHP assessments.

Conclusion: The results are indicative of the perceptions of the performance levels attained and the areas that need improvement.

Keywords: Analytic hierarchy process, framework for action, risk assessment, monte carlo, samulation local adaption, analytic hierarchy process, hyogo framework for action.

1. INTRODUCTION

The Hyogo Framework For Action (HFA) was developed as a 10-year plan in 2005. The primary objective was to prepare and protect against natural disasters thereby creating a safer environment. Different stakeholders are to be engaged in reducing the risks and losses associated with disasters. Stakeholders are to be drawn primarily from the public and private sectors and should include communities and international agencies. These stakeholders work as a team to achieve disaster resilience by following the five main actions outlined by HFA. These actions are:

1.1. Institutional Development or Local/City Governance (HFA1)

Disaster risk reduction should have national and a local priority. Strong institutions should be developed to implement activities to achieve disaster risk reduction. Risk assessment and early warming (HFA2) - It is important to identify, assess and monitor disaster risks. Early warning of impending disasters is also a necessity.

1.2. Knowledge Management (HFA3)

Disaster resilience can be developed at all levels through knowledge, innovation and education.
For the culture of safety, resilience should also be nurtured and developed.

1.3. Vulnerability Reduction (HFA4)

It is important to identify and reduce the underlying risk factors, and Disaster preparedness (HFA5) - Disaster preparedness should be strengthened at all levels in order to respond effectively to disasters. These five actions will help nations and communities to significantly reduce their disaster risk burden. The involvement of stakeholders helps to build resilience capacities and also ensures that local contexts are integrated with the action plans. The costs of disasters are enormous and they include social, economic, and environmental assets. When resilience is built, these costs are minimized. It is necessary to develop local resilience since the needs of the communities may differ. As a result, different actions or strategies may be needed to address their unique circumstances.

The Hyogo Framework For Action (HFA) is a result of the acceptance by the global community resulting in developmental failures and that there is a need for good governance to achieve disaster risk reduction and protect livelihood. The HFA supplements the work already being done by civil society organizations and the International Committee of the Red Cross (ICRC). It gives global attention to disasters and also provides directives to achieve Disaster Risk Reduction (DRR) by focusing on achievable actions [1]. Many African countries are now instituting programs for DRR. This list includes countries like the West African country of The Gambia, South Africa, and Nigeria [2-4].

On March 14 - 18, 2015, the Third UN World Conference on Disaster Risk Reduction (DRR) was held in Sendai, Japan to review the implementation of HFA and to adopt a successful framework for disaster risk reduction. The HFA was effectively replaced by the Sendai Framework. However, the Hyogo Framework for Action (HFA) still forms a major basis for capacity building in the developing countries and serves as a solid foundation for stakeholder inclusiveness. The aim of the present work is to offer guidelines for developing priorities for each of the actions and their related tasks given the unique circumstances of a particular nation. This is done on the premise that there are no universally accepted priorities that should be adopted. Rather, each nation should review the HFA and develop its own set of priorities and apply it in resource allocation. This focused application of HFA will help the country build resilient communities in case of disasters.

Although the Hyogo Framework for Action (HFA) has undoubtedly gained momentum across the local, regional, and global communities during the past decade, few case studies in the African continent were developed to answer the following questions:

- Is there an effective way to achieve stakeholder inclusiveness?
- Are there gaps between "expectations (i.e. expected goals)" and "actual performance" in capacity building and communication achieved by the different communities?
- Do policymakers assign the same weight or priority to each main action (and task areas) documented in the HFA?
- What is the robustness of any empirical assessments resulting from multiple-attribute decision-making processes?

We try to address these questions by studying the perceptions of 26 disaster management experts in Nigeria. These experts attended a workshop sponsored for stakeholders that are engaged in the country’s emergency preparedness. The 26 experts were involved in work sessions aimed at critically evaluating their respective agency’s current performance and needs (or expectations) for capacity building in the five main action areas and their associated task areas. In this work, we use a multi-criteria decision-making model (the Analytic Hierarchy Process (AHP) to evaluate the application of the HFA in Nigeria (Fig. 1). The AHP is widely used in multiple-attribute decision making [5-11]. Priority indices were then generated for five main actions and their associated task areas. A 95 percent confidence interval estimate was further constructed to identify dominant and inferior priorities for main actions and the tasks needed to accomplish each.

2. BACKGROUND

2.1. HFA - Strategic Views

Since 2005, the Hyogo Framework for Action (HFA) has served as the guiding framework for
national governments and civil society organizations for disaster risk management. The expected result of HFA over the 2005-2015 period is a tremendous reduction of disaster losses in communities and countries. One of the requirements of the Hyogo Framework is to be able to periodically monitor the progress with the implementation of the framework. This will help in assessing the successes being made in terms of disaster risk reduction and to ensure that proper policies are being implemented.

According to the United Nations International Strategy for Disaster Reduction (UNISDR) [12], significant progress has been made in the institutional and legislative arrangements for disaster risk reduction at national levels. Legislation on disaster risk issues should be synchronized with pre-existing legislative frameworks in other associated sectors (such as water resources, agriculture, power and energy). National action plans should be harmonized with national policies in the key development sectors. Although there seems to be progress in setting up institutional structures, commensurate efforts have not been made in allocating resources to encourage broad-based engagement in disaster risk reduction.

2.2. HFA - Empirical Studies

Roberts [13] notes the increase in local strategies to climate change adaptation. HFA can be localized and the priorities for action can be turned into local ideas [14]. By 2009, about 22 African nations have established national platforms to achieve HFA [14]. Olowu [15] points to the lack of adequate empirical facts concerning the efficiency and effectiveness of various governance methods for disaster risk reduction. Maxwell et al., [16] review the application of the HFA framework in the city of Makati, Philippines. They associate five main actions of the HFA with the twenty tasks identified by UNISDR (Fig. 1). Tables 1 (column 1) and 2 (column 2) show the descriptions of the five main actions (or HFAs) and the twenty tasks (or Ti, i = 1,…, 20 as noted in Fig. 1) needed to accomplish each main action. Maxwell et al., [16] in their paper, addressed the following issues:

The importance of the tasks in achieving a particular main action plan. In other words, will multi-stakeholder dialogue help in establishing foundations for disaster risk reduction? What is the priority of the task within work responsibilities?

Their survey of city officials shows that HFA1 (Institutional Development or Local/City Governance) and HFA 5 (Disaster Preparedness) are most relevant in the city of Makati, Philippines. With respect to HFA1, task 4 (i.e. Prioritizing disaster risk reduction and allocating appropriate resources) is the most relevant indicator. As for HFA5, task 20 (i.e. Strengthening planning and programming for disaster preparedness) is the most important.
The UNISDR global assessment report shows that since 2007 [17], “146 governments have participated in at least one cycle of the HFA review using the online HFA Monitor. In 2011-2013, 136 countries submitted reports.” The report identified the top two performance areas of the HFA framework as HFA5 and HFA1. Thus, the empirical findings of the study [16] are consistent with that of the global assessment report [18]. Both studies also concur that HFA3 (Knowledge Management) and HFA4 (Vulnerability Reduction) present a challenge at both local and national levels.

Consequently, the midterm reviews of the implementation of the Hyogo Framework for Action (HFA) in Cuba, Dominica, Jamaica, the Virgin Islands (UK) and the Cayman Islands note that [19]: “with the acceleration of global climate change and - given the vulnerability of Caribbean countries, the increasing risk experienced by the Caribbean to a range of natural, environmental and technological hazards remains one of the region’s most critical unresolved development problems.” Implementation obstacles in the report were identified as follows [19]:

- lack of resources,
- lack of political will,
- lack of enforcement law, and
- Changing a national culture.

Leadership, skill development, quantification of impacts, and cross-disciplinary linkages were all identified as key elements to achieve success.

The role of HFA in guiding the worldwide effort in disaster risk reduction [18] cannot be understated. It has assisted the articulation of ample advancements towards disaster risk reduction as contrasting to piecemeal efforts. From 2005 to 2015, many nations structured their disaster risk management programs via the five HFA Priorities for Action as key guiding posts. Local communities were subsequently better positioned to deal with the enormous challenges posed by disasters [20-23]. Our research is therefore intended to identify areas of high priorities and also areas where capacities should be developed. To build resilient communities, the Hyogo Framework for Action (HFA) is not only strategic but also indispensable. This view is supported by the study by Stanganelli [24] who gave the reasons as follows: (1) HFA is a comprehensive, community-based framework, (2) HFA is a theoretical, but interconnected process, and (3) HFA can be used to identify the gap that still exists between actual practices and theoretical DRR&M and Sustainable Development (SD) frameworks.

A Guide for Implementing the Hyogo Framework for Action by Local Stakeholders [25] is the main source for any DRR&M and SD initiatives at the local level. Twenty tasks, grouped in five areas, are presented [25]. They are adopted in this study to rank the HFA five priorities for action in the case of Nigeria. Twenty tools suggested by the implementation guide [25] are also presented. For the case of local/city governance (HFA1, Fig. 1), for example, related tools are: (1) focal point for DRR - resource allocation, (2) multi-stakeholder dialogue, (3) DRR framework and action plan, and (4) stakeholder engagement/coordination mechanisms.

2.3. Disaster Management and Emergency Preparedness

Disaster and emergency preparedness help to mitigate the impact of disasters. Disasters have long-term impacts on communities and seem to affect the poor mostly [26]. The poor are more vulnerable and are often not resilient. Disasters affect their livelihood, economic power, and social status. Thus, disasters add to the persistence of the cycle of poverty in society. Alcantra-Ayala [27] reports that the occurrence of natural disasters in developing countries is caused by two major factors:

2.3.1. Geographical Location and Geologic-Geomorphological Settings

Furthermore, their vulnerability to natural disasters is exacerbated by their endemic development problems. While it is often difficult to prevent certain natural disasters, the use of scientific approaches to forecast impending disasters may help to reduce vulnerability to disasters especially in major cities of the developing countries that may lack adequate preparedness [23, 27-29]. Disaster management initiatives and emergency preparedness plans can complement each other to reduce vulnerability and diminish the impact of disaster.

The Global Facility for Disaster Reduction and Recovery (GFDRR) note that collaboration between countries and international organizations may help developing countries to reduce their vulnerability to natural hazards and to adapt to climate change [30].
At the World Conference on Disaster Risk Reduction held from March 14-18, 2015 in Sendai, Japan, a new Global Framework for Disaster Risk Reduction was adopted. This new framework known as Sendai Framework for Disaster Risk Reduction (SFDRR) 2015 - 2030 replaces the Hyogo Framework for Action and has been adopted by 187 UN Member nations including Nigeria. The SFDRR builds on the successes of HFA.

2.4. AHP and the Robustness of AHP Assessments

The Analytic Hierarchy Process [9] has been widely applied as a multi-criteria decision-making model. It is based on the prioritization of needs given different criteria and a common goal [5-7, 9-11, 31]. The AHP was developed by saaty [9]. It uses expert judgments and a scale-based system to develop priorities for different alternatives or attributes. There are some rational to the use of AHP in the ranking of HFAs. These are outlined as follows:

a) The AHP is used to make pairwise comparisons between competing alternatives or attributes.

b) Both quantitative and qualitative factors can be considered in using the AHP.

c) The consistency of the decision-maker can be measured with the AHP.

d) The AHP has been applied in many areas of study including conflict resolution, technology selection, water resources management, etc.

e) AHP is selected in this study out of our own biases and the need to ensure the consistency of the decision-maker. However, there are other multi-criteria objective models that one may want to use to address some of the questions raised in this study.

A series of pairwise comparisons are conducted between alternative actions or decisions (i.e. main actions of the HFA and their associated task areas). These comparisons are done using a nine-point scale. The scales are defined as follows: 1 = equal importance; 3 = moderate importance of one action over the other; 5 = strong importance; 7 = very strong importance; 9 = extreme importance. The even numbers 2, 4, 6, and 8 are used for compromise while reciprocals are used to show inverse comparisons. The geometric mean for a pairwise comparison is computed for the group. The use of geometric mean is necessary in order to preserve the reciprocity property [32, 33]. An AHP template can be developed using Microsoft Excel or the Expert Choice software program for AHP. The current literature has not focused much on the robustness of AHP assessments.

One of the objectives of this paper is to evaluate "expectations" and perceived "performance" of the Hyogo Framework for Action and then identify areas for improvement and capacity building. This work applies a more quantitative methodology to address this problem in a different geographical location [17].

3. RESEARCH METHODS

3.1. Data Collection Processes and the Application of AHP

The first part of our empirical study was derived from a workshop on capacity building sponsored by the National Emergency Management Agency (NEMA) of Nigeria. NEMA oversees the disaster risk reduction program in Nigeria. Its services include disaster preparedness as well as local adaptation and knowledge building and communication to the greater community. The purpose of the workshop was to understand the capacity building needs of the country. Both public and private agencies in the country that are involved in the disaster risk management were invited to the capacity building workshop held at one of the premier universities in the country as part of stakeholder inclusiveness. Attendance was open to all participants at no fees. Participants were largely disaster risk professionals. They were given basic lectures on disaster risk reduction with an introduction to the Hyogo Framework for Action (HFA). Case studies on the flood disaster that affected the country in the years 2010 and 2012 were also presented and analyzed. The sessions were interactive and participants were able to exchange views and share their varied experiences. At the conclusion of the lecture series, efforts were made to assess the country’s current performance in contrast to the expectations of HFA’s main actions (or HFAs) and their associated task areas (or Ti, i=1,…,20 as noted in Fig. 1).

The workshop lasted for three days. The first day was devoted to lecture series and interactive discussion sessions. On the second day, each participant was randomly assigned to five groups: Local/City Governance, Risk Assessment and Early
Warning, Knowledge Management, Vulnerability Reduction, and Disaster Preparedness. A facilitator who is a university lecturer was assigned to each of the five groups. The facilitators are to guide the group’s discussions. They also ensure that the groups are focused on the specific main action of the HFA. Each group also has a team leader. Each team evaluates the policies that have been made with respect to the different HFAs. Consequently, the team reviews the current performances of the responsible agencies as well as identifies areas for capacity building. The teams also match the performances of these agencies to the expectations of the HFA. This became more prudent given that the 10-year review of HFA was concurrently going on at the same time in Japan.

On Day 3, all the groups were merged in an auditorium. Each group presented its discussions and conclusions with respect to the current performances and matched that against expectations. The groups also identified areas for capacity building. The presentations were open to further debate and discussions by all the participants. The discussions were recorded and compiled.

At the end of the discussions, another lecture was presented to all the participants on the hierarchical structure of our current HFA (Fig. 1) and the use of pairwise comparison matrices of the AHP. The ordinal rating scale to be used for the pairwise comparisons was also presented. An example is shown in Appendix I. Further, the matrix-type questionnaire to be used in the study was discussed before it was issued to the participants. The participants who are the respondents, in this case, were encouraged to take it home to be completed and to later return the completed forms to a provided address. These questionnaires were returned within a period of 2 weeks. The returned questionnaires were screened to make sure that they were properly completed. A total of 26 good questionnaires were returned. The matrices were analyzed using the methods of the Analytic Hierarchy Process (AHP). To unify the independent matrices into one matrix for ease of analysis, the geometric means of each of the cells in the matrices were obtained. These means became the object of further analysis or application through the AHP.

3.2. The Robustness of AHP Assessments

The ranking of the five main actions of the HFA and their associated task areas helps to identify the most important action of the HFA to emphasize on. Consequently, resources can be allocated accordingly. This entire process involves value judgments by experts and such judgments are necessary to make effective decisions. Policy-makers may employ such judgments for effective policymaking. However, it should be noted that expert judgements are perceptual and may be influenced by the different worldviews and the cognitive style of the experts [7]. It is therefore imperative that the robustness of the AHP assessments is examined. This is done by conducting a Monte Carlo simulation on the results obtained through the AHP. After a warm-up period, 1000 simulation runs were generated on MS-Excel following the uniform probability distribution. These runs were necessary to achieve stability or steady-state behavior. Subsequently, the standard errors and confidence interval bands were computed so as to clearly identify dominant main actions either in terms of "expectations" or actual "performance" as perceived by the participants. The underlying mathematical models behind the AHP and Monte Carlo simulation are presented in Appendix II.

4. EMPIRICAL RESULTS

4.1. Demographic Data

A summary statistics of the demographic data is presented in Appendix III. It is observed that the participants are familiar with the contents of disaster risk management. Further, all the participants have participated actively in all areas of disaster risk management although the areas of Search & Rescue, Disaster Risk Reduction, Communication, and Relief and Intervention seem to be more prominent. In spite of all these, 75% of the participants reported that they have not heard of the HFA. This may be an indication that there is a communication gap in passing the information on to practitioners.

4.2. Prioritizing the Main Actions

The first sets of pairwise comparison matrices were to compare five main actions of the HFA in terms of their relative importance ratings based on both perceived "expectations" and actual "performance". The example in point can be found in Appendix I. The aim is to see if our disaster management experts in Nigeria are actually reaching their expected goals and perhaps, identify needs for capacity building. The priority indices of five main
actions of the HFA were computed using the methods of AHP described in Section 2.4.

"Disaster Preparedness" is perceived to be the most important main action with a priority index of 0.258. It is followed by "Risk Assessment and Early Warning" which has a priority index of 0.219. The priority indexes of the five main actions are relatively close to each other (Table 1). This suggests the perceived importance of each action in achieving disaster risk reduction. However, when we evaluate the actual performance, it is strikingly remarkable to notice that the participants rated their performance on "Disaster Preparedness" very high with a priority index of 0.350. Disaster management agencies in Nigeria also seem to do relatively well in each of the main actions except for the case of Local/City Governance (with a priority index of 0.085). This seems to suggest their perceived lack of institutional structures at both the local, state and federal levels to address disaster risk reduction. "Risk Assessment and Early Warning" which is expected to be very high in "expectations" is rated third in terms of "performance" thus suggesting the need for improvement through capacity building and provision of resources to support such activities.

### 4.3. Prioritizing Task Areas

Table 2 presents the respective task areas (or T<sub>i</sub>, i=1,...,20 as noted in Fig. 1) that are needed to achieve each of the main actions.

#### 4.3.1. Local/City Governance

The expectation of T1 (Engage in multi-stakeholder dialogue to establish foundations for disaster risk reduction) is perceived to be the least important in terms of "expectations." Conversely, T1 is perceived to be the least in terms of "performance" while T2 is ranked the highest in terms of perceived "performance." There is, therefore, a wide gap between the expected and actual performance. Efforts should be made to improve the performance of T1.

#### 4.3.2. Risk Assessment and Early Warning

T7 (Assess capacity and strengthen early warning system) and T8 (Develop communication and dissemination mechanisms for disaster risk information and early warning) completely dominate T5 (Establish an initiative for community risk assessment to combine with country assessments) and T6 (Review the availability of risk-related information and the capacities for data collection and use) in terms of "expectations." With respect to "performance", the rank order was maintained. However, it is shown that T8 dominates T7, T6, and T5. T7 has a marginal dominance over T5 but clearly dominates T6. The result shows an agreement between the rank orders generated for both "expectations" and actual "performance." and consistent with the reports of [33]. The rating scores differ widely between the two groups. These differences could be attributed to the ways resources are distributed to accomplish these tasks. For example, dominant tasks should consume most of the available resources. Rather than trying to optimize, it may be better to satisfice. In other words, resources should be allocated to accomplish all tasks rather than disproportionately allocating resources to the tasks with a significantly higher rank order.

#### 4.3.3. Knowledge Management

The three tasks required to achieve knowledge management are T9, T10, and T11, as shown in

<table>
<thead>
<tr>
<th>Main Actions (or HFAs)</th>
<th>Expectation</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Priority Index</td>
<td>Ranking</td>
</tr>
<tr>
<td>Local/City Governance</td>
<td>0.197</td>
<td>3</td>
</tr>
<tr>
<td>Risk Assessment and Early Warning</td>
<td>0.219</td>
<td>2</td>
</tr>
<tr>
<td>Knowledge Management</td>
<td>0.160</td>
<td>5</td>
</tr>
<tr>
<td>Vulnerability Reduction</td>
<td>0.166</td>
<td>4</td>
</tr>
<tr>
<td>Disaster Preparedness</td>
<td>0.258</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 2. Prioritizing task areas (Ti) under each main action – expectation vs. performance.

<table>
<thead>
<tr>
<th>Action 1</th>
<th>Hyogo Tasks under Each Main Action</th>
<th>Expectation</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Local/City Governance</td>
<td>Priority Index</td>
<td>Ranking</td>
</tr>
<tr>
<td>Task 1</td>
<td>Engage in multi-stakeholder dialogue to establish foundations for disaster risk reduction</td>
<td>.282</td>
<td>1</td>
</tr>
<tr>
<td>Task 2</td>
<td>Create or strengthen mechanisms for systematic coordination for DRR</td>
<td>.206</td>
<td>4</td>
</tr>
<tr>
<td>Task 3</td>
<td>Assess and develop the institutional basis for disaster risk reduction</td>
<td>.237</td>
<td>3</td>
</tr>
<tr>
<td>Task 4</td>
<td>Prioritize disaster risk reduction and allocate appropriate resources</td>
<td>.274</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Action 2</th>
<th>Risk Assessment and Early Warning</th>
<th>Priority Index</th>
<th>Ranking</th>
<th>Priority Index</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task 5</td>
<td>Establish an initiative for community risk assessment to combine with country assessments</td>
<td>.183</td>
<td>3</td>
<td>.194</td>
<td>3</td>
</tr>
<tr>
<td>Task 6</td>
<td>Review the availability of risk-related information and the capacities for data collection and use</td>
<td>.129</td>
<td>4</td>
<td>.145</td>
<td>4</td>
</tr>
<tr>
<td>Task 7</td>
<td>Assess capacities and strengthen early warning systems</td>
<td>.330</td>
<td>2</td>
<td>.245</td>
<td>2</td>
</tr>
<tr>
<td>Task 8</td>
<td>Develop communication and dissemination mechanisms for disaster risk information and early warning</td>
<td>.358</td>
<td>1</td>
<td>.416</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Action 3</th>
<th>Knowledge Management</th>
<th>Priority Index</th>
<th>Ranking</th>
<th>Priority Index</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task 9</td>
<td>Raise awareness of disaster risk reduction and develop education program on DRR in schools and local communities</td>
<td>.405</td>
<td>2</td>
<td>.408</td>
<td>1</td>
</tr>
<tr>
<td>Task 10</td>
<td>Develop or utilize DRR training for key sectors based on identified priorities</td>
<td>.172</td>
<td>3</td>
<td>.264</td>
<td>3</td>
</tr>
<tr>
<td>Task 11</td>
<td>Enhance the compilation, dissemination, and use of disaster risk reduction information</td>
<td>.424</td>
<td>1</td>
<td>.328</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Action 4</th>
<th>Vulnerability Reduction</th>
<th>Priority Index</th>
<th>Ranking</th>
<th>Priority Index</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task 12</td>
<td>Environment: Incorporate DRR in environmental management</td>
<td>.082</td>
<td>7</td>
<td>.116</td>
<td>6</td>
</tr>
<tr>
<td>Task 13</td>
<td>Social needs: Establish mechanisms for increasing resilience of the poor and the most vulnerable</td>
<td>.123</td>
<td>6</td>
<td>.124</td>
<td>4</td>
</tr>
<tr>
<td>Task 14</td>
<td>Physical planning: Establish measures to incorporate disaster risk reduction in urban and land-use planning</td>
<td>.172</td>
<td>2</td>
<td>.117</td>
<td>5</td>
</tr>
<tr>
<td>Task 15</td>
<td>Structure: Strengthen mechanisms for improved building safety and protection of critical facilities</td>
<td>.153</td>
<td>3</td>
<td>.131</td>
<td>3</td>
</tr>
<tr>
<td>Task 16</td>
<td>Economic development: Stimulate DRR activities in production and service sectors</td>
<td>.146</td>
<td>4</td>
<td>.114</td>
<td>7</td>
</tr>
<tr>
<td>Task 17</td>
<td>Financial/economic instruments: Create opportunities for private sector involvement in DRR</td>
<td>.142</td>
<td>5</td>
<td>.152</td>
<td>2</td>
</tr>
<tr>
<td>Task 18</td>
<td>Emergency and public safety; disaster recovery: Develop a recovery planning process that incorporates DRR</td>
<td>.181</td>
<td>1</td>
<td>.247</td>
<td>1</td>
</tr>
</tbody>
</table>

(Table 2) Contd...
Table 2. T11 (Enhance the compilation, dissemination, and use of disaster risk reduction information) has the highest "expectations" and it is second in "performance." T9 (Raise awareness of disaster risk reduction and develop education program on DRR in schools and local communities) is first in "performance" but second in "expectations." There are no dominant tasks when it comes to expectations. T9 however, dominates T10 (Develop or utilize DRR training for key sectors based on identified priorities) in practice.

4.3.4. Vulnerability Reduction

There are seven task areas in this main action. They are T12, T13, T14, T15, T16, T17, and T18. A sketch is used to show the rank order in Fig. (2). It is shown that T18 (Emergency and public safety; disaster recovery: Develop a recovery planning process that incorporates DRR) has the highest rank for both "expectations" and "performance". T15 (Structure: Strengthen mechanisms for improved building safety and protection of critical facilities) has the rank of 3 for both cases. The rankings of T15 and T18 appear to be in agreement for both expectations and performance. However, all the other tasks differ in their rankings of "expectations" and "performance".

4.3.5. Disaster Preparedness

T19 (Review disaster preparedness capacities and mechanisms and develop a common understanding) and T20 (Strengthen planning and programming for disaster preparedness) are the tasks for disaster preparedness. T20 dominates T19 in both "expectations" and "performance."

4.4. Monte Carlo Simulation, the Robustness of AHP Assessments and Beyond

The priority indices presented in Tables 1 and 2 were then used as the basis to run Monte Carlo simulation. For each priority indices, 1000 simulation runs were conducted and the means and standard deviations were computed (Appendix II). The means of the priority indices obtained from the simulation runs were very close to the original priority indices computed from the participants’ perceptions. Standard deviations were computed from the simulation runs and the 95 percent confidence bands were established (Appendix II, equation (8)). Using MS Excel templates, we can thus identify dominant and inferior priorities for main actions and the tasks needed to accomplish each. The results are shown with stacked charts shown in Figs. (3 and 4). The emphasis of the former is on "expectations" of five main actions, while the focus of the latter is on "performance". Fig. 3 clearly shows that in terms of perceived "expectations", HFA5 (Disaster Preparedness) and HFA2 (Risk Assessment and Early Warning) completely dominate HFA4 (Vulnerability Reduction) and HFA3 (Knowledge Management). The result in the case of perceived "performance", as shown in Fig. 4, is however different. This result seems to show that HFA5 (Disaster Preparedness) completely dominates all the other Actions while HFA1 (Local/City Governance) is dominated by all the other actions. This clearly suggests the perceived high rating of their performance in terms of "Disaster Preparedness" but suggests the inadequacy of "Local/City Governance". While the other three actions (i.e. Risk Assessment and Early Warning, Knowledge Management, and Vulnerability Reduction) are dominated by "Disaster Preparedness" and may benefit from improvement and perhaps a capacity building, they are not as "critical" as the perceived poor performance observed in "Local/City Governance".

The robustness of our AHP assessments in this paper is ascertained and its results can be further applied in resource allocation modeling. We present an example of how these results could be applied in resource allocation in Appendix IV.

5. DISCUSSIONS AND IMPLICATIONS OF THE RESEARCH FINDINGS

There has been a lot of progress made in modeling the spatial impacts of disasters in national and international contexts. However, a limited number
Fig. (2). The rank order on 7 task areas of Vulnerability Reduction.

Fig. (3). The stacked chart of perceived "expectations" on five main actions (Expf = Expected Value; Exp UBExp = Upper Bound; Exp LBExp = Lower Bound).

Fig. (4). The stacked chart of perceived "performance" on five main actions (Expf = Expected Value; Exp UBExp = Upper Bound; Exp LBExp = Lower Bound).
of studies have been conducted on the African continent. This may be explained by the fact that disaster management is often seen as different from the other economic or development associated events in terms of their occurrences and predictability. Prevention, management and Disaster Risk Reduction (DRR) are major challenges for countries of the world.

The following implications can also be drawn from this work:

5.1. Stakeholder Inclusiveness

Even though Matsuoka and Shaw [17] identified five main actions (or HFAs) and their associated task areas (or $T_i$, $i=1,...,20$ as noted in Fig. 1) as a global concern to address natural disasters, however, it is imperative that each nation prioritizes these main actions (or HFAs) and their associated task areas (or $T_i$) based on its unique needs and circumstances. Our findings suggest that efforts should be made to improve the performance of $T_1$ that is, engaging in multi-stakeholder dialogue to establish foundations for Disaster Risk Reduction (DRR). This finding is consistent with the strategic views of the HFA such as "broad-based participation" presented in Section 2.1 and A Guide for Implementing the Hyogo Framework for Action by Local Stakeholders [25] highlighted in Section 2.2.

This paper recognizes the need to involve disaster management experts in solving disaster risk problems. There is a need for local content to be integrated with policymaking on disaster risks. This may often be lacking when international standards and guidelines are adopted without evaluation of the local needs.

5.2. Capacity Building and Communication

A multi-criteria decision-making model is used to prioritize the five main actions (or HFAs). This enables policymakers to focus on the HFA that is of more importance in their local area. Consequently, more resources can be allocated to achieve such an action plan.

Tables 1 and 2 present results on the current performance in responding to disasters and also suggest areas that capacities should be developed in order to build resilient communities. Different countries may have different needs especially in developing countries where situations may be different from what may be obtainable in more developed countries.

The five main actions (or HFAs) can be viewed as composite objectives that are very broad and need to be broken down into operational forms. When a nation rates its "performance" low in a particular action (or HFA) it perceives to be critical to mitigating disasters, it suggests there is a need to realign strategies, reallocate resources, and perhaps, build capacities to develop the competence that may be needed to achieve an expected goal.

5.3. Local Adaptation

The Hyogo Framework for Action (HFA) serves as a guideline and a good baseline or benchmark for nations to compare their current "performances" against expected priorities identified for five main actions (or HFAs). Institutional developments are critical to manage and prevent or even adapt to some natural disasters. Different nations are at different levels of preparedness. It is therefore imperative that nations assess their strengths and weaknesses and develop core competencies to mitigate against natural disasters.

The results of this study are consistent with that of Matsuoka and Shaw [17] and the Global Assessment Report [18]. Our study found that the most important main action is HFA5 (Disaster Preparedness) and the most important task for HFA5 is T20 (Strengthen planning and programming for disaster preparedness). Matsuoka and Shaw [17] and the Global Assessment Report [18] also reported the same results. Although they found HFA1 (Local/City Governance) to be the next in terms of importance, however; we found it to be ranked third while HFA2 (Risk Assessment and Early Warning) is ranked 2nd. T1 (Engage in multi-stakeholder dialogue to establish foundations for disaster risk reduction) and T4 (Prioritize disaster risk reduction and allocate appropriate resources) ranked closely as 1st and 2nd to achieve HFA1 and this is consistent with the findings of [17]. For HFA2, T8 (Develop communication and dissemination mechanisms for disaster risk information and early warning) and T7 (Assess capacities and strengthen early warning systems) were found to be the top-ranked tasks respectively. The Global Assessment Report [18] identified HFA3 (Knowledge Management) and HFA4 (Vulnerability Reduction) as the major challenges at both national and local levels. In the case of Nigeria, we found the major challenges to be HFA1 and HFA3. Surprisingly, the perception is that the performance of HFA4 is currently high in Nigeria as it is rated 2nd. This result validates the state of
governance in the country. Governance at both local and national levels still presents major challenges and it is not surprising that it is given this priority.

The method of this study can be applied to understand the perceptions of disaster management experts in any country or community. It can help to identify and minimize the gap that may exist between the perceived importance of the action plan and the current performance. Many of the nations at risk of natural disasters are in the coastal lines and in the developing countries. Often times, they do not have the capacity to withstand environmental hazards let alone natural disasters. Some of these countries may also not have the economic capacity to solve their own problems or absorb the impacts of natural disasters. They may often rely on international aids to deal with disaster management issues. Resources are scarce and limited in supply. It is important, therefore, to systematically allocate the limited resources so that key problems can be solved.

Managing disasters is an issue not only for the developing world. The challenges faced by the United States to effectively manage the 2005 Hurricane Katrina; and the 2015 Eastern Star tragedies on the Yangtze in China are good examples of the problems the world community is still facing in dealing with disasters. Nevertheless, it is important to note that countries all over the globe have acknowledged that it is needful to develop a comprehensive regulatory plan targeted at the prevention, management and reduction of disasters. HFA is a worldwide plan of action or policy to reduce disaster risks [34]. Incorporation of the HFA is a sine qua non for efficient and effective Disaster Risk Reduction (DRR).

The approach adopted in this work recognizes that a significant reduction in disaster losses can be mitigated by involving stakeholders and evaluating the priorities that affect the social, economic, and environmental assets of the different countries or communities.

CONCLUSION

The impacts of the Hyogo Framework for Action (HFA) of 2005 - 2015 on the resilient communities in the United States, Asia, Africa, Europe, and beyond increasingly dominate major debates in the public arena. Many nations at the present time have also established disaster management agencies as well as response and recovery networks at local, regional, and federal levels to deal with disaster-related challenges. This work addresses four core challenges to the advancement of the HFA for years to come: stakeholder inclusiveness, capacity building and communication, local adaptation, and the robustness of AHP assessments. A case study of Nigeria is presented to enhance our understanding of these four emerging challenges. Significant changes to the resilient landscape and proactivity against disasters can be achieved by applying the processes and procedures outlined in this work. Furthermore, this work highlights the effective pathway to deal with the concerns of communities at all levels. This approach enables policymakers and the critical mass in any local context to understand local culture and lifestyles, different dimensions of community resilience, and stakeholder behaviors, perceptions, and attitudes. We expect that our proposed approach can be applied in resolving conflicts and dealing with environmental pressures that may arise from multi-stakeholders that are involved (e.g. Sendai Framework for Disaster Risk Reduction and the seventeen Sustainable Development Goals (SDGs) as defined at the United Nations SD Summit on 25 September 2015).

DISCLOSURE


CONSENT FOR PUBLICATION

Not applicable.

AVAILABILITY OF DATA AND MATERIALS

Not applicable.

FUNDING

This study is partly funded by a grant from the National Emergency Management Agency (NEMA), Nigeria and The Shell Petroleum Development Company of Nigeria Limited (SPDC) through the endowed SPDC JV Professorship in Environmental Management and Control.
CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

The authors would like to thank the anonymous reviewers for their comments and suggestions to improve our initial manuscript.

SUPPLEMENTARY MATERIAL

Supplementary material is available on the publisher’s web site along with the published article.

REFERENCES


