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Towards Promoting Efficient Management Of Mass-Housing Reconstruction Schemes

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ABSTRACT

To ensure quick socio-economic recovery of the communities affected by insurgents' attacks in the north-eastern Nigeria, the first phase of the mass-housing reconstruction scheme has been completed but with many issues overshadowing the achievement like unsatisfactory involvement of local beneficiary communities; poor cooperation among key stakeholders; and communication gaps between donors, construction companies and local beneficiaries, which results in low quality housing products. Therefore, it became necessary to ensure that only contractors who satisfactorily passed the efficiency test are allowed to participate in the subsequent phases of the reconstruction scheme. Thus, this paper provides quantitative technique for evaluating the efficiency of contractors in managing the housing reconstruction. It is expected that the technique will seek to guide informed decisions on the efficiency of managing the reconstruction scheme, which is in different phases and locations. Although the evidences on which the results of this study emanate from reconstruction of building structures experiences in some parts of Nigeria, the technique developed could be adopted in other areas faced with similar issues. This paper updated existing knowledge on the management of mass-housing reconstruction works and offers support to decision-makers and practitioners involved in managing reconstruction of building structures affected by insurgency.

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1. Introduction

The wanton destructions caused by the Boko Haram terrorist group in the north-eastern part of Nigeria claimed over twenty thousand human lives, destroyed physical infrastructure and significantly disrupted socio-economic activities in the region (Abdu and Pahirage, 2017; Shettima 2016, Adesoto and Peters 2015). About 293,000 residential housing units were severely damaged (Mariam et al. 2016). Residential houses in the cities and urban centers were mostly affected due to the bomb blasts, shelling and fire.

To date, the Borno State government has repaired about 30,000 housing units in Bama, Damboa, Gwoza, Kaga, Konduga, Mafa, Maiduguri, Mobbar, and Nganzai areas (Mumini, 2019). This figure represents a paltry 4% of the entire 430,000 residential housing units destroyed and the 293,000 units that were severely damaged due to the insurgency. The figure is

considered very low for a mass housing reconstruction scheme that targets a speedy reintegration of the IDPs in their permanent communities. Although the progress of the reconstruction works is hampered by paucity of funds, social sustainability issues and lack of existing strategy for utilizing the donor fund; evidence shows that the poor management of the reconstruction works during the implementation phase remains highly predominant.

Among the poor management practices observed are prolonged procurement procedures; delays in supply of essential project resources; unsatisfactory involvement of local beneficiary communities; poor cooperation among key stakeholders; lack of regulatory framework for enforcing conformance to quality management plans and construction guidelines; communication gaps between donors, construction companies and local beneficiaries, which results in low quality housing products; heavy political influence and involvement of corrupt stakeholders. Corroborating this, previous studies in different climes (Liu and Liu 2012) have identified ineffective project organization and management of the reconstruction process as one the leading factors for unsuccessful reconstruction of residential buildings.

Consequently, it is imperative to pay greater attention to the management practices involved in the reconstruction scheme (Ahmed 2011). However, extensive literature search indicates there is lack a quantitative strategy to evaluate contractors' efficiency in managing the reconstruction project. Thus, this study seeks to introduce a fundamental mathematical tool that can be used to evaluate contractors' efficiency in managing reconstruction project for houses affected by the Boko Haram insurgency. This objective will primarily include the systematic identification of the appropriate criteria to be applied to effectively examine the efficiency level of the management practices adopted for reconstruction scheme and to accurately determine the relative significance of each criteria empirically.

1.1 Original Contribution of the Study

In spite of the strategic importance of efficient management of post-disaster reconstruction of building structures, the enormous funds allocated for housing repair, renovation and reconstruction works worldwide, and the need for a quick resettlement of the displaced people, it is clear from Table 1 that there is a dearth of knowledge in providing a quantitative approach or tool for evaluating the efficiency of the reconstruction works for building structures.

Table 1. Management of post-disaster reconstruction of building structures - A review of related frameworks

Authors	Previous Works
Bilau et al., (2018)	The main contribution of this work is the development of a conceptual framework that could be applied in managing post-disaster housing repair and reconstruction. The paper also determined the barriers influencing the management of housing repair initiatives in developing countries.
Vahanvati (2018)	The author developed a framework for promoting the efficiency of the owner-driven housing reconstruction (ODHR) scheme. The paper further asserts the significance of adopting the ODHR framework as case studies from India were presented to assert the effectiveness of the framework in promoting the repair of a more resilient built environment.
Jamshed et al., (2018)	The central theme of this study is the development of proposed conceptual framework that would significantly enhance the involvement of local community beneficiaries during post-disaster repair, renovation & retrofitting works. One of the salient features of this framework is its potential to serve as a platform for affected local communities to proactively recover socially and economically based on their needs and terms.
Sadiqi et al., (2017)	The authors' contribution is the development of a conceptual framework for active involvement of local communities in the preconstruction stages of post-disaster repair, renovation & retrofitting projects. The framework has the potential to enable reaching synergy between satisfying the needs of the local communities and the project development plans.
Bilau et al., (2015)	A conceptual and pragmatic framework was introduced in this study for handling the managerial impediments often encountered when executing mass housing repair, renovation & retrofitting project. An obvious limitation to this framework is that it does not provide a proficiency index to determine the actual efficiency level of the management practices of construction companies handling the implementation of mass housing retrofitting projects. The proficiency index would indicate the score allocated to each management practice criterion based on the actual management practices proficiency level of a construction organization.
Lu and Xu (2015)	The authors' contribution is the development of a consolidated conceptual framework capable of promoting collaborative efforts among non-governmental organizations participating in the implementation of post-disaster reconstruction.
Ophiyandri (2013)	The main contribution of this work is the development of a model for managing the risks associated with local communities' participation in housing renovation projects. The author further produced a risk response document and established set of factors for efficient implementation of community-oriented housing renovation works in the aftermath of disaster.

Patel and Hastak (2013)	This study introduced a conceptual framework that outlines the strategy to support construction organizations to ensure timely delivery of repair and retrofitted houses to victims of disaster, conflict, or insurgency. It is expected that effective implementation of this framework/strategy would seek to ameliorate the sufferings of the affected communities and ensure quicker socio-economic recovery.
Von Meding et al., (2009)	The authors' contribution was basically to the non-governmental organizations involved in post disaster repair works. A conceptual framework was designed by the authors, which incorporates the principles of disaster, strategic and project management, with each specific management area contributing significantly to the successful implementation of the framework.

For instance, the previous studies of (Bilau et al. 2015, 2018) focused centrally on initiating a conceptual framework capable of facilitating the management of post disaster housing repair/reconstruction works in developing countries. The authors identified the challenges bedeviling the management of repair/reconstruction initiatives as well as the management actions to mitigate the problems in order to achieve desired objectives. Nonetheless, an obvious limitation of the framework developed is that it primarily highlights the main impediments to successful management of post-disaster repair/reconstruction of building structures and the key impediments that were identified, are mostly qualitative in nature. The frameworks developed in the works of (Bilau et al. 2015, 2018) are predominantly conceptual in nature, which could not be used directly to quantitatively evaluate the efficiency of reconstruction works.

While the earlier contributions of (Bilau et al. 2015, 2018) captured most of the essential barriers and procedures for managing post disaster housing repair and reconstruction works, the glaring contribution of other previous research works presented in this study is on the active involvement of the local beneficiary communities in post disaster repair and reconstruction of building structures. Thus, the central theme of these studies does not dwell much on the management aspect of post disaster repair and reconstruction of building structures, rather, it is more towards socio-economic recovery of the beneficiaries. An exception to this, is the contribution of Von Meding et al. (2009), which presented an efficiency-based framework that could be adopted by non-governmental organizations during post disaster repair and reconstruction works. The most salient management input in the framework is the consideration of strategic management, which helps the non-governmental organizations to familiarize themselves with concepts and strategies of permanent reconstruction of affected communities, since they usually operate well outside their expertise and face many daunting challenges as they implement repair and reconstruction programmes.

The quantitative tool (framework) proposed in this study incorporates eight integral management-performance components and uses a proficiency index to ascertain the exact efficiency level of the management practices adopted for each reconstruction project. The efficiency index indicates the score allocated to each management practice criterion according the actual management practices efficiency level for each project. Therefore, each reconstruction project can be evaluated and grouped based on its management practices efficiency evaluation scores. It is expected that the framework will seek to guide informed decisions on the efficiency of the reconstruction scheme, which is in different phases and locations.

Although the evidences on which the results of this study emanate from reconstruction of building structures experiences in some parts of Nigeria, the framework could be adopted in other areas faced with post-disaster reconstruction of structures. This paper updated existing knowledge on the management of post-disaster reconstruction works to building structures and offers valuable help to regulatory decision-makers and practitioners involved in managing reconstruction of building structures affected by insurgency.

2. Criteria for Promoting Contractors' Efficiency in the Management of Building Reconstruction Works

The development of a quantitative assessment tool in this paper involved identifying, determining, and prioritizing the criteria that promote contractors' efficiency in the management of reconstruction works for building structures. In achieving these objectives, a methodical and extensive literature search together with expert-based survey were adopted, which are explained in Section 3 of this paper. The criteria together with their classification into distinct management practice clusters are presented in the following sub-sections.

2.1 Criteria A –Cash Flow and Financial Management

The practices for effective management of project cash flow and financial management for reconstruction schemes can be very daunting particularly when several funding sources are involved (Fengler et al. 2008). Thus, the establishment of a multi-donor trust fund is regarded as a best practice that could help to enhance coordination and efficiency of reconstruction process, reduce administrative costs, and provide strategies for efficient use of donor funds (Koria 2009). In order to ensure transparency, accountability and probity in managing the project cash flows and finances, it is a best management practice to establish a system for monitoring project finances, assessments, and control and to equally set-up a robust system for endorsing financial accounting and reporting using standards (Olshansky et al. 2012). This will help to minimize corrupt acts like embezzlement of reconstruction funds, bribes for award of contracts and inducing local communities to accept poorly reconstructed houses.

2.2 Criteria B - Safety Risk Management

Safety risk management is an important criterion critical to the proficiency evaluation of the management of the reconstruction scheme (Do et al. 2019, Xi et al. 2018, Přibyl et al. 2018). Conducting a vulnerability analysis helps to identify risk factors, nature of hazards, severity levels of the hazards as well as the extent of exposure to the hazards, which will be vital in developing effective building regulations that will ensure reconstruction of safe resilient, and sustainable housing (Nepan and Chen 2015, Trohanis 2010). Thus, implementing this consolidated management approach will seek to promote safety of the buildings and the local communities from susceptibility to any form of hazards.

2.3 Criteria C - Quality Management

The management of quality is central to the successful implementation of any sustainable reconstruction scheme. Across the globe, poor workmanship quality is always a common attribute of many sustainable housing reconstruction schemes (Ophiyandri et al. 2013). Thus, the evaluation and identification of the much-needed skills for housing reconstruction works before workers' mobilization is a good management practice that facilitates good craftsmanship and quality of housing in reconstruction projects. The management agency spearheading the reconstruction projects is expected to provide enhanced building codes, technical guidelines for construction, quality specifications and standards that will enable the efficient delivery of safe and resilient housing (Bilau et al. 2016).

2.4 Criteria D - Supply Chain Management

Sustainable housing reconstruction initiatives are dependent on the delivery of supplies to the point of need (Bilau et al. 2017). For sustainable housing reconstruction works to be executed effectively, it is imperative to ensure that resources are readily supplied as and when due. Among the many factors that may lead to poor supplier performance are the enormous nature of resource procurement, failure of the local markets to meet huge demands, the problems of inflation in the local economy as well as fierce competition among various suppliers (Zuo et al. 2008). Thus, managing sustainable housing reconstruction process requires high-level expertise and proficiency in the management of supply chains. The expertise needed includes effective analysis, evaluations, planning, procurement, delivery of key resource needs for the reconstruction works. Engaging supply chain management experts will seek to ensure scheduled and quality delivery of resource, costs and time savings, and ensure that high value for donor funds is achieved (Chang et al. 2011).

2.5 Criteria E - Manpower Management

Reconstruction projects deal with various human resource challenges (Chang-Richards et al. 2013). The efficient management of manpower for reconstruction initiatives begins with the involvement of specialists to analyze, evaluate and plan the skilled and unskilled human resource requirements that would enable successful implementation of reconstruction works (Bilau et al. 2017). This is necessary as many building reconstruction schemes are usually beyond the local construction industries' capacities, which brings about a dearth of specialists as well as skilled labour. For speedy reconstruction of solidly built, acceptable and sustainable housing, a number of strategies should be established to sort out the human resources requirements. This includes the use of multi-skilled labour approach and engagement of local construction experts that will mobilize and recruit other skilled workmen from the local communities (UNISDR 2015).

2.6 Criteria F - Coordination & Logistics Management

Generally, reconstruction schemes involve the participation of various stakeholders at different levels with contrary perspectives and overlapping obligations for various interconnected works, which makes it quite difficult for a coordinating agency to handle efficiently (Bilau et al. 2017). Thus, it is crucial for project contractors handling reconstruction works to establish an effective communication strategy with proper feedback system to ensure better coordination and enhanced dissemination of information. To effectively coordinate the activities of the various stakeholders involved in reconstruction schemes, it becomes necessary for the contractors to establish a multi stakeholder platform that will enable active participation of stakeholders, promote consensus building among them to attain the reconstruction objectives, sort out resource management issues and promote accountability and operational efficacy (Gajendra et al. 2013).

2.7 Criteria G - Communication Chain Management

The engagement of several stakeholders with divergent background, perspectives, interests, and responsibilities necessitates conducting communication-based analysis to ascertain the perceptions, competencies and expectations of the stakeholders, which will help to develop a framework for effective communication strategy and stakeholder coordination (Jha and Duyne 2010). An efficient communication structure determines communication objectives, identify the major stakeholders involved, and enables the establishment of communication plans for effective management of information and communication. Other operational measure for promoting the proficient communication chain management include the use of appropriate communication channels, conducting regular meeting and seeking communication feedback as these would enable presentation of progress, proffer solutions to challenges and help to establish efficient communication strategy (Tagliacozzo and Magni 2016).

2.8 Criteria H - Monitoring & Control

Despite having comprehensive construction organizations plan in place, many construction organizations projects across the globe are blighted with monitoring and control issues during implementation (Bilau et al. 2016, Ophiyandri et al. 2013). To start with, it is considered a best management practice to establish a multi-tiered institutional strategy that will seek to

promote proficient monitoring and control functions for construction organizations works. This could either be a local monitoring and control committee, regional authority, or dedicated management agency (Mannakkara and Wilkinson 2013). Conducting technical assessments of the new built houses should be done to ensure compliance to standards while guidelines for corrective measure are utilized to remedy the observed defects on the construction organizations retrofitted houses. More so, there is a need for inclusion of structural health monitoring sensors and systems, which is likely to greatly increase the life-cycle cost of the repaired buildings (Li et al. 2014, You et al. 2014). Structural health monitoring systems could ensure increased safety and reliability of the repaired structures while considerably reducing future maintenance and repair costs (Karamloo et al., 2019; Yu et al. 2019; Přibyl et al., 2018; Huang and Nagara 2014).

3. Research Methods

Developing a suitable fundamental mathematical tool that can be used to evaluate the efficiency in managing the reconstruction of buildings requires a lot of technicalities. This primarily includes the systematic identification of the appropriate criteria to be applied to effectively examine the management practices adopted for the reconstruction projects. It is equally essential to accurately determine the relative significance of each criteria empirically. Most importantly, a review of previous works related to the management of ass-housing reconstruction schemes was conducted methodically in order to gather the relevant criteria needed for this study. From the systematic literature search, a list of preliminary criteria was generated, which was subsequently followed by the expert-based survey. The justification for adopting this approach was to obtain accurate information from the experts considering their high level of experience, proficiency and specialization in the subject under study.

Thus, the experts primarily examined and reviewed the original list of criteria presented to them. The experts had to go through this rigorous process in order to avoid repetition of criteria, eliminate redundancies, improve and provide operational explanations when required. Thus, a revised list of eight main criteria along with their eighty-two corresponding sub-criteria was generated. Remarkably, this process was used to prune the criteria list and significantly minimized the researcher's bias in selecting the criteria, thereby consolidating the validity of the findings. In the closing stages of the expert-based survey approach, the experts were tasked with the prioritization of the main criteria for promoting efficiency in the management of housing reconstruction through rank ordering. Thereafter, the participants evaluated the significance of each sub-criterion, which adopted a Likert scale of 1 to 5 that represents 'very low' to 'very high' level of importance.

It should be noted here that mainly professionals with the requisite knowledge and experience on the subject were invited to participate through judgmental sampling. This sampling technique was used to allow the selection of professionals whose experience permit an understanding of how the implementation of reconstruction should be managed efficiently. Thus, the respondents who did not fit the requirements of the expert-based survey were simply excluded. About eighty indigenous and expatriate professionals who are well conversant with sustainable housing reconstruction projects in Nigeria participated in the expert-based survey. They are predominantly contract and procurement managers, project managers, construction managers, and site managers that boast of long years of relevant professional experience in the built environment. Thus, the experts' overall proficiencies increase validity to the findings of the study.

4. Development of the Efficiency Assessment Framework

This section involves the development of a fundamental mathematical technique that can be applied directly to evaluate the contractors' efficiency in managing housing reconstruction projects. The sequence for the development of the proposed mathematical tool is presented in Figure 1.

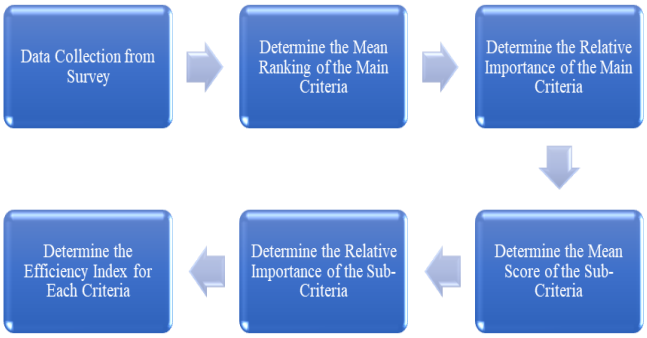

Figure 1 Flowchart for the framework development

4.1 Determining the Mean Ranking and Relative Importance of the Main Criteria

The criteria used for evaluating contractors' efficiency in managing housing reconstruction projects have been mentioned in the previous sections. Thus, the data gathered from the expert-based survey was analyzed thoroughly according to the Mean Ranking (MR) and Mean Score (MS) as applied by Sodangi (2019), Ng et al. (2005) and Assaf et al. (1995). The Mean Ranking of each main criteria was obtained using the equation below:

$$MR_{main\ criteria} = \frac{\sum f \times r}{N} (1 \le MR \le 8) \dots\dots\dots\dots\dots (1)$$

From the equation (1) above, the frequency of the experts' responses to each rating for each main criterion is denoted by *f*, and *r* denotes the experts' ranking assigned to each main criterion while *N* denotes the total number of responses for each assessed main criterion. Thereafter, the figure (value) obtained for the Mean Ranking of each main criteria was duly used to calculate Relative Importance (RI) of each main criterion using the equation below:

$$RIMC_j = \frac{\sum_{i=1}^{N} MR_i}{MR_j} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

From the equation (2) above, the relative importance (RI) of the j^{th} main criterion is denoted by $RIMC_j$ whereas MR_j denotes the mean ranking (MR) of the j^{th} main criterion. Referring to Table 2, it is clear that "cash flow and financial management" was considered the most outstanding main criterion by the survey respondents. This outcome upholds the previous findings of Bilau et al. (2017, 2016) that underlines the implication of cash flow and financial management during the reconstruction of buildings for post-disaster settlements.

Table 2. Main criteria for promoting efficiency in managing housing repair works

Main Criteria	**Mean Ranking (MR)**	**Relative Ranking**	MR_i/MR_j	**Relative Importance (RI)**
Cash flow & financial management	1.107	1	11.751	0.174
Safety risk management	1.238	2	10.508	0.155
Quality management	1.310	3	9.935	0.147
Supply chain management	1.524	4	8.538	0.126
Manpower management	1.702	5	7.642	0.113
Coordination	1.821	6	7.143	0.106
Communication chain management	1.976	7	6.583	0.097
Monitoring & control	2.333	8	5.576	0.082
Total	**13.012**		**67.676**	**1.000**

This highly prioritized criterion is problematic with repercussions for efficient management of sustainable housing reconstruction projects. For instance, the multiple sources of funds have different and competing accounting requirements and time frames, which could lead to circumstances that will adversely compromise the quality and efficiency of the reconstruction implementation. Thus, an early 'needs analysis' is essential to determine the resource requirements for the reconstruction scheme, which could be used by stakeholders to mobilize resources for reconstruction works (Bilau et al. 2015).

On the other hand, "monitoring and control" was rated the least most important main criteria by the respondents despite its huge relevance for promoting efficient management of housing reconstruction works. The ranking obtained does not in any way undermine the significance of this criterion in the successful implementation of housing reconstruction schemes. As pointed out by Bilau et al. (2017), monitoring and control during the implementation of housing reconstruction works could be ensured by providing product quality management plan, timescales, cost plans, and production plans while mobilizing experienced workers and local workers to monitoring units and providing an efficient system for monitoring, controlling and evaluating the reconstruction process. This strategy serves as a basis for monitoring progress, improving production output, quality, speed and efficiency of the reconstruction process.

4.2 Determining the Mean Score and Relative Importance of the Sub-Criteria

This section presents the sub-criteria used by the respondents to evaluate contractors' efficiency in managing housing reconstruction works. Details of these sub-criteria have been provided before now. Therefore, the responses of the experts were analyzed according to the Mean Score (MS). To start with, the Mean Score (MS) for each sub-criterion was calculated using the equation below to ascertain the importance of each sub-criterion.

$$MS_{sub-criterion} = \frac{\sum f \times s}{N} (1 \le MS \le 7) \ldots\ldots\ldots\ldots\ldots (3)$$

In the equation (3) above, the frequency of the experts' ratings for each sub-criterion is denoted by *f*. The score given to each sub-criterion by the experts is denoted by *s* while *N* denotes the total number of responses for each assessed sub-criterion. Furthermore, the figure (value) obtained as the Mean Score of each sub-criterion was then used to calculate Relative Importance (RI) of each sub- criterion using the equation below, where $RISC_{ij}$ denotes the relative importance of the i^{th} sub-criterion under the jth main criterion.

$$RISC_{ij} = \frac{MS_{ij}}{\sum_{i=1}^{N} MS_{ij}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

The summary of the mean scores and relative importance of the sub-criteria are presented in Table 3. From the table, it is obvious that "conducting needs assessment" was rated by the respondents as the top-most significant sub-criterion (MS = 6.93) for assessing the proficiency of the management practices of construction organizations. This is indeed corroborating global initiatives for promoting the efficient reconstruction and delivery of sustainable housing especially to communities blighted by conflicts, insurgency or disasters. Previous studies (Bilau et al., 2017; Ranghieri and Ishiwatari, 2014; Trohanis and Read, 2010; Barakat, 2003) emphasized on the significance of conducting needs assessment as it helps to identify the resource requirements for sustainable housing reconstruction scheme. The studies further emphasized strongly on the importance of engaging local communities in the needs assessment in order to enable comprehensive community level analysis as well as beneficiary satisfaction in financial support.

"Conducting multi-hazard susceptibility evaluation of reconstruction sites" is the next most highly rated sub-criteria with a Mean Score of 6.920. The ranking of this sub-criterion is without any doubt an integral management practice that could make or mar the efficient implementation of any sustainable housing reconstruction process. Conducting thorough assessments of this nature helps to discover risk issues, nature of hazards along with their corresponding severity level and the extent of exposure to them (Sysyn et al. 2019, Bilau et al. 2017, Benson and Twigg 2007, Benson et al. 2007, Pantelic 1991).

Notwithstanding the significance of "providing capacity development avenues for recruited workers" sub-criterion in assessing the efficient management of housing reconstruction process; this sub-criterion obtained the lowest Mean Score (3.220) from the participants. The rating obtained does not in any way undermine the high significance of this sub-criterion. This is because capacity development of the workers develops local capacities for effective engagement, expands skill supply, and promote socio-economic sustainability for the reconstruction project (Schilderman and Lyons 2011, Barenstein and Pittet 2007). Nonetheless, providing capacity development avenues for recruited workers leads to effective transfer of knowledge, decreases costs, increases workers' retention as well as earning potential, which have strong effect on the successful implementation and management of the housing reconstruction scheme.

4.3 Determining the Efficiency Index for Each Criteria

At this stage, the relative importance of each sub-criterion $RISC_{ii}$ and its corresponding main criterion's relative importance $RIMC_i$ are combined with the weighted scores to obtain a performance index for assessing contractors' efficiency in managing housing reconstruction works. Accordingly, the performance index denotes the score given to each criterion based on the actual efficiency level used in managing the reconstruction works. Thus, the performance index is computed using the equation below:

$$PI_{ij} = \frac{RISC_{ij} \times RIMC_j \times PWS}{7} \times 100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

In the equation (5) above, the performance index of i^{th} sub-criterion under the j^{th} main criterion is represented by PI_{ij} while *PWS* is the performance weighted score of the seven (7) different performance levels, which are given as; 1 = unacceptable; 2 = very poor; 3 = poor, 4 = acceptable; 5 = good, 6 = very good and 7 = excellent. For instance, excellent performance in "conducting needs assessment" can be calculated using the obtained values from Table 3, where $RISC_{ii}$value for the sub-criterion is 0.110 and the equivalent $RIMC_i$ value of the sub-criterion is 0.174. Meanwhile, Table 3 provides the *PWS* value for excellent performance as 7. Therefore, substituting the above set of values in equation (5), the efficiency index is computed below:

$$PI_{\text{conducting needs assessments}} = \frac{0.110 \times 0.174 \times 7}{7} \times 100 = 1.911$$

Table 3 Efficiency Assessment showing the 'mean scores' and 'relative importance' of the sub-criteria for promoting contractors' efficiency in the management of building reconstruction works

Criteria	**Relative Importance (RI)***	**Performance Weighted Score (PWS)**							**Proficiency Score**
		Unacceptable	Very Poor	Poor	Acceptable	Good	Very Good	Excellent	
		(*1)	(*2)	(*3)	(*4)	(*5)	(*6)	(*7)	
Cash flow & financial management	0.174	2.486	4.971	7.457	9.943	12.429	14.914	17.400	Sub-total (A)
Safety risk management	0.155	2.214	4.429	6.643	8.857	11.071	13.286	15.500	Sub-total (B)
Quality management	0.147	2.100	4.200	6.300	8.400	10.500	12.600	14.700	Sub-total (C)
Supply chain management	0.126	1.800	3.600	5.400	7.200	9.000	10.800	12.600	Sub-total (D)
Manpower management	0.113	1.614	3.229	4.843	6.457	8.071	9.686	11.300	Sub-total (E)
Coordination & Logistics Management	0.106	1.514	3.029	4.543	6.057	7.571	9.086	10.600	Sub-total (F)
Communication chain management	0.097	1.386	2.771	4.157	5.543	6.929	8.314	9.700	Sub-total (G)
Monitoring & control	0.082	1.171	2.343	3.514	4.686	5.857	7.029	8.200	Sub-total (H)
Performance score for all criteria = (A + B + C + D + E + F + G + H)		**14.286**	**28.571**	**42.857**	**57.143**	**71.429**	**85.714**	**100.000**	**Total Score Obtained**

** Relative Importance (RI) obtained from Table 2*

5. Conclusions

The model presented in this paper is a fundamental and direct mathematical tool that could be readily utilized to evaluate contractors' efficiency in managing housing reconstruction. Contractors handling reconstruction works can be evaluated and grouped based on their management practices efficiency evaluation scores. Thus, this evaluation framework can serve as a valuable tool in a wide-ranging managerial, economic and social context to stakeholders responsible for policy formulation and general management of the sustainable housing reconstruction works. The assessment scores generated from the quantitative assessment form demonstrate the management practices efficiency rating for the contractors executing the reconstruction process, and this efficiency rating will underline the management aspects requiring improvements. Therefore, deviations from the best practice measures for managing sustainable housing reconstruction programmes can easily be analyzed and evaluated to come up with logical justifications for successful outcome, failure and the lessons that improve learning, innovation and continuous improvement. Although the evidences on which the results of this study emanate from reconstruction of building structures experiences in some parts of Nigeria, the technique developed could be adopted in other areas faced with post-disaster mass-housing reconstruction. This paper updated existing knowledge on the management of post-disaster retrofitting works to building structures and offers valuable help to regulatory decision-makers and practitioners involved in managing retrofitting of building structures affected by insurgency.

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