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UNDERSTANDING HOLISTIC DETERMINANTS INFLUENCING THE PERFORMANCE OF PERSONNEL AND INTERVENTION OF ENVIRONMENTAL AGENCIES IN FLOOD-PRONE COMMUNITIES OF SOUTHWESTERN NIGERIA

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ABSTRACT

Incessant flooding with its impact on environmental sustainability and human survival has been implicated in the loss of valuables among the inhabitants of flood-prone communities in Nigeria. However, the dearth of mitigation methods to combat floods in Nigeria is worrisome thereby depreciating social and physical development. Therefore, understanding holistic determinants influencing the performance of environmental agencies' personnel and intervention in flood-prone communities was investigated. Purposive and random sampling techniques were used with a sample size of 66 respondents selected from the 3 selected States, Oyo, Ogun, and Lagos respectively. A survey design and questionnaire method were used for data collection. Socio-economic characteristics of personnel, readiness of agencies'

personnel advocacy (RAPA), and personnel and intervention performance (PIP) were the parameters studied. Data analysis was conducted with descriptive statistics, chi-square, and multivariate probit at $\alpha_{0.05}$. Chi-square tested the relationship between variables which showed there was a significant relationship between age and flood management skills of personnel ($\chi^2 = 27.776$, $p = 0.03$); and years of experience of personnel and free flow of information ($\chi^2 = 51.843$, $p = 0.00$). Further, the multivariate probit model showed that the performance of personnel and intervention of environment agencies in flood management facilities (β= .633), flood management skills of personnel (β= .638), adequate flood management skills of personnel (β= -1.022), free flow of information (β= 1.074), and adequate staff development (β= .605) were significantly influenced by holistic factors such as marital status, creation of awareness and others. The study concluded that personnel investigated were observed to show readiness in advocacy of flood management and were actively engaged in deploying intervention. Technocrats and relevant stakeholders should prioritize policy formulation on environmental adaptation strategies.

Keywords: *Advocacy*, *Determinants*, *Effectiveness*, *Flood-prone areas*, *Nigeria***.**

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1. INTRODUCTION

Flooding is an occurrence that results from heavy rainfall with the natural water courses not able to convey excess water. According to Obeta (2014), flooding continues to be an increasing problem in many parts of Nigeria, catching individuals and communities by surprise in a repeatedly exasperating way, disrupting social activities, damaging

infrastructure, and even resulting in the death of people and livestock. Similarly, Obebi (2013) asserts that Nigeria's 923,768sq km land area is made up of 13,000sq km of water which has contributed to flooding in Nigeria when there is heavy downpour. In 2001, for instance, Abia, Adamawa, and Akwa Ibom states witnessed heavy downpours and rainstorms that affected about 5,000 people which was explained further by Obebi (2013) who confirmed that in the same year, about 12,300 people were displaced by torrential rain which destroyed farmlands, damaged properties, and submerged buildings in Zamfara state. Furthermore, Emeriobeole (2015) asserts that flood is one of the most devastating natural disasters in the world claiming lives and causing stupendous property damage that can be imagined.

However, the floods have led to mitigation measures identified in Oyo, Ogun, and Lagos States, Southwestern Nigeria vis-à-vis effective waste management, functional drainage, demolition of buildings on the floodplains, and re-channelisation of water bodies were also observed as unsustainable (Odunola & Balogun, 2015). This was substantiated by Ologunorisa & Tersoo (2006) that inadequate channelization of water courses and non-evaluation of stream basins in flood-prone communities have led to unsustainable management of floods in Nigeria.

Jeb and Aggarwal (2008) opined the reduction of flood risk depends largely on the amount of information on floods that are available and knowledge of the areas that are likely to be affected during a flooding event. Agbonkhese, et al., (2014) suggested that early warning is a proactive measure to

controlling flooding in Nigeria. Also, Aderoju et al., (2012) believed that useful modern-day techniques could help government and relief agencies to identify areas that are vulnerable to flooding, and plan for flood occurrences in the future.

The knowledge of remote sensing and geographical information systems (GIS) is a tool that can be used to investigate and map areas that are less or more vulnerable to flooding in conjunction with forecasting techniques to predict the precipitation intensity and duration in the nearest future (Aderoju et al., 2012) Ibid.

Further, according to Ogie et al. (2019), submitted that non-structural approaches involve soft measures like flood forecasting, flood insurance, flood risk analysis, land use planning and zoning, policy response, flood awareness programs, flood emergency planning and response, and post-flood recovery. In congruence, the federal government of Nigeria raised some objectives in the 2003 Agenda to tackle flood occurrence through the provision of a master plan and relief measures for victims, and mitigation of flood through relevant land use laws and edicts (Adetunji and Oyeleye, 2018). According to Kuntiyawichai (2012), there had been provision of loss bearing policies such as public relief funds, flood insurance, floodplain zoning, flood forecasting, and warning schemes. However, Schanze (2006) established that absolute flood protection cannot be achieved.

In reducing the impact of flood disasters, the federal government of Nigeria declared an early warning of the likely occurrence of flood in the major cities of Lagos, Kano, and

Kaduna which was upgraded in 2014 with the installation of 307 web-based flood warning systems throughout the country (Nemine, 2015). Moreover, Okoruwa (2014) established that the Ministry of Environment and Water Resources also acquired and installed four stand-alone automated functional flood early warning facilities along rivers Alamutu, Eruwa, and Owena River basins in Southwestern Nigeria.

Structural measures are altering tools utilized to mitigate floods. However, according to Amangabara and Gobo (2010), these structural measures could be costly and on their own cannot get rid of floods. Moreover, flood management in coastal megacities of developing nations (CMDN) can benefit from both structural and non-structural measures (Ogie et al., 2019). However, as exemplified by Li et al. (2016), structural measures are hard infrastructure like dykes, drainages, floodgates, and reservoirs which are useful in containing flood water. Chang (2005) buttressed that in any environment two types of mitigation exist which are hard and soft mitigations.

Adelekan (2016) identified notable engineering projects that have been carried out in Lagos since 1998 as the Greater Lagos Drainage Master Plan with the execution of channelization works in 2011 and 69 km of concrete water collector drainage.

Chan et al. (2012, 2013, 2014) and Yin et al. (2015) expressed that coastal megacities in Asia were overly dependent on structural approaches to flooding, while little or no attention was paid to sustainable flood risk management, and of course transcends hard engineering measures to include non-structural complementary solutions such as early warning systems, improved access to flood risk information, emergency

evacuation planning, building codes, wider stakeholder engagement, land use, flood insurance, and environmental education programs.

According to Oshodi (2013), in mitigating the effects of flood by the Lagos State Government, certain strategies were adopted such as the expansion of drainages and upgrading some primary drainages in Bariga, Surulere, Gbagada, and other strategies throughout the state like removal of debris, advising dwellers in flood plains on relocating and demolition of homes in response to major flood disaster. Southwestern Nigeria has experienced prevalent flood hazards, which will underpin this study to delve into the effectiveness of environmental agencies' personnel in deploying mitigation measures in flood-prone communities. This will further prompt research interest among researchers and environmentalists to enforce policies on effective forestry land use strategies for environmental safety among stakeholders. Based on the foregoing, the study is poised to examine the socioeconomic characteristics of personnel, the readiness of agencies' personnel in advocacy of flood management awareness creation (RAPA), the intervention performance of personnel (PIP), and the factors influencing the performance of personnel and intervention of environment agencies.

2. REVIEW OF LITERATURE

2.1 Flood Management in Nigeria

According to Nwosu (2014), flooding is having a great impact on millions of people every year. Therefore, there is a need for flood management implementation in the short term. This is because it is impossible to have a complete grasp of climate and

other natural causes of floods for urgent and systematic preparedness to mitigate its effects (Abiodun *et al*., 2008). Furthermore, controlling or minimizing flood vulnerability on human activities, lives, and properties should come with the utmost readiness and preparedness from respective government institutions, according to Abiodun *et al*. (2008). Traditionally, Nigeria has relied much on a structural measure like engineering intervention to manage floods and others such as planting vegetation to retain extra water (greening measures), terracing upland areas to enhance water retention, channelization to divert flood water, and building dykes, reservoirs or retention ponds in floodplains. Thus, the expansion of cities into surrounding floodplains where standards of flood protection are lower is another challenging issue with drainages in many city centers already becoming dilapidated, with most valuable assets and properties predisposed to greater risk.

Furthermore, an integrated management approach should be adopted to ameliorate flood vulnerability in Nigeria. This approach comprises different methods aimed at controlling, and managing floods, and reducing their aftereffects (Obebi, 2013). The strategy is a shift from solely structural measure to a more balanced non-structural measure. Infrastructural operation and maintenance involve building and constructing the necessary structures to curtail the vulnerability of hazards, especially in flood-prone areas, and maintaining existing ones (Obebi, 2013). Furthermore, effective communication deals with creating awareness about flood occurrence by personnel of environmental agencies and through flood monitoring facilities. For example, constructing a flood-frequency curve based on

historical records and examination of vegetation to determine how often on average flood of a certain size would occur in a particular area.

Equally, past studies have enunciated those anthropogenic activities such as deforestation, haphazard developments resulting in the blockage of drainages and water ways also contribute to flooding (Mfon *et al*., 2022). In addition, they exemplified that due to population explosion in urban areas and rural areas likewise, most developers now extend their housing development to low-lying areas near water bodies and water-logged areas where flooding is inevitable. According to Mfon *et al*. (2022), the neglect by the government and its agencies to design and implement viable policies at various levels has contributed to flooding together with poor environmental planning and sanitation. However, they explained that the strategies for the management of flooding in cities and villages should largely be premised on the development of drainage channels. Moreover, the available flood management strategies in most cities are largely ineffective, and as such, it is difficult to contain the challenges of flooding and the gross lack of inadequate response from the government to enforce legislation that would ensure orderly development and discourage people from embarking on deforestation and also developing on flood-prone areas. Furthermore, Okoye (2019) corroborated the necessity of analyzing perennial flooding and integrated risk management strategy for flood management in Nigeria. He observed that the need to manage flood hazards should stem from observing that floods occur in Nigeria which has resulted in loss of lives, sources of livelihoods, property and socio-economic infrastructure. Hence, in other to manage flood

hazards, he engaged in a discourse with the aim of identifying strategies and prospective solutions for controlling flooding. He observed that there is a need for the development of appropriate channelization and dredging to enhance the free flow of sudden deluge and run-offs.

2.2 Agencies Responsible for Floods Mitigation in Nigeria

In the events of massive losses of lives and properties due to flooding, successive governments have established agencies and institutions in order to manage the effects of natural hazards and human-induced flood disasters and implement public policies in the area of flood management (Adefisoye & Arum, 2021). They further stated that presently, the National Emergency Management Agency (NEMA), the National Environmental Standards and Regulations Enforcement Agency (NESREA), the Nigerian Hydrological Services Agency (NIHSA), the Nigerian Meteorological Agency (NiMET) are some of the prominent federal government agencies saddled with the responsibility of managing various aspects of floods, with NEMA as the lead agency. Therefore, an overview of the responsibilities of these institutions/agencies is presented:

2.2.1 National Emergency Management Agency (NEMA)

NEMA, as the lead agency in Nigeria's flood management arena, was established in 1999 to replace the National Emergency Relief Agency (NERA) and cater to broader aspects of disaster management which NERA did not have the capacity to do. Specifically, the Act that established NEMA saddled the Agency with the overall function of managing emergencies and disasters in Nigeria. According to the Establishment Act, the

Agency shall among the other things: (a) Formulate policy on all activities relating to the disaster management in Nigeria and co-ordinate the plans and programs for efficient and effect response to disasters at national level; (b) Monitor the state of preparedness of all organization or agencies which may contribute to disaster management in Nigeria; (c) Collate data from relevant agencies, so as to enhance forecasting, planning and field operation of disaster management; (d) Educate and inform the public on disaster prevention and control measures; (e) Co-ordinate and facilitate the provision of necessary resource for Search and Rescue and other forms of disaster curtailment activities in response to distress calls; (f) Co-ordinate the activities of all voluntary organizations engaged in emergency relief operations in any part of the Federation; (g) Receive financial and technical aid from international organization and non-governmental agencies, for the purpose of disaster management in Nigeria; (h) Collect emergency relief supply from Local and foreign source and from International and non-Governmental Agencies; (i) Distribute emergency relief material to victims of natural or other disasters and assist in the rehabilitation of the victims, where necessary (j) Liaise with State Emergency Management Committees, to assess and monitor, where necessary, the distribution of relief materials to disaster victims. (k) Process relief assistance to such countries as may be determined from time to time; and (l) Liaise with the United Nations Disaster Reduction Organizations such as other international bodies for the reduction of natural and other disasters (NEMA Act, 1999, p. 4; NDMF, 2010).

2.2.2 National Environmental Standards and Regulation Enforcement Agency (NESREA)

In 1999, the Federal Government of Nigeria merged the Federal Environmental Protection Agency (FEPA) and other relevant departments to form the Federal Ministry of Environment, but without an appropriate enabling law on enforcement issues. This situation created a vacuum in the effective enforcement of environmental laws, standards, and regulations in the country. However, in 2007, the bill for an act establishing NESREA was passed by the National Assembly, signed into law, and published in the Federal Republic of Nigeria Official Gazette No. 92. Vol. 94 of 31st July 2007 (http://www.nesrea.gov.ng/about-us/). NESREA has the responsibility for the protection and development of the environment, biodiversity conservation, and sustainable development of Nigeria's natural resources in general and environmental technology in particular, including co-ordination and liaison with relevant stakeholders within and outside Nigeria on matters of enforcement of environmental standards, regulations, rules, laws, policies, and guidelines. The NESREA Act empowers the Agency to be responsible for enforcing all environmental laws, guidelines, policies, standards, and regulations in Nigeria, as well as enforcing compliance with the provisions of international agreements, protocols, conventions, and treaties on the environment to which Nigeria is a signatory (http://www.nesrea.gov.ng/about-us/). Specifically, the Agency has the overall function to enforce compliance with laws, guidelines, policies, and standards on environmental matters; and since flooding is an environmental issue in Nigeria, NESREA is a critical stakeholder in flood management in the

country. It is important to note that in recognition of NESREAS's strategic role in flood management, NEMA, in 2013 signed an MoU with the NESREA alongside NOA to foster inter-agency collaboration in the management of floods in Nigeria (NEMA, 2013).

2.2.3 Nigerian Meteorological Agency (NiMET)

The Nigerian Meteorological Agency (NiMET) came into existence by an Act of the National Assembly – NiMET (Establishment) ACT 2003, enacted on 21st May 2003 and became effective on 19th June 2003 following presidential assent. It is a Federal Government agency charged with the responsibility of advising the Federal Government on all aspects of meteorology; the Agency projects, prepares, and interprets government policy in the field of meteorology, and issues weather (and climate) forecasts for the safe operations of aircraft, ocean-going vessels, and oil rigs. The Act also makes it the responsibility of the Agency to observe, collate, collect, process, and disseminate all meteorological data and information within and outside, co-ordinate research activities among staff, and publish scientific papers in the various branches of meteorology in support of sustainable socio-economic activities in Nigeria. Importantly, NiMET produces the annual Seasonal Rainfall Prediction, a publication that predicts and alerts the likelihood of flood occurrence in the country.

2.2.4 Nigeria Hydrological Services Agency (NIHSA)

NIHSA was established as an agency in the Ministry of Water Resources and given the mandate to provide the services

required for assessing Nigeria's surface and groundwater resources in terms of quantity, quality, distribution, and availability in time and space for efficient and sustainable management (NIHSA, 2018). Primarily, the Agency provides hydrological data and information on the location of water resources, their extent, dependability, quality, and the possibility of their utilization and control continuously. Since 2013, NIHSA has been creating awareness of flooding through its Annual Flood Outlook (AFO). Other activities of NIHSA include the provision of professional advice to various levels of government in Nigeria on all aspects of hydrology. It also collaborates with NiMET to issue flood forecasts and contributes towards creating awareness of flooding among local communities.

2.3 Conceptual Framework of Performance of Environmental Agencies in Flood Management

The conceptual framework shows the sequence of inter-relationships among variables of the performance of environmental agencies in flood management. The framework is based on environmental agencies' personnel advocacy of flood management and intervention being influenced by socio-economic characteristics and other extant factors. Therefore, the conceptual framework of the performance of environmental agencies in flood management adopted the "Environment Agency flood incident management process map" (Environment Agency, 2007). The Environment Agency developed a 'process map' that shows how their FIM process operates, and the roles of Environment Agency personnel. The process map was created with the assumption that the National

Flood Forecasting System (NFFS) and Flood Warning Direct System (FWD) would be implemented. The process map, however, shows how all the activities fit together. The FIM process is a series of 'nested' process diagrams, the top level of which is shown in Figure 1 below:

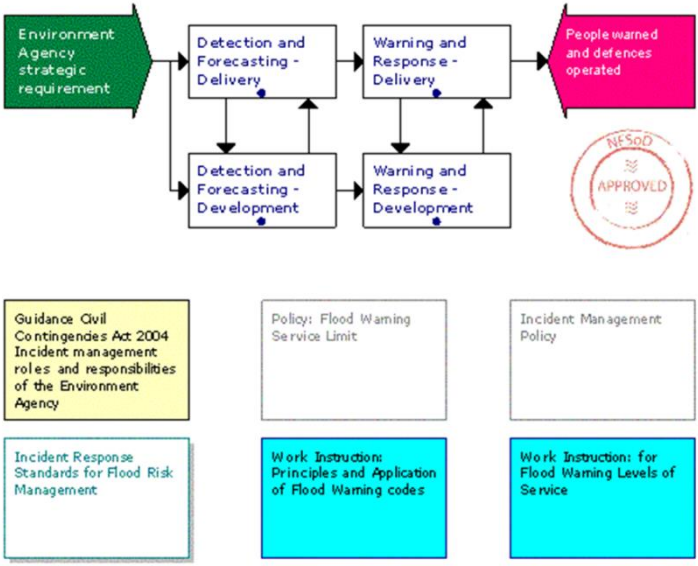

Figure 1. Environment Agency's Conceptual Diagram for Flood Management (2007).

3. RESEARCH METHODOLOGY

3.1 Study Area

The study was conducted in selected states of Southwestern Nigeria with a focus on Personnel of environmental agencies in flood-prone communities. Southwestern is a geopolitical region

in Nigeria. It has a land size of 114.271km². This region was estimated in 2020 to have a population of about 32.5 million with an approximate figure of 20.44 percent of Nigeria's population according to the National Bureau of Statistics (2006) and; the United Nations (2006). The selected Southwestern states were Oyo, Ogun, and Lagos respectively. The major tribe of this geopolitical zone is Yoruba with several dialects coupled with other ethnicity in Nigeria like Hausa, Igbo, and so on. These selected Southwestern states comprise three main vegetation which are mangrove forest, tropical rain forest, and guinea savannah.

3.2 Sampling Procedure and Sample Size

The study made use of purposive and random sampling. The use of this procedure was informed by fairly even representation across the environmental organizations and the mandate of the organizations within the studied area. Furthermore, personnel/staff of mitigation institutions were selected with purposive sampling. The institutions were the Ministry of Environment in Oyo, Ogun, and Lagos; Ogun-Oshun River Basin Authority, National Emergency Management Agency, NEMA, Nigeria Meteorological Agency, NIMET, National Environmental Standard and Regulations Enforcement Agency, NESREA, Ibadan Urban Flood Management Program, IUFMP, and Forestry Research Institute of Nigeria, FRIN. The study employed qualitative data collection of primary data through the use of a questionnaire and face-to-face interview methods. About 80 copies of questionnaires were administered randomly among the staff of selected mitigation institutions but sixty-six (66) copies were retrieved.

3.3 Analytical Techniques

Some analytical tools were employed for data analysis. Data were analyzed with descriptive statistics such as frequency and percentages. Specifically, objective 1 was analyzed with frequency and percentages, and objectives 2 and 3 with the mean scores in the form of a Likert scale. Chi-square test and Multivariate probit (MVP) analysis were used for test of relationship and influence respectively. The choice of MVP was considered due to several activities engaged in by personnel of environmental agencies in response to interventions and the model was considered to allow the use of several chains for the estimate. This model analyses selected factors that influence performance of personnel and intervention in the studied area.

a. Chi-square Test

This can be expressed as,

$$\chi^2 = \Sigma\left[\frac{(f_o - f_e)^2}{f_e}\right] \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where:

χ^2 = Chi-Square

Σ = Total

f_O = frequencies of observed nominal variables, that is the selected demographic variables.

f_e = expected frequencies of occurrence determined from response categories.

b. Multivariate Discrete Choice Model

The multivariate probit model was employed to investigate factors that influence performance of personnel and the intervention of agencies.

$zi = XiB + \varepsilon i \; i = 1...n$ .....(2)

Where:

Yi = vector of dependent variables (each serves as personnel's performance, i.e. effectiveness)

X' = vector of explanatory variables; that is awareness parameters

βi = vector of coefficients

εi = random error term and n is the number of observations with zero means and unitary variance.

c. Operationalization of Likert Scale and Mean Scores

Personnel was asked to respond to statements on "readiness of agencies' personnel in advocacy among inhabitants South-western Nigeria" with a 5-point Likert scale depicting "Strongly Agree", "Agree", "Undecided", "Disagree", "Strongly Disagree". The benchmark was obtained; thus, 5+4+3+2+1 = 15 divided by 5 equals 3.0. Hence, a cut-off mean point of 3.0. A mean below 3.0 implies low readiness of agencies' personnel in advocacy of flood management, and a mean equal to or greater than 3.0 implies high readiness. In addition, the same benchmark applies to intervention performance operationalization with a 5-point Likert scale depicting

"Excellent", "Very Good", "Good", "Fair", and "Poor". Hence, a cut-off mean point of 3.0. A mean below 3.0 implies low performance of agencies' personnel and intervention, and a mean equal to or greater than 3.0 implies high performance of agencies' personnel and intervention.

4. RESULTS AND DISCUSSION

4.1 Socio-Economic Characteristics of Personnel of Government Institutions Responsible for Flood Management

Table 1 presents the socio-economic characteristics of personnel of identified environment agencies responsible for flood management. The Table shows the distribution of the environment agencies constitute 27.3% of personnel from the Ministry of Environment, followed by Ibadan Urban Flood Management Project; (IUFMP) with 21.2%, NESREA (13.6%), FRIN (12.1%), NEMA (10.6%), Ogun-Oshun River Basin Development Authority (9.1%) and NIMET (6.1%) respectively.

Further, it was found that the majority of the personnel (83.3%) were male. Also, about 33.3% of them were between 41-50 years of age, followed by 30.3% of them between 31-40 years of age. This corroborates Ogbogu (2017) who reported that more male constitutes the staff strength of the Ministry of Environment in Southwestern Nigeria. Also, the majority of personnel (71.2%) were married while about 68.2% were of Christian faith.

On educational background and work experience of personnel, 57.6% of them had higher degree qualifications while 43.9%

had between 11 and 15 years of work experience. Another 21.2% of them had worked 5 years or less in their organizations.

The distribution of personnel's work designation in their various agencies (Table 1) also revealed 21.2% of them as building technicians/structural-civil engineers/senior technical officers. This was followed by 18.2% enforcement/safeguard officer, consultant/community officer (7.7%), field operation/forest officer (6.1%), emergency response officer (6.1%), meteorology officer (6.1%), senior officer (6.1%), supervisors of fieldwork (4.5%) and others respectively.

The study also revealed that 72.7% of the personnel of the agencies as experts in flood management and only 9.1% perceived the land use approach as a sustainable flood mitigation measure even though 77.3% believed that both natural and structural engineering measures of flood control are sustainable. This indicates that most of them are directly involved in mitigating flooding with expertise in both natural and structural engineering measures for flood management. These findings corroborate Adekola *et al*. (2019) who opined that the work of flood mitigation and related government agencies in Nigeria is mostly in the area of flood adaptation.

Assessing personnel's perception of nature-based solutions to flood control in the study area, it was 71.2% believed in the use of Reforestation/ Afforestation for flood management while 63.6% of them had the capacity for nature-based practices. This indicates that reforestation and afforestation could be very intense nature-based methods of stabilizing the environment against the occurrence of flooding in southwest Nigeria. This agrees with the finding of Adekola *et al*. (2019) who reported

that the planting of 5 million trees campaign as an afforestation approach for flood adaption measure in Southern Nigeria.

Table 1. Socio-Economic Characteristics of Personnel of Environment Agencies in Southwestern Nigeria

Parameters	Frequencies	Percentages	Mode
Identified institutions			
IUFMP	14	21.2	
NiMET	4	6.1	Ministry of Environment
FRIN	8	12.1	
Ministry of Environment	18	27.3*	
NEMA	7	10.6	
NESREA	9	13.6	
Ogun-Oshun RBDA	6	9.1	
Gender			
Male	55	83.3*	Male
Female	11	16.7	
Age (Years)			
21-30	13	19.7	
>30-40	20	30.3*	31-50
>40-50	22	33.3*	
>50-60	10	15.2	
≥ 60	1	1.5	
Marital status			

Single	19	28.8	Married
Married	47	71.2*	
Religion			
Islam	21	31.8	Christianity
Christianity	45	68.2*	
Education			
Secondary	1	1.5	Higher Degree
ND/NCE	4	6.1	
HND/BSc	23	34.8	
Higher Degree	38	57.6*	
Work Experience (Years)			
≤ 5	14	21.2	
5-10	11	16.7	11-15
10-15	29	43.9*	
15-20	7	10.6	
≥ 20	5	7.6	
Work status in the agency			
Building technician/Structural Engineer	14	21.2*	
Consultant/Community Officer	5	7.7	
Data Analyst	2	3.0	
Director/Deputy Director	2	3.0	Structural Engineer
Emergency Response Officer	4	6.1	

Enforcement/Safeguard Officer	12	18.2	
Field Operation/Forest Officer	4	6.1	
Head of Unit	1	1.5	
Hydraulic Consultant	1	1.5	
Meteorology Officer	4	6.1	
Mining Engineer	1	1.5	
Principal Monitoring Officer	2	3.0	
Environmental Protection Officer	1	1.5	
Relief/Rehabilitation Officer	2	3.0	
Researcher	2	3.0	
Senior Officer	4	6.1	
Supervisors of fieldwork	3	4.5	
Unit Head of Public Affairs	1	1.5	
Urban Development Officer	1	1.5	
Professionalism in Flood Management			
An Expert	48	72.7*	Expert
Not an Expert	18	27.3	
Sustainable Mitigation Methods			
Natural method (land use)	6	9.1	Both methods
Structural Engineering method	9	13.6	
Both methods	51	77.3*	
Perceived Use of Nature-based Solutions to Flooding			

Agroforestry useful	4	6.1	Not useful
Agroforestry not useful	62	93.9*	
Reforestation/Afforestation, useful	47	71.2*	Useful
Reforestation/Afforestation is not useful	19	28.8	
Crop Rotation useful	3	4.5	Not useful
Crop Rotation is not useful	63	95.5*	
Shifting Cultivation useful	1	1.5	Not useful
Shifting Cultivation not useful	65	98.5*	

Source: Field survey, 2021

4.2 Readiness of Personnel of Environment Agencies' Advocacy of Flood Management in Flood-Prone Communities

Table 2 presents the distribution of agencies' readiness in advocacy of flood management in flood-prone areas. The Table shows that creating awareness by distribution of publications to the rural public about flood management with a mean score of 4.6 ranked 1st. This infers that awareness and attitudinal change among the inhabitants was very effective in the flood-prone areas. This concurs with the submission of Jeb and Aggarwal (2008) that reduction of flood largely depends on the information available to and knowledge of residents of flood-prone areas. Furthermore, the availability of GIS equipment for the timely defection of flood in flood-prone areas (4.6) ranked 1st, installing educational posters in public places about flood management (4.4) ranked 2nd., education courses for agency's personnel about flood management (4.3) ranked 3rd, and others means of creating awareness to influence attitudinal change

among the respondents of flood-prone areas respectively as shown in the Table. This indicated that necessary equipment and information on flood management effectively trickled down to the inhabitants of flood-prone areas of Southwestern Nigeria as confirmed by Aderoju et al. (2012) who submitted that technical measures and knowledge of remote sensing, and geographical information systems are useful to helping government, and relief agencies in identifying flood-prone areas in order to mitigate flood events. Okoruwa (2014) and Nemine (2015) confirmed the same, that the Federal Ministry of Environment had installed functional flood early-warning facilities which are community-based in Nigeria.

The personnel of agencies who were responsible for flood management also underwent educational courses which had a mean score of 4.3 ranked 3rd. This implies that personnel of agencies were trained and equipped effectively with skills and knowledge in flood management which confer on them as subject matter specialists with mitigation measures in Southwestern Nigeria. This is in conformity with Nemine (2015) who submitted that the Federal government had funded and equipped the personnel of NIMET, and other stakeholders saddled with the responsibility of warning the public of the imminent dangers of flooding and mitigating the effects of floods, especially in the year 2012.

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Table 2. Readiness of Personnel of Agencies' Advocacy of Flood Management in Flood-Prone Communities of Southwestern Nigeria

Parameters	SA	A	U	D	SD	Mean scores/ Ranking
	F %	F %	F %	F %	F %	
Creation of awareness through publications	50 (75.8)	11(16.7)	2(3.0)	1(1.5)	2(3.0)	4.6 -1st
Installation of educational posters and billboards	44(66.7)	12(18.2)	3(4.5)	5(7.6)	2(3.0)	4.4 - 2nd
Education training for personnel	36(54.5)	17(25.8)	9(13.6)	2(3.0)	2(3.0)	4.3 - 3rd
Available GIS equipment for timely detection of flood	50(75.8)	13(19.7)		1(1.5)	2(3.0)	4.6 -1st
Organizing educational programs	34(51.5)	8(12.1)			24(36.4)	3.4 - 5th
Dissemination of information on public participation	39(59.1)	3(4.5)		11(16.7)	13(19.7)	3.7 - 4th
Teaching dwellers of flood-prone communities	26(39.4)	6(9.1)		1(1.5)	33(50.0)	2.9 - 6th
Organizing an environmental sanitation program	33(50.0)	9(13.6)			24(36.4)	3.4 - 5th
Presentation through audio-visual program	37(56.0)	7(10.6)		10(15.2)	12(18.2)	3.7 - 4th

Note: SA = Strongly Agreed, A = Agreed, U = Undecided, D = Disagreed, SD = Strongly Disagreed.
Note: F = frequencies, % = percentages in parentheses.
Source: Field Survey, 2021.

4.3 Personnel and Intervention Performance of Environment Mitigation Agencies

The results in Table 3 show that keeping staff abreast of the development in the agency with a mean score of 4.0 which ranked 1st, followed by free flow of information to and from within and between administrators through their subordinates with a mean score of 3.7 which ranked 2nd. This implies that the level of knowledge of the latest developments within the organization was high among the personnel. This has become increasingly necessary because agencies across the selected States of Southwestern Nigeria have shown high performance in their responsibilities to ensure flood management is achievable. This finding is supported by studies of Bateman and Snell (2004) which affirmed that a higher sense of achievement would afford workers freedom to use their initiatives and enhance commitment to their organization. Table 3 further reveals the availability of flood management skills of personnel having a mean score of 3.0 and ranked 3rd, followed by all cadres of staff having "a say" in the decision-making process on flood management with 3.0 which ranked 3rd respectively. This infers that personnel of agencies in the study area had high management performance and acumen in their responsibility to protect and safeguard the environment from being submerged by flooding. Ogbogu (2017) corroborates the findings that staff of an environment organization in Lagos, Nigeria were encouraged with motivations for growth through opportunities from their workplace to carry out intervention activities in combating flooding.

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Table 3. Personnel and Intervention Performance of Environment Mitigation Agencies

Parameters	E		VG		G		E		P		Mea scor Rank
	F	%	F	%	F	%	F	%	F	%	
Availability of flood management facilities	5	(7.6)	7	(10.6)	2	(3.0)	26	(39.4)	26	(39.4)	2.1 -
Availability of flood management skills of personnel	3	(4.5)	26	(39.4)	6	(9.1)	28	(42.4)	3	(4.5)	3.0 -
Adequate flood management skill of personnel	2	(3.0)	24	(36.4)	15	(22.7)	22	(33.3)	3	(4.5)	3.0 -
Free flow of information to and from within and between administrator through their subordinates	26	(39.4)	12	(18.2)	11	(16.7)	17	(25.8)	-	-	3.7 -
Enjoyment of commensurable salary increase/promotion by personnel.	2	(3.0)	8	(12.1)	24	(36.4)	20	(30.3)	12	(18.2)	2.5 -
Adequate staff development in flood management.	2	(3.0)	5	(7.6)	25	(37.9)	8	(12.1)	26	(39.4)	1.8 -
Keeping staff abreast of the developments in the ministry or program.	24	(36.4)	21	(31.8)	15	(22.7)	6	(9.1)	-	-	4.0 -
All cadres of staff have "a say" in the decision-making process on flood management.	6	(9.1)	11	(16.7)	33	(50.0)	12	(18.2)	4	(6.1)	3.0 -
Availability of welfare services such as health care, transportation, and housing.	11	(16.7)	2	(3.0)	8	(12.1)	16	(24.2)	29	(43.9)	2.2 -
Adequacy of welfare services	10	(15.2)	3	(4.5)	8	(12.1)	15	(22.7)	30	(45.5	2.2 -
Adequacy of flood management facilities.	4	(6.1)	1	(1.5)	7	(10.6)	32	(48.5)	22	(33.3)	2.0 -

Note: E = Excellent, VG = Very Good, G = Good, F = Fair, P = Poor.
Note: F = Frequencies, (%) Percentages in parentheses.
Source: Field survey, 2021.

Table 4 presents the chi-square analysis for the test of the relationship between socioeconomic characteristics towards personnel and the intervention of environmental agencies. The results (Table 4) show that the sex and religion of personnel had no significant relationship with the intervention's performance, whereas age had a significant relationship with available flood management skills of personnel (χ^2 = 27.776, p = 0.03). This indicates age could easily influence the skill acquisition of

personnel for flood management because age has the potential to enforce eagerness in any individual to learn new technology. This finding corroborates the Environment Agency (2005) which submitted that age is an important factor for personnel perception of performance of flood management technologies. Also, there is a relationship between education and available flood management facilities (χ^2 = 27.319, p = 0.04); education and available flood management skills of personnel (χ^2 = 50.559, p = 0.00); education and adequate flood management skills of personnel (χ^2 = 61.141, p = 0.00). This implies that education has a strong effect on securing facilities for flood management and making efficient use of skills acquired for flood management in flood-prone communities of Southwestern Nigeria. This corroborates Mastulen et al. (2021) who opined that education has a significant relationship with workers' performance in most environmental agencies. Furthermore, the marital status of personnel had a significant relationship with available flood management facilities, available flood management skills of personnel, and their adequacy. This indicates a high form of commitment of married personnel to flood management intervention. In addition to other significant relationships, years of experience of personnel has a significant relationship with the free flow of information for high performance of environment agencies (χ^2 = 51.843, p = 0.00). This indicates that many years of practicing environmental services could enforce and enhance adequate and frequent dissemination and trickling of information passage for effective flood management in flood-prone communities of Southwestern Nigeria. This is in line with the submission of the Environment Agency (2005) that previous experience of

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personnel performance in emergency management influences their response to flood preparedness.

Table 4. Chi-Square Showing Relationship between Personnel's Socio-Economic Characteristics and Selected Personnel and Intervention Performance of Environmental Mitigation Agencies

Selected Socio-economic Characteristics of Personnel	Available Flood Management Facilities	Available flood Management Skills of Personnel	Adequate Flood Management Skill of Personnel	Free Flow of Information	Adequate Staff Development in Flood Management
Gender	4.553 (0.81)	4.543 (0.81)	4.618 (0.79)	7.231 (0.30)	5.556 (0.69)
Age	25.305 (0.07)	27.776 (0.03)*	24.588 (0.08)	13.792 (0.31)	15.555 (0.48)
Education	27.319 (0.04)*	50.559 (0.00)*	61.141 (0.00)*	15.250 (0.23)	9.553 (0.89)
Marital Status	15.645 (0.05)*	28.182 (0.00)*	44.078 (0.00)*	8.808 (0.19)	5.09 (0.75)
Religion	3.179 (0.53)	4.687 (0.32)	5.895 (0.21)	0.936 (0.82)	8.751 (0.07)
Years of Experience	28.455 (0.24)	29.321 (0.21)	30.667 (0.16)	26.675 (0.09)	51.843 (0.00)*

Note: Chi square (χ^2) = values without parentheses, p- value in parentheses, * = Significant @ $\alpha_{0.05}$
Source: Field survey, 2021.

Table 5 showcased the multivariate probit analysis of holistic factors influencing the performance of personnel and intervention of environment agencies in flood management. The results in Table 5 showed that the marital status of personnel influenced performance and intervention based on

available flood management facilities. The variable had a positive coefficient and was significant at $\alpha_{0.05}$. This implies that the probability of personnel and intervention performance increases as married personnel's commitment increases which suggests that marital responsibility could raise their level of performance in flood management.

The creation of awareness by publications influenced available flood management facilities and adequate staff development of personnel. The variable had a positive coefficient and was significant at $\alpha_{0.05}$. This indicates that the more chances of personnel's access to flood management facilities and their development for performance. In other words, the high level of performance as the creation of awareness is given serious attention.

Installation of posters and billboards limited influence on adequate staff development with importance for high performance of personnel of environment agencies. The variable had a negative coefficient and was significant at $\alpha_{0.05}$. This implies that the chance of personnel and intervention performance decreases as the installation of posters and billboards rises. It suggests that the installation of posters and billboards has limited the performance of personnel and intervention of environment agencies.

Education training influenced available flood management facilities and adequate staff development. The variable had a positive coefficient and was significant at $\alpha_{0.05}$. This indicates that the chances of personnel and intervention performance increase as educational training for stakeholders is organized frequently and consistently. This suggests that education is a

very useful means to improving the performance of personnel and intervention of environment agencies.

Organizing environmental sanitation influenced the available flood management skills of personnel, adequate flood management skills, free flow information, and adequate staff development. The variable had a negative coefficient and was significant at $\alpha_{0.05}$. This indicates that the probability of personnel and intervention performance reduces as organizing environmental sanitation becomes a more frequent activity. This confers that organizing sanitation might not contribute conspicuously to flood management in flood-prone communities of Southwestern Nigeria.

The R-squared in Table 5 showed that the performance of personnel and intervention of environment agencies were weak despite their strong influence by the holistic determinants at 11.6%, 5.6%, 8.2%, 4.4%, and 9.5% respectively.

Table 5. Multivariate Probit of Factors Influencing Performance of Personnel and Intervention

Parameters	[a]Available Flood Management Facilities	[b]Available flood Management Skills of Personnel	[c]Adequate Flood Management Skills of Personnel	[d]Free Flow of Information	[e]Adequate Staff Development in Flood Management
Gender	.096 (0.39)	-.231 (0.55)	-.084 (0.81)	-.036 (0.93)	.486 (0.22)
Age	.264 (0.11)	-.112 (0.45)	-.145 (0.28)	.034 (0.84)	.146 (0.33)
Education	-.240 (0.34)	-.182 (0.43)	-.144 (0.49)	-.329 (0.21)	.221 (0.35)
Marital Status	.633 (0.03)*	.267 (0.31)	.243 (0.31)	-.093 (0.75)	.142 (0.59)
Years of Experience	-.054 (0.63)	-.109 (0.28)	-.130 (0.16)	.022 (0.85)	.129 (0.22)

Creation of awareness by publications	.803 (0.01)*	.397 (0.11)	.297 (0.18)	.356 (0.14)	.605 (0.01)*
Installation of posters & billboards	-.359 (0.11)	.098 (0.61)	.212 (0.21)	-.335 (0.08)	-.580 (0.00)
Educational training of personnel	.528 (0.01)*	-.244 (0.16)	-.266 (0.09)	-.786 (0.00)*	.479 (0.01)*
Organizing educational programs	-.326 (0.41)	-.076 (0.83)	.203 (0.51)	1.074 (0.00)*	-.106 (0.75)
Dissemination of information on public participation	-.387 (0.30)	.638 (0.05)*	.477 (0.09)	.429 (0.17)	-.689 (0.03)*
Organizing environmental sanitation	-.230 (0.64)	-1.190 (0.01)*	-1.022 (0.01)*	-1.078 (0.01)*	.802 (0.05)*

Note: β- Beta coefficient without parentheses, p-value in parentheses, * = Significant @ $\alpha_{0.05}$, R-squared = [a] .116, [b] .056, [c] .082, [d] .044, [e] .095.
Source: Field survey, 2021.

5. CONCLUSION AND RECOMMENDATIONS

The study investigated factors influencing the performance of environmental agencies' personnel and intervention in flood-prone communities of Southwestern Nigeria using the multivariate probit model. The findings from the multivariate probit model showed that the performance of personnel and intervention of environment agencies were significantly affected by holistic factors such as marital status, creation of awareness by publications, installation of posters and billboards, educational training, and organizing environmental sanitation. The study concluded that personnel investigated were observed to show readiness in advocacy of flood

management and were actively engaged in deploying intervention in flood management. Although the performance of personnel and intervention were lacking in strength to mitigate flood in the flood-prone communities of Southwestern Nigeria. It is therefore recommended that relevant stakeholders in the flood-prone communities ensure that decisions that support a wide range of sustainable green-based/forest-based mitigation approaches are made. In addition, the formulation of policy on environmental adaptation strategies by technocrats and relevant stakeholders was recommended.

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