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Integrated approach to Wetlands and River Basin Management: The case of the Netherlands Meanderene de Maas River project

[1]Okogbue, Blessing C., [2]Sajo, Opeyemi S., [3]Nurtjahya, Eddy and [4]Manandhar, Bikram

1. Dept. of Fisheries Technology, Federal Polytechnic Ekowe, Bayelsa State, Nigeria.
2. College of Agriculture, Joseph Ayo Babalola University, Osun State, Nigeria.
***3.** Department of Biology, Universitas Bangka Belitung, Indonesia.*
4. Tribhuvan University, Institute of Forestry, Hetauda, Nepal.
Corresponding email: bless.okogbue@gmail.com

ABSTRACT

The integrated approach to wetland management incorporated stakeholder analysis, governing policies and frameworks for wetland management as well as the analysis of ecosystem goods and services. This is very vital in the effective and sustainable management of Wetlands to ensure people-based and eco-friendly options. The Maas (Meuse) River basin project in the Netherlands involved the engagement of all stakeholders and interest groups in the planning process. The in-depth consultations with experts aimed to culminate in a preferred design out of the six different designs developed to execute the Maas wetland project. The three designs considered were revolved around agriculture, nature development, dyke resizing and/or relocation, river bank manipulations to increase river water retention for effective water regulation; thus, their potential impacts were assessed in this study. Semi-structured interviews, visual site observations and direct approach were used to collect data. Results revealed the varying challenges the project posed on the environment and the people. The ecosystem service analysis showed that the three proposed designs namely; the Iconic Maas, the Lommerijke Maas and the Ruige Maas designs for the project were eco-friendly and support ecosystem goods and services however, agriculture was excluded from Lommerijke and Ruige Maas designs. The farmers and residents on the dyke area are negatively affected as relocation was inevitable if the Lommerijke Maas design is considered. The features of Lommerijke and Ruige designs do not accommodate agriculture on the flood plains but will enhance carbon sinks via nature development and afforestation. The Iconic Maas scenario permits cultural heritage and farming. These outcomes were assessed based on both national and international guidelines, policies and regulatory standards governing the implementation of wetlands and climate change-based projects. The Netherlands government therefore, considered the climate impact, wetland conservation and national safety policies as priority. Thus, this integrated process fostered inclusive consideration, public participation/stakeholder education and ecosystem prioritization for effective implementation and sustainable management successes for climate change mitigation.

Key words: Stakeholder Analysis, Wetland Management, Meuse River, Climate Change, Ecosystem Services

INTRODUCTION

The current threats posed by revolting nature resulting to disasters such as flood, typhoons, and hurricanes call for attention. During these perilous occasions, farmlands are lost leading to food insecurity and hunger, ecosystems are modified which may not be favorable to inhabiting organisms, lives and properties are also at stake which negatively impacts the nation's economy. This is very important due to the fact that there are so many low-lying communities in the seven continents of the world as well as different countries situated along the deltas of the global

marine coasts. Netherlands is one of those countries connecting to the North Sea as well as Nigeria connecting to Atlantic Ocean at the Niger delta areas. In the year I995, over 250,000 people were relocated from a central river area of the Netherlands due to high river water influx caused by heavy down pour in the neighboring Switzerland and Germany. In I953, storm surge also caused heavy flooding in Zeeland in the same country resulting to heavy loss of life and properties (Eserin *et al.,* 2003). Dykes were therefore designed to protect the lands and withstand water pressure. However, protecting the areas from high intrusion of rain water pressure remains a priority to the Netherlands government and should also be the same for any exposed city or countries. This gave rise to a national reinforcement programme termed "delaplan voor de rivierine" in the Netherlands (Huisman *et al*., 1998 In: Enserink *et al.,* 2003) which means "The plan for the riverine".

Currently, due to the climate change projections, the Netherlands government is on the plans again to put proactive and adaptive measures in place for the future, spanning from 2015 to 2028 and beyond. The wetlands and water resource management projects in the Netherlands take central position more or less because of the low lying position of the country in the European landscape. The European Union member state agreement in the year 2000 on Water Framework Directives was designed locally and implemented in 2015 in the Netherlands. This thus involved the Netherlands Rijkswaterstaat (The National Government), the Provinces (State Government Councils), the Municipalities (Local Government Councils) and the Water Boards that have the mandate to maintain and manage wetlands and all water works and facilities in the country (Project Team, 2009; Jager *et al*, 2016).

Four major rivers known as the Rhine, the Meuse (Maas), the Ems and the Scheldt rivers in the Netherlands constitute the freshwater wetlands. The Maas de Meanderene Project was mapped out only around the Maas River in the Southern part of the Netherlands along a 25 km dyke majorly situated in the Oss municipality (Oss Local Government) of the Province of Noord Brabant (North Brabant State Government) where the river flows in from Belgium. The threats of flood resulted in the establishment of Water Boards from the year 1100 to oversee constructions and maintenance of water control structures such as dams and dykes (Project Team, 2009). These structures keep the water out from inundating the Cities, High ways and Farmlands.

Despite the mandate of the Netherlands Water Boards, the engagement of stakeholders in the project planning and decision making processes was observed to be a common practice where the concerns and interests of the citizens are put on the table for deliberations and to make them more aware of their environments and hence, better stewards. This is known as public participation where in most cases representatives of different interest groups were invited for consultations though not a permission to act as integral part of the decision making parliaments.
These environmental based projects strongly affect the citizens and so concern them as well. They affect the environment and so also attract the interest of environmental scientists and managers who are also stakeholders.
Taking final decisions on the designs, construction and management of the best option to be adopted out of the six (6) different scenarios in the wetland project became an issue. The varying designs of the project at one point or the other require conversion of farmlands, displacements of residents and possible relocations of industries, private owned businesses of all types as well as manipulation of flood plains for grasslands or nature reserve to achieve dyke improvement, more room for the river and nature development.

The risk of flooding in low-lying delta areas is very high compared with upstream zones. The Niger delta area of Nigeria is faced with the same challenges and wetland/water management-related issues as seen in the case of the Netherlands. During the 2012 and 2018 floods in Nigeria, farmlands were completely inundated, high level loss of farm animals especially fish from overflown ponds and water-based diseases affecting some others. The 2019 flooding in some parts of the country was an indicator that flooding maybe be occurring yearly, hence, the need for proactive and attendant measures to tackle the climate change threats.

Also a similar case has been recorded in Indonesia around the city of Pangkalpinang as located in a low-lying riverine area which makes it prone to flooding in the wet season, and rob through the Rangkui River (Lia and Febri, 2019). The situation was discovered to be aggravated by the rate of deforestation, and land change activity in the city which also reduce vegetation covers. In February 2016, a heavy rain fall which made about 300 mm in two consecutive days resulted in the flooding of the Pangkalpinang city coupled with the invasion of overflown Rangkui River at the same time.
In East Africa also, the flooding situations in Kenya in March 2018 also arose from noticeable change in rainfall pattern which has affected several other countries. Tana River County was

reported to be one of the worst hit by the flood. More than 6, 000 livestock were reportedly destroyed, about 8, 450 acres of farmlands under water, and vital irrigation systems swept away. This rainfall pattern has been termed El Nino (IFRC, 2018; OCHA, 2018). Thus, such low-lying developing countries can simulate, modify or generate the scenarios and management strategic approaches that best address their home situations from this standpoint to tackle projected climate crisis.

This paper therefore reveals the need for community involvement and stakeholder participatory approach to wetlands management and also the need for ecosystem consideration in related projects. It is all inclusive in nature to ensure successful achievement of project goals. The community engagement in the Maas river project targets the safety of the people, wetlands and nature reserve of the country. The detailed goal of the project was communicated to the citizens during the meetings and via diverse media platforms. Considering the priority the international body placed on wetlands protection during the Ramsar Convection (Frazier, 1999 In: Okonkwo *et al.*, 2015), and the laws established to protect them, these laws are currently established in various countries such as the Netherlands where these policies are implemented, hence, its reference in this work as a case study.

The Maas River case study is presented in this paper as reference data for easy simulation by other developing or already developed low-lying States. Countries in uplands and upstream areas such as Nepal which is land-locked and very environmentally vulnerable to monsoon flooding and landslide (CDP, 2018) also require the same approach in water management and land reclamation programmes. It is eco-friendly and climate-smart approach to water regulation challenges and eco-based issues. This publication thus sorts to promote the need to identify the different stakeholders on any River basin, identify the various ecosystem services existing in the river basin and assess the potential impact of proposed project designs on the stakeholders and on the Maas freshwater ecosystem as a case study.

METHODOLOGY

Geographical location: The Netherlands is one of the countries situated in the North-Western part of Europe bordering the North Sea. While some parts of the country lies below sea level, the lowest area lying in the western part of the country where it contacts the North Sea is at the city

of Rotterdam which lies 6m below sea level N 51.9225006 Lat., 4.4791698 Long. With this geographic scenario, 65 % of the Netherlands in the absence of water control structures will be submerged daily posing great risk to life and the economy (Huisman *et al*., 1998).

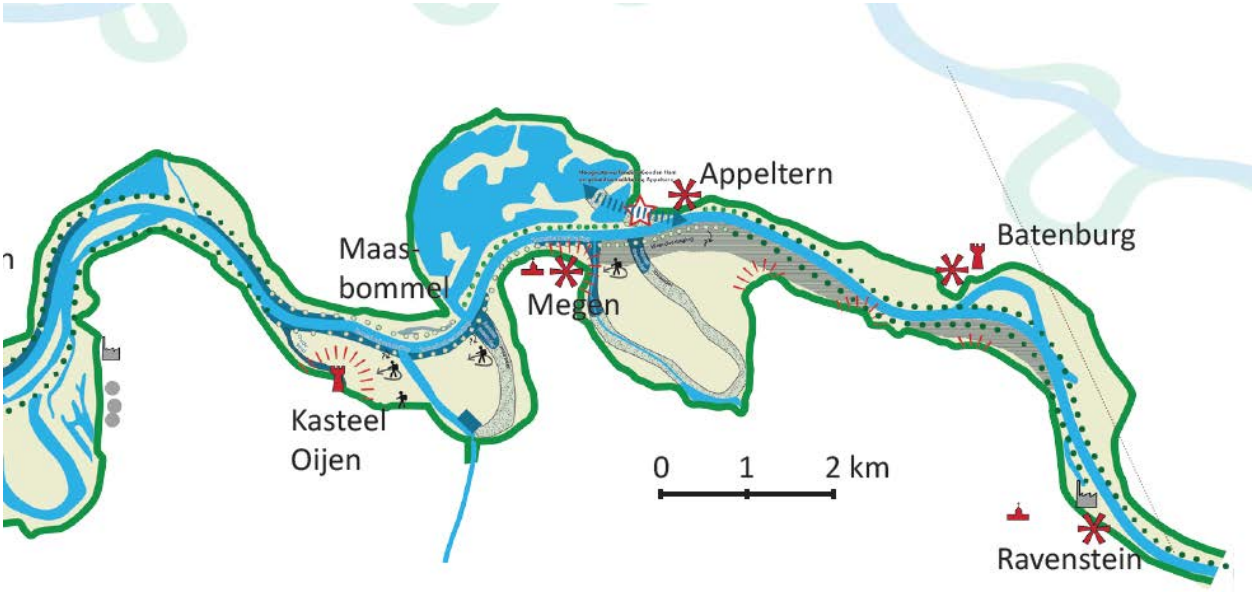

Figure 1. Map of the Netherlands Maas River project area (IWRM, 2018).

Study Area: 25 km of the Maas River within the Oss Municipality, North Brabant Province of the country stretched from Ravenstein to Lith which constitutes 21 communities along the river.

Data collection:

Data collection was achieved through interviews, review of literatures and internet-based researches. Semi-structured interview (SSI) was adopted for face-to-face interactions with selected key stakeholders and representatives of various interest groups for primary data collection. The overall data collection process therefore involved field work for visual site observations and direct approach (USEPA, 2013). The field trips included visits to the Netherlands Water Boards, Nature-based NGO (Naturr Monumentu), Oss Municipality, North Brabant Province, Farmers Association (ZLTO), Business Owners'Association (Brewery, Water sports, Entrepreneurs Association), Village Council Head (for five villages – Ravenstein, Batenburg, Appeltern, Megen and Oijen).

***Data analysis*:**

This study sort to identify the potential impact of the project options on both stakeholders and the ecosystem services of the Maas River basin and wetlands. Therefore, graphical analysis of data was employed for ecosystem service report while Matrix analysis was used for stakeholder distribution and issue prioritization for impact analysis (O'Hara, 2009 In: FAO, 2012).

RESULTS

The different stakeholders in the Maas river project were captured in the matrix illustration in Figure 2. The farmers, land owners and village councils representing about 21 villages from Lith to Ravenstein have very high interest due to the fact that their lands, homes and farmlands are covered in the Maas project area. However, their influence is very low as they are not in the decision making parliamentary and central council. Nonetheless, they were invited to participate at various workshops and for consultations.

The government at all levels were involved with very high interest to ensure safety of life and properties and also have great influence being at the decision making position. Other industries and entrepreneurs were partially interested as their businesses were not directly affected due to their locations outside the target project area. However, their businesses maybe witnessing boosts with increased tourism and recreation which will come with the modifications.

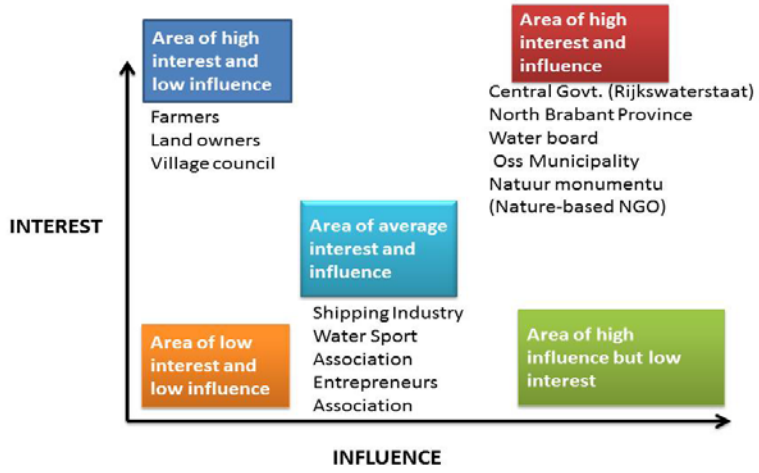

Figure 2. Stakeholder matrix showing the levels of influence and interest in Maas River Project Area

Table 1: The features of the three design options for the Maas River Meandering project

S/N	ICONIC MAAS	LOMMERIJKE MAAS	RUIGE MAAS
1.	Lower water level by 20cm by deepening river	Lower water level by 20cm via raising dyke and expanding river	Lower water level by 20cm via expanding river and maintaining low dyke
2.	Lower flood plains	Lower river banks	Lower river banks
3.	Connect to meander, making room for the river	Connect to meander to make room for the river	Connect to meander to make room for the river
4.	Nature and grasslands managed by grazing	Develop Nature: grassland, trees on the banks & dykes	Develop Nature – grasslands, trees
5.	Historic sites and city walls maintained	Historic sites not priority	Historic sites not priority

6.	Service tourists – cycling, walking, bird watching. Boating not considered	Service tourists – cycling, boating, walking, bird watching	Service tourists – cycling, boating, walking, bird watching
7.	Agriculture is supported – Crop farming and dairy cattle prioritized	Agriculture is only grazing to maintain the grasslands. Zero cropping	Zero agriculture – no cropping, no dairy rearing. Nature is grasslands only and managed by grazing
Impact analysis	Agriculture is promoted. Tourism for historic and cultural heritage is also promoted. Nature is not supported in Iconic Maas scenario	Crop and dairy farmers displaced. Residents on dyke houses destabilized. Water/nature-related recreation and tourism promoted	Crop & dairy farmers displaced from floodplains. Tourism and nature recreation promoted

The three scenarios that represent three project designs out of the six designs for the Maas River project are presented in Table 1. The first is the Iconic Mass which has to do with preserving the cultural heritage of the Dutch, the second is the Lommerijke meaning Leafy, which has to do with vegetation or nature development and the third is Ruige Maas meaning Rough which has to do with creating more meander in the flood plain.

The Iconic Maas River option is ideal for agriculture (cropping, dairy production and grazing), for residents living on the dyke and tourists on cultural heritage and historic sightseeing. Conversely, nature development which is partly government's goal to tackle climate change impact will not be achieved if this option is adopted.

The Lommerjke Maas River option will be preferred by the entrepreneurs, nature tourism and recreation as they will benefit more on economic scale because, increasing nature reserves will attract more recreation and tourists to patronize their businesses. However, crop farmers will lose their farms and possibly, their livelihood although they will be relocated.

The dyke house owners will also lose the value of their homes as the increase in dyke height in this design will block the nature view which is the main reason for the high price tag on the houses on the dyke. They could also get relocated to other areas.

Tourism and recreation will boost local economy for the entrepreneurs in beer industry, restaurant business, cargo shipment, boat recreation, nature lovers if the Ruige Maas River scenario is decided by the government for implementation on the project area. Again, owners of houses built on the dyke will find this option suitable as the dyke will not be raised and so will not block the river and nature views.

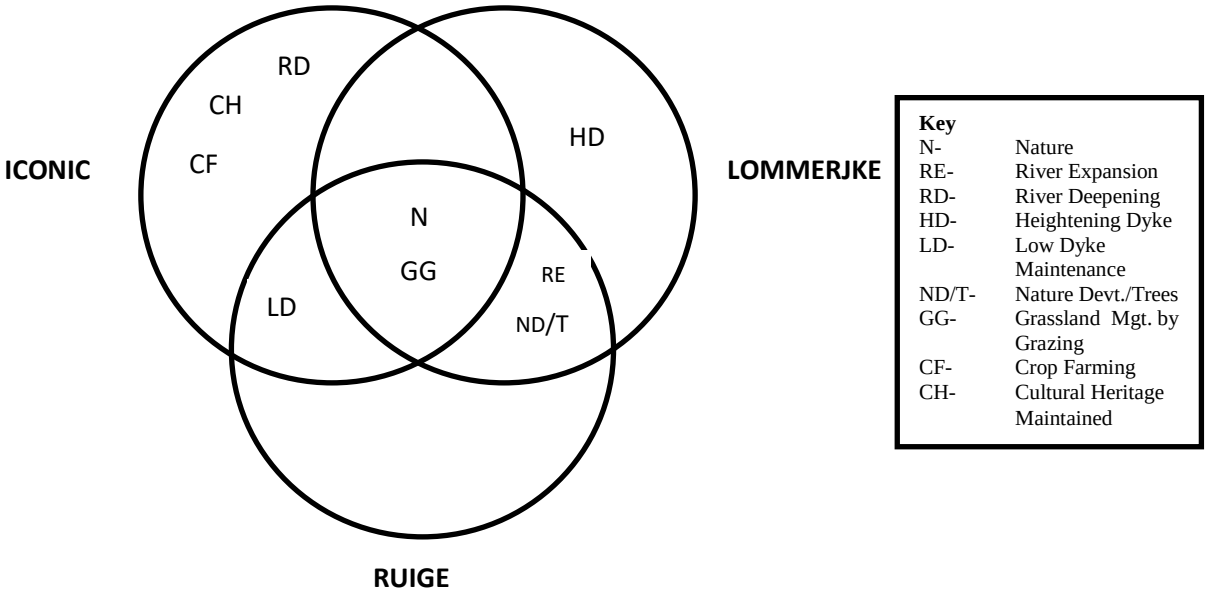

Figure 3. Venn diagram showing the different features of the three options for the Maas River Meandering project with their similarities and differences

Nature and grassland development appeared to be common to all the three scenarios though at varying degrees. A nature area managed by grazing simply implies that nature development will not exceed grasslands. Trees and woody shrubs will not be allowed to dominate. This is the feature of the Iconic Maas design which is in contrary to the Lommerjke and Ruige Maas designs that supports afforestation and grasslands for biodiversity restoration in the Maas river basin. However, in the Iconic scenario, there will be no afforestation, rather agriculture and cultural heritage will be supported as the retention capacity of the river will also be increased by deepening of the river bed and not increase of dyke height which will not obstruct the nature view for residents on the dyke.

Table 2: The potential impacts of the respective Maas River project designs on the ecosystem services

S/N	ECOSYSTEM SERVICES	ICONIC	LOMMERRJKE	RUIGE
PROVISIONING SERVICES				
1.	Food production from farming	↑	↓	↓
2.	Water transport	↑	↑↑	=
3.	Raw material – clay for bricks	↑	↑	↑
4.	Cattle production	↑	↑↑	↑
5.	Freshwater	↑	↑	↑

6.	Medicinal plants	↑	↑	↑↑
REGULATING SERVICES				
1.	Flood control	↑	↑↑	↑
2.	Water recharge	↑	↑↑	↑
3.	Microclimate regulation	↑	↑↑	↑↑
4.	Carbon sequestration	↑	↑↑	↑↑
5.	Soil fertility	↑	↑	↑
6.	Pollination	↑	↑	↑
7.	Nutrients recycling	↑	↑	↑
8.	Soil sedimentation	↑	↑	↑
9.	Moderation of river flow	↑	↑	↑
10.	Self-cleaning & purification	↑	↑	↑
CULTURAL SERVICES				
1.	Tourism – Ecotourism	↑	↑↑	↑
2.	Recreation	↑	↑↑	↑
3.	Boating pleasure	↓	↑	↑
4.	- Cycling	↑	↑	↑
5.	- Walking & sight seeing	↑	↑↑	↑
6.	- Bird watching	↑	↑	↑
7.	- Swimming	↑	↑	↑
8.	- Sport fishing		↑	↑
9.	Historic sites	↑↑	↑	–
10.	Aesthetic nature view	↑↑	↑	↑
11.	Camp sites	–	↑	–
12.	Floating structures on water for education services, tourism, habour	–	↑	–

Key: Where the arrows ↑ ↓ – indicate increase, decrease and neutral respectively.

However on the contrary, the Lommerjke and Ruige Maas designs excluded agriculture which appeared as downward arrows indicating reduction in food production. This indicates that the

farmers could lose their farmlands, get displaced or relocated while the Iconic Maas design on the other hand, will accommodate their farming hence, boost in food production.

Again, the Lommerjke and ruige designs will boost nature development which involves afforestation and grassland management. This will gainfully tackle climate change effect as the vegetation creates more sink for carbon (IV) oxide sequestration thereby reducing global warming.

DISCUSSION

Table 1 shows the features and the potential impacts and outcome of the three different scenarios on the ecosystem and stakeholders assessed. This study infers that the three project options – the Iconic, Lommerijke and Ruige designs for the Maas river project are environmentally friendly and safe for the country's economy and the masses. These scenarios will not impact the wetland negatively rather, the varying interests of the stakeholders were at stake, hence, the consultations for better and efficient wetland governance. The three will all necessitate the creation of more room to accommodate excessive overflow of river water. Iconic design involves deepening of river beds (dredging), lowering of flood plains and connecting to meander, while lommerijke and ruige designs permit expansions of the rivers, lowering of river banks and connecting to meander to make more room for the river in case of overflow and flooding.

From the Venn diagram (Fig. 3), it could be seen that the three scenarios have nature in common as well as making more room for the river either by deepening or expanding the river. This shows that the target of the government is to ensure safety of the country to guard it against flooding and to maintain and/or conserve nature which will help sequester greenhouse gases to reduce climate change impact and also support biodiversity. Remarkably, the three options are eco-friendly and supports ecosystem services of wetlands. Though food production may be on the decline if Lommerijke and Ruige designs are implemented, the relocation of farmers to safe areas that are less prone to flooding will also boost agriculture.

This is in consonance with the main goal of the Maas River banks project by the government of the Netherlands in 2015 which is to improve the ecosystem for cleaner and healthier water, more room for the river to control flooding and to create good habitat for biodiversity (Rijkswaterstaat, 2015). The objectives to achieve safety of the Netherlands are embedded in the designs of the Wetland and River basin project which is targeted to be achieved by expanding or deepening the river, raising the old dyke or maintaining it low, developing nature and using the

grazing cattle to maintain low flowery grasslands on the floodplains with or without farming in the flood plains to achieve the main goal.

The major ecosystem services provided by the Maas River and wetlands generally are provisioning services, regulatory services and cultural services (Table 2). The wellbeing of Wetland ecosystems such as the Maas River is good to prioritize due to its high economic value and socio-cultural importance to the local dwellers and for any country's economy. It plays vital role in regulating aquatic and climatic conditions, sequestering carbon (IV) oxide, flood control (Barbie, 1997) and also in integrated water resources management. It is on this premise that the government of Netherlands through the Water Boards based their management approach and design to manipulate the system proposing six different models. Priorities are placed on options that will rule out or minimize wetlands loss especially, where they are required for provisioning and regulatory services such as flood control, fisheries resources and water supply. Emphatically, the Lommerjke and Ruige Maas designs will support this national target.

Considering the priority the international body placed on wetlands protection during the Ramsar Convection (Frazier, 1999 In: Okonkwo *et al.*, 2015), and the laws established to protect them, they are put in place and used as strategies to tackle climate change threats. This is why these designs (Lommerjke and Ruige Maas designs) are remarkable in their features to support climate change mitigation (Table 1).

The ecosystem goods such as aquatic resources like fin and shell fishes, aquatic birds and insects that drive pollination are adversely affected by climate change impact. The dissolved oxygen in the water bodies result from the photosynthetic activities by the aquatic vegetation in the wetlands. These plants sink carbon (IV) oxide into the environment as they sequester the carbon into woody tissues during photosynthesis (Nwajiobi *et al.*, 2020) thereby removing the major greenhouse gas known as carbon dioxide from the atmosphere, in other words, contributing to climate change impact mitigation.

In addition, the water ways for water transportation of materials within the Netherlands is very remarkable. Manipulating the river and the flood plains will enhance boat transportation and logistics. The regulatory and flood control services rendered by the river is the major attraction for the wetland manipulations to ensure farmers do not lose their farm produce in case of flooding. This will result to pre-harvest losses and resultant food availability hitches for the masses. To tackle these foreseen hazards, the Lommerjke and Ruige Maas designs ruled out farming on flood plains. A flood plain is a flat area of land next to a river or freshwater body. It

is usually prone to flooding. The knowledge that flood carry nutrient-rich silt and sediment which get deposited when flood recedes making the plains fertile attracts farmers. On the long run, the predicted or unpredicted floods could rend farmlands and destroy crops, hence, the reason for the the Lommerjke and Ruige Maas design options to safeguard food security.

Afforestation and nature development features of the Lommerjke and Ruige Maas scenario in this study is considered as one way to tackle climate change. These measures have been taken by Indonesian government to forestall future flooding of the Indonesian Pangkalpinang city which was caused by excessive rainfall and overflowing wetlands. The project included the empowerment of the provincial river basin forum by the government to ensure strengthened coordination among local and provincial agencies and the production of seedlings for revegetation project by the communities (Aulia 2016; Zulkodri 2016). The communities situated in the Indonesian Pangkalpinang city also were part of all forms of the Rangkui River basin management programmes in order to ensure that they execute best practices in their land and water based operations and overall activities, thereby fostering participatory approach and public awareness.

In Nigeria for instance, as a Ramsar site, the Oguta Lake Watersheds Protection project was targeted to revitalize the lake to promote sustainable development and management of wetlands resources (Okonkwo *et al.*, 2015). This was designed to involve the local community and members. The need for community engagement using the stakeholder participatory approach in conducting community-based environmental and water-based projects has been identified since the outcome directly or indirectly affect the people. A study by Ajibola *et al.* (2015) revealed the engagement of some stakeholders in the ecosystem service analysis in the Niger delta, however, the participants were not listed. The essence of stakeholder participation is to consider the various interests and scale them in the light of governing policies and frameworks in order to decide on the most environmentally friendly and preferred approach and design for the River basin project, as in the case of the “Maas de Meanderene”.

The laws placed on wetlands protection by international body during the Ramsar Convection (Frazier, 1999 In: Okonkwo *et al.*, 2015), are currently established in various countries such as the Netherlands where these policies are implemented. This is important to the Dutch government due to the fact that Netherlands is situated in the delta area with extensive networks of water ways, flood plains, rivers and lakes, canals and also characterized by moderate climate

and rains (Huisman *et al*., 1998). The issues of the water sector in the Netherlands borders around water quantity management rather than water quality. Thus, water quantity management becomes a priority which is also the case of the Niger delta area of Nigeria. Nevertheless, the drought situations due to deficient summer/monsoon rainfall as in the case of southern part of Pakistan (PMD, 2018) also require integrated approach involving stakeholder participation in its strategic planning and implementation processes as it is an integral part in wetland and integrated water resource management.

Stakeholder participation is important in ecosystem-based programmes. The need for stakeholder consultations in water and wetland-based projects cannot be overemphasized. Government work around policies and procedures guiding such environmental projects. The different stakeholders such as individual farmers, organizations and entrepreneurs were considered as they all contribute to the growth of the country and economy one way or the other. Decisions that adversely affect them concern the government as well.

This process involving public communication, consultation and participation (Rowe, 2005 In: Deval *et al,* 2015) accommodated all these groups. This is notable as the eco-friendly Dutch river banks project on Maas River had strong stake from farmers, residents, business owners and associations, environmentalists and other interest groups who were intensively engaged in the early stages of the project (planning and scoping stages). In the planning stage of any project, research for sufficient knowledge on issues is highly required for proper issue identification and prioritization. The Netherlands government and Water Boards were detailed with information on subject matter due to diverse professionalism and expertise at their disposal. Therefore, scientists and experts are also stakeholders to be consulted as was achieved by the Netherlands Water Boards. Hence, the place of the stakeholder in resource management for better stewardship. If industries and individuals are to improve their management practices and living conditions to reduce the impacts on wetlands, they must be engaged in the integrated water resources management projects.

Finally, it is noteworthy that the involvement of the citizens in the planning stage by the government councils concerned enhanced communication, cooperation and shared responsibility. This has also been confirmed by USEPA (2013). Therefore, stakeholder analysis and participation is highly commendable for environmental based and wetland projects.

CONCLUSION

The different project scenarios have unique features and accommodated one or more of agriculture, nature development, and river or dyke capacity improvement. The field study analysis which is potential impact assessments showed that the three proposed designs for the Maas River project were eco-friendly and will support ecosystem services. The nature development and widening or deepening the river to connect meanders are to create more room for the river to flow and overflow in case of flooding which will be checked by the dykes. This is very important because, flooding ravages farmlands, fishponds, lives and properties.

The nature development on the other hand, will create more vegetation to tackle buildup of greenhouses gases, climate change impacts and for a more balanced ecosystem. Thus, engaging the public and stakeholders exposed them to situational knowledge and plans of their government councils for the peaceful co-existence of nature and inhabitants of wetland and river basin areas. Engaging stakeholders was discovered to get them more aware of situations as well as government intentions and the need for adaptive measures in the face of climate change threats. This makes them better stewards of their wetlands and natural resources as they get more informed and educated.

RECOMMENDATIONS

1. The Maas River case study is presented in this paper as reference data for easy simulation by other developing low-lying States. Therefore, the eco-friendly project scenarios are recommended for simulation and modification in developing country situations to best address home wetland and climate change issues.
2. City dykes are recommended to tackle water quantity challenges in the Niger delta area for instance, just as they are used in the Netherlands to protect the lands and withstand water surge and pressure. Protecting riverine areas from flooding should be a priority to the Nigerian government as well as other threatened nations.
3. Since urban infrastructural developments aggravate the rate of deforestation/ reduction in vegetation covers, wetland loss and land change activity, government should ensure safety of the country to maintain and conserve nature (forests and natural aquifers) which will help sequester greenhouse gases to reduce climate change impact, also support biodiversity and ecosystem services.
4. It is noteworthy that the involvement of the citizens in the planning stage by the Dutch government enhanced communication, cooperation and shared responsibility. This is

therefore recommended for developing countries to boost public education and information exchange between decision makers and the masses.

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