https://dx.doi.org/10.4314/dujopas.v10i2c.2
ISSN (Print): 2476-8316
ISSN (Online): 2635-3490
Dutse Journal of Pure and Applied Sciences (DUJOPAS), *Vol. 10 No. 2c June 2024*

Flood Risk Management: Perspectives From Europe, Africa, And Asia

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Abstract

Flooding is a general or temporary condition of partial or complete inundation of normally dry areas of land from overflow of inland or tidal waters or unusual and rapid accumulation of surface water. The impacts of flooding include mortality, widespread infections and vector-borne diseases, homelessness, and food insecurity, among others. This paper attempts to review the issues related to Flood Risk Management (FRM) in Europe, Asia, and Africa. These include flood risk perception and preparedness, integrated flood risk management, and its challenges. The rationale behind this review stems from the necessity of public awareness and risk perception of the scenario as essential prerequisites for adaptation. This is due to the fact that perception frequently drives behavior. For those involved in risk management policy and action, it will provide a clear image, and it can also be used as a vantage point for further research. It has been found that some of the hurdles faced by FRM include the politicization of techniques, a lack of funding and experienced individuals, inadequate assessment tools, and inadequate data. Anarchy in social and environmental governance exacerbates socio-economic and ecological degradation, while delays, dominance, and fragmented approaches are making FRM more challenging and costly. There is a need for collaborative and pragmatic approaches to manage the impacts of flooding, with researchers continuing to offer critical perspectives as the relationship develops.

Keywords: Flooding, Perception, Risk Management, Stakeholders, Strategies

INTRODUCTION

According to Morristown (2010), a flood occurs when water overflows onto typically dry ground or when a normally dry area is flooded. The intensity and duration of rainfall, the antecedent moisture condition, the steepness of the terrain, the types of soil, the amount of vegetation, and the density of development in the watershed, changes in the landscape as a result of wildfires, the presence of features like levees and flood control channels, and flow velocity, are some of the factors that Price *et al.* (2007) list as influencing the frequency and severity of flooding. Peduzzi *et al.* (2009) estimated that over 800 million people worldwide reside in places that are vulnerable to flooding. According to Guha-Sapir *et al.* (2013),

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hydrological disasters accounted for 32.9% of all-natural disasters in the United States in 2012; floods accounted for the majority of these events, which affected over 9 million people and caused damage estimated at 0.58 billion US dollars. According to the same source, floods caused more than 4.7 billion dollars' worth of damage in Europe in 2012, and approximately 0.83 billion and 19.3 billion US dollars' worth of damage in Africa and Asia, respectively. A total of 2.9 billion US dollars were lost as a result of four distinct floods that struck UK cities in 2012, affecting hundreds of people (Guha-Sapir *et al.* 2013). Flooding has caused hundreds of thousands of people to become impoverished in several African nations, such as Nigeria (National Emergency Management Agency, 2013).

The Associated Programme on Flood Management (2017) document states that the standard definition of flood risk is the result of exposure, susceptibility, and hazards. A potentially harmful physical occurrence that could result in death or serious injury, property damage, disruption of social and economic life, or environmental degradation is referred to as a hazard. A hazard's potential to cause harm relies on how vulnerable people, infrastructure, buildings, and other things are to it. According to the same source, the planning process for Integrated Flood Management is viewed as a cyclical one that leads to risk-based decision-making. The framework, which essentially consists of four elements; flood risk analysis, flood risk appraisal, implementation, and framing of flood risk, reflects the policy cycle. These processes must be followed cyclically both within a single planning cycle and throughout subsequent years. Successful planning requires consensus on problem assessment and policy objectives. For this reason, the framework's core components are stakeholder interaction and communication via a collaborative process of fact-finding and decision-making. The goal of Flood Risk Management (FRM) is to lower the likelihood of flooding for those who live in flood prone areas. While risk management strategies seek to identify and execute actions that minimize overall risk, leaving only residual risk (National Research Council, 2013).

Perception of Flood Hazard in Europe and Africa

A study by Kellens *et al.* (2011) sought to understand how people in Belgium perceive the hazards of flooding along the coast. The poll took into account both locals and residential tourists due to the significance of the tourism sector on the Belgian coast. On the basis of scaled items pertaining to the dangers of coastal flooding and storm surges, risk perception was evaluated. Furthermore, a range of personal and residential attributes were assessed. It was discovered through the use of multiple regression analysis that factors such as age, gender, experience with prior flood threats, and real flood risk assessments largely impacted risk perception.

According to Chritina *et al.* (2013), the ability to handle disasters through the phases of readiness, response, and recovery is reliant on urban governance. Their research looked at flood danger in the global south and how people's perceptions of risk affect how local governments and citizens handle emergencies. Results from a case study of Ekurhuleni, South Africa, showed that past mistrustful interactions with the local government have an impact on the risk perceptions of the local populace. On the other hand, the local government representatives acknowledged that their ability to address flood-related hazards is hampered by their inadequate capacity for policy implementation. Perceptions of flood risk by municipalities and communities can also be tainted by development difficulties. In order to effectively manage these risks, it was advised that communities and local governments collaborate in a way that is complementary to one another. Similarly, Bodoque *et al.* (2016) evaluated the degree of awareness of a particular emergency civil protection plan and examined the social perception of flash flood danger at the local level in Spain. The findings

indicated that roughly 60.8% of respondents had a low perception of risk. It suggested that emergency management strategies should incorporate societal risk perception and information that is specifically customized to the area, particularly in metropolitan areas that are vulnerable to flash floods. To increase communities' resilience, risk communication must be put into practice.

On the other hand, Scolobig *et al.* (2012) looked at case studies in an Italian Alpine Region to investigate the gap between preparedness and awareness of flood risk. The findings showed that locals felt somewhat ready for an occurrence and somewhat concerned about the possibility of flooding. There were notable distinctions between the assessments of individual subjects and those of entire groups. Additionally, there was a glaring disparity between the desire to take self-defense measures and the actual implementation of family preparation measures. Overall, the risk awareness was significantly higher among those residents who had been personally affected by a flood in the past. The link between risk awareness and preparedness was not at all straightforward. The results further revealed the complexity of residents' perspectives and decisions about risk-related issues.

Integrated Flood Risk Management in Europe and Asia

According to Hegger *et al.* (2014), vulnerable urban agglomerations can become more resilient to flooding by diversifying and aligning their flood risk management methods; nevertheless, this may call for the creation of new Flood Risk Governance Arrangements (FRGAs) or modifications to already-existing ones. It also highlighted the fact that while there is technical knowledge about FRM, there is currently a lack of cohesive scientific understanding on the actual and required FRGAs. The study discussed the emergence of the "multilayered safety" risk-based strategy in the southern Dutch city of Dordrecht. It suggested comparing various FRGAs in various geographical areas and emphasized that it will make it possible to identify viewpoints for local government agencies and public-private partnerships. A legal and policy study on the application of the European Union Floods Directive (2007/60/EC) in six nations; Belgium, England, France, Poland, Sweden, and the Netherlands—was supplied by Priest *et al.* (2016). The study found that, partly due to the floods directive's emphasis on procedural rather than more substantive requirements, its impact on boosting social resilience has varied among countries. The results of the analysis demonstrated that, in certain instances, the goals of harmonizing FRM have been superseded by established flood risk management traditions, even in spite of the emphasis on trans-boundary river basin management. It came to the conclusion that the directive ought to be reinforced by calling for increased collaboration and giving the relevant authorities in international river basin districts more authority.

The effect of policy measures aimed at reducing risk depends on the capacity of households to adapt and respond to floods; this depends on their social vulnerability (Koks *et al.* 2015). Using Rotterdam, in the Netherlands, as a case study, their results showed that large heterogeneity in social vulnerability is found within the population at risk. It concluded that FRM measures should not be applied homogeneously across large areas but tailored to local characteristics based on the socio-economic characteristics of individual households and neighborhoods. Tingsanchali, (2012) described the concepts of integrated urban flood disaster and risk management in Thailand. Thus, the study highlighted that in most developing countries, flood disaster management activities are handled by the government. The participation of non-governmental agencies and the private sector is very limited. Activities are exercised rather independently, without proper coordination or integration. It further emphasized that the strategic framework for integrated flood disaster management includes four cyclic steps, namely: preparedness before flood impact, readiness upon flood arrival,

emergency responses during flood impact, and recovery and rehabilitation after flood impact. The study concluded that community participation in flood risk assessment as well as in the planning and implementation of risk management measures is crucial to the success of FRM plans.

Foti, *et al.* (2008) highlighted ways and how stakeholders can be involved in the decision-making process; these are: Information sharing, Collaboration, Joint decision-making, and Empowerment; where the collaborators transfer the control of decision-making to stakeholders.

However, Arambepola and Gabrielle (2009), in studying the effective strategies for urban FRM in Bangkok; suggested that urban disaster risk management can be achieved through:

I. Proper Land Use Management
II. Mainstreaming Disaster Risk Reduction (DRR) in planning processes
III. Integrating DRR in socio-economic and livelihood programs focusing on urban poor
IV. Establishing a participatory process for designing and implementing disaster recovery programs
V. Promoting city-level early warning and alert dissemination to urban communities
VI. Setting up an urban emergency response system
VII. Sharing of knowledge and good practices of urban DRM

Barrientos, (2014) conducted a study that offered valuable insights into the institutional components of integrated flood control in Guatemala at the local, national, and trans-boundary levels. The study discovered that various organizations were involved in flood management on both a local and national scale. The local councils for development are in charge of planning and preventing floods at the local level. It found that while some towns were engaged in proactive flood response, prevention, and recovery efforts, the extent of their efforts was constrained by a lack of financial and technical resources. Local players in the decision-making process, such as farmer organizations and other stakeholders are frequently disregarded. The study clearly showed that the national coordinator for risk reduction to disasters, the secretariat for planning and programming of the presidency, the Guatemalan Ministry of Infrastructure and other national institutions are in charge of planning and implementing flood management strategies, leaving local actors to mainly public consultation. Due to obstacles like territory conflicts and sovereignty difficulties over international rivers, flood control institutions are mainly missing at the trans-boundary level, particularly for international rivers. An evaluation of flood risk control strategies and their inevitability in metropolitan areas worldwide was carried out by Idris and Dharmasiri (2015). The outcome demonstrated that neither structural nor nonstructural measures could prevent floods. The study made the unorthodox recommendation that urban flood risk can be sustainably reduced by integrating existing solutions and, where practical, partially and systematically returning land use to its natural condition.

Europe's Public and Stakeholder Engagement in Flood Risk Management

Individuals and organizations with an interest in development, safety against flooding, and flood protection are considered stakeholders in this context, according to Foti *et al.* (2008). Government or the public sector, civil society, the commercial sector, and rights holders—property owners and groups that will be touched by the decisions being made—are some ways to categorize stakeholders. An essential foundation for securing the FRM procedure in the political and administrative network is the examination of stakeholders, their roles, obligations, and demands (Fleischhauer, *et al.* 2012). Understanding modelling, and

regulating floods are severely hampered by the intricate interplay of social, ecological, and physical phenomena (Wheater, 2002). Thus, efforts to plan for and manage floods face significant complexity and uncertainty (Hall & Solomatine 2008), and they must balance and mediate among multiple sectors and competing interests. Both the drivers of increased flood risk and the implications of flooding touch on a wide range of sectors. Over the past 20 years, there has been a trend in flood management towards an integrative risk management paradigm due to the recognition of these elements and the persistence of flood disasters despite ever-improving structural defences (Heintz, *et al.* 2012). The limitations of an over reliance on structural flood defences, expert-led planning from the top down, and "hard" engineering solutions are acknowledged by this emerging paradigm. Alongside the principles of risk-based decision-making and integrative management, stakeholder engagement and public participation are seen as central to effective FRM, and appear prominently in most related policy statements and management frameworks (Huitema, *et al*. 2009).

Evers, *et al.* (2012) looked into how Collaborative Modeling (CM) might facilitate the active participation of stakeholders and social learning processes. Using the UK's Cranbrook catchment and Germany's Alster catchment as case studies, the findings demonstrated that involving a broad range of stakeholders in the FRM decision-making process raised their awareness of the issue, increased their level of knowledge, and increased their sense of personal responsibility for it. The study verified that the application of collaborative modeling techniques and tools, as well as participatory governance in FRM, depend on the incorporation of "local" knowledge. It was established that in order to successfully complete collaborative modeling, face-to-face interaction is essential. Additionally, it may help establish long-term involvement frameworks FRM. According to O'Donnell *et al.* (2017), obstacles brought about by poor communication and divided roles prevent candid conversations. The Learning and Action Alliance (LAA) framework was assessed in their study as a change agent that encourages teamwork and speeds up the shift to more environmentally friendly action. Social learning improved organizations' and individuals' abilities to handle differences in view points and actions, redefining knowledge, according to research that used the Newcastle LAA as a case study. Members were inspired to adopt an integrated and inclusive mindset in order to create shared ideas and strive toward urban flood resilience by the social learning that resulted from the Newcastle LAA. Nye, *et al*. (2011) on the other hand, examined the evolution of a more socio-technical variety of Flood and Coastal Risk Management (FCRM) in the UK. It emphasizes community engagement and personal responsibility for flood risk planning, awareness and resilience alongside more traditional, centrally managed structural and technical measures. The study suggested that social measures in FCRM offer the potential to open up interdisciplinary, collaborative pathways to FRM solutions that are sustainable. It concluded that through these activities, different perspectives, knowledge and solutions were expressed and deliberated. The study recommended a more collaborative form of engagement aimed at empowering 'flood risk citizenship' which is a necessary tool for tackling the multidimensionality and complexity of flood and coastal risk management.

In light of the paucity of research on learning about the design of governance, Newig, *et al.* (2015) looked at the various participatory FRM planning processes that are presently taking place throughout the German federal states. According to the report, in the first planning cycle for the floods directive, officials have tended to base their decisions on past experiences in their respective federal states when creating and implementing participatory processes. The study recommended that policy makers learn how to create successful participatory flood risk planning in a coordinated and methodical manner. In Germany, according to Gierk and Stratenwerth (2010), the legal responsibility for flood directive implementation and reporting

lies with the state environmental ministries, which, together with their environmental agencies produce the flood risk assessments and flood hazard and risk maps. In some municipalities partnerships are tasked with the definition of measures, which are then collected by higher-level authorities in a 'bottom-up' approach. Others organized the planning process in a 'top-down' manner wherein state-level authorities proposed measures on which municipalities were then consulted.

A study by Fleischhauer *et al.* (2012) looked at how the public and stakeholders participate in FRM. This is due to the directive from the European Union (EU), which called for increased governance-related decision-making and aimed to actively involve interested parties in the creation of FRM plans. Stakeholder workshops and case studies conducted by the researchers have demonstrated that, in order to prevent inefficiencies or a lack of clarity regarding responsibilities, communication about stakeholders and the definition of their roles is necessary during the implementation of the EU FRM directive in member states. Additionally, the utilization of the risk governance assessment tool enhanced the participation of pertinent parties. It aided the body overseeing the governance process in determining the pertinent parties and evaluating the process' effectiveness in light of risk governance guidelines. It was concluded that the public's involvement is indirectly raised as a result of the risk governance principles touching on public-related issues. The governance structures within which FRM strategies are entrenched have a significant impact on how they are implemented in the 18 urban zones in six European nations that are considered susceptible. Implementing innovative, integrated policies may be delayed or even obstructed by fragmentation in flood risk governance arrangements. Fragmentation is often due to little coordination and collaboration between the policy domains of spatial planning and disaster management and between public and private actors. Introducing bridging mechanisms that connect different strategies, actors, perspectives, rules and resources may provide solutions and aid the implementation of integrated flood risk management (STAR-FLOOD, 2014).

Challenges of Flood Risk Management in Asia and West Africa

Shah *et al.* (2015) conducted a critical analysis of flood management methods in order to investigate the barriers to the success of flood risk management strategies and technologies in South east Asia. The study found that the categorization of floods with various sources and hydrological uncertainties resulting from climate and river morphological variations restrict the accuracy of flood prediction. Furthermore, the process of risk assessment and evaluation for flood control projects is constrained by shifting land use in floodplains and the possibility of generating new hazards. The study suggested that the planning approach for flood management uses dynamic sustainability considerations. These comprise combining structural and nonstructural flood risk reduction solutions, enhancing stakeholders' comprehension of flood risk perception, safety, and risk communication techniques, and lastly the requirement for extensive research on the above challenges. Equally, Dissanayaka and Pinnawala, (2017) examined the issues and challenges of urban flood hazard management in North Colombo Region, Sri Lanka. Their findings showed that evacuation and emergency response mechanisms in relation to the 2016 flood hazard had a short-term success and were not sustained. Other constraints to urban flood risk management include; inadequate regulations, lack of institutional cooperation, and insufficient resources. It recommended the implementation of long-sighted policies and stakeholder synergy to overcome such challenges.

Ouikotan *et al.* (2017) identified the deficiencies and obstacles to a sufficient FRM in coastal West African cities (Dakar, Accra, Cotonou, and Lagos).The study found that a lack of funding

and qualified staff is the reason why there are insufficient data and assessment tools. Measures were poorly maintained and FRM projects were isolated at the time of the study. It emphasized the necessity of working with academic institutions to further research endeavors and the comprehensive management of FRM, which considers all potential forms of flooding, climatic scenarios, and population shifts. The study suggested that all stakeholders should explicitly identify and agree upon the criteria for selecting structural and nonstructural measures.

Barriers to Collaborative Flood Risk Management

Thomas, (2002) noted that the increased use of stakeholders in environmental decision-making has raised concerns about the quality of decisions these processes produce; he also examined the quality of the decisions from stakeholder-based processes. Overall, the case study record indicated that low-quality judgments emerging from stakeholder processes should not be a major worry. Evidence of stakeholders making better judgments contributing fresh insights and concepts, and having sufficient access to technical and scientific resources can be found in most circumstances. The study came to the conclusion that thorough stakeholder processes are more likely to produce high-quality decisions.

According to Lamond and Proverbs' (2009) in a study, "Resilience to flooding: lessons from international comparison," current approaches to flood control place a strong emphasis on urban resilience. According to the study, there are numerous obstacles to be addressed in order to promote the installation of resilient measures. This is evident from a survey of worldwide literature on flood proofing of dwellings and the views of individuals living in flood plains. A lot of these obstacles are shared by the studied populations as well: informational obstacles, emotional restraints, scheduling conflicts, and aesthetic concerns must all be addressed in any suggested plan. Additional restrictions are determined by financial, regulatory, and local conditions. It was concluded that plans that have been successful in overcoming some or all of these issues can teach us valuable lessons. According to Chin-Pei Tseng *et al*. (2012), there is evidence in the literature that suggests three categories of potential hurdles to stakeholder engagement in FRM: barriers linked to time, power imbalances, and stakeholder-based barriers. Through in depth-interviews with research participants, it was discovered that new barriers to involvement arose from a failure to recognize and consider the micro-politics in the engagement process. Unexpectedly, power sharing brought up new obstacles. The study concluded that rather than viewing these discrepancies as essentially problematic, advocates of flood risk reduction actions need to be more analytical in their attempts to comprehend the "micro-political positions" of all the stakeholders they come into contact with.

Linda, *et al.* (2016) discovered that when FRM is considered a ‘pure’ public good (which demonstrates characteristics of non-rivalry and non-excludability) the emergent form of public participation does not increase public awareness of flood risk or encourage investment in private protection measures. But when the benefits are solely considered public priority goods (which are services deemed as essential to public wellbeing regardless of characteristics) public awareness of flood risk increases, yet disputes arise regarding service provision and maintenance.

Furthermore, Gina, *et al*. (2016) concentrated on local government as a crucial domain for managing flood risks. Their study evaluated the institutional structures, technology, resources, and mindset of four distinct local government departments in the City of Cape Town, as well as the degree of cooperation between them on FRM, using a nodal governance

paradigm. A lack of capacities, political contestation, the dominance of a technical approach, and difficulties in sharing risk are the four main obstacles to collaborative urban FRM. The study concluded that breaking down nodal governance is a crucial first step in finding areas of cooperation and bolstering urban flood control procedures. Similarly, the partnership between the Cape Town municipality's Flood Task Team and Civil Society Organizations (CSOs) was acknowledged by Desportes, *et al.* (2016) as an inventive strategy for mitigating flood risks. "Improving flood risk governance through multi-stakeholder collaboration: a case study of informal settlements, Cape Town" is the title of the report that contains that information. It found that one of the obstacles preventing stakeholders in the study region from working together to minimize flood risk is the politicization of informal settlements. The study stressed that by developing more politically neutral forums for stakeholders to interact with one another, academics may aid in removing these obstacles.

CONCLUSION

Without a doubt, this has given insight into the trends, problems, and prospects of FRM in these regions. It has also demonstrated that some of the hurdles faced by FRM include the politicization of techniques, a lack of funding and experienced individuals, inadequate assessment tools, and inadequate data. Anarchy in social and environmental governance exacerbates socio-economic and ecological degradation, while delays, dominance, and fragmented approaches are making FRM more challenging and costly. It has been stated that integrated flood management is rooted in the cooperation of stakeholders. However, sustainability is not simple or uncomplicated. This is because no flood occurrence is the same because of factors including the socio-economic status, geographic features, and climate patterns of the impacted areas. As the threat of flooding increases, there is a need to work together to manage the impacts of flooding, with researchers continuing to offer critical perspectives as the relationship develops.

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