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Revisiting Flood Management Process in Transboundary Koshi River in Nepal and India

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Synopsis

This study aims to investigate the various aspects of flood management process in the transboundary Koshi River between India and Nepal focusing on the institutional framework. The technical and administrative cause of the most disastrous and most recent flood in 2008 are discussed. Existing policies and institutional mechanism between Nepal and India on the management of the Koshi River are analyzed. In reference to such policies and institutional mechanism, lack of proper co-ordination and complex organizational structure was identified as one of the major element that has hindered the effective flood management along with other few elements. Finally, based on the experiences of the transboundary river flood management around the world as well as considering the unique nature of Koshi, different key elements that might be helpful in improving the management of floods are proposed.

Key Words: Koshi River, Floods, Flood Management, Institutional mechanism

1. INTRODUCTION

Floods are one of the hazardous natural disasters that have a severe impact on life and property. According to a recent report, floods are the most frequent type of disaster which accounts for almost 43% of all the climate-related disasters that occurred in the last two decades and affected more than 2 billion people (UNISDR, 2018). Flood as a natural hazard has many definitions. It can be defined as ‘water outside its normal confines’ to ‘inundation which causes damage’ (FLOODsite, 2005). Flood causes fatalities, human displacement, economic loss and a huge impact on ecology and environment. These events occur due to many natural causes as well as human activities. High precipitation, typhoon are some natural factors while improper land use change, deforestation, unplanned development works in upper regions are some human activities that cause or triggers flood events. In recent

year, it has become more frequent be it due to climate change or human interference. There are many structural and non-structural measures that have been adopted around the world to minimize the losses due to flood. Despite pouring a huge amount of money, effort and researches to minimize the losses of life and properties there are many challenges that have remained unsolved. For example, various flood control measures have been implemented in the Mississippi River, USA but the risk of the flood still persists (www.wired.com).

Flood control and management in a river basin are one of the important aspects of the river basin management plan. For example, River law in Japan incorporates flood management as one of the three components of integrated river basin management (IDI & JRA, 2006). And if the river basin is of transboundary nature, the management becomes even challenging because it requires the co-operation

among two or more countries. According to UN-WATER, transboundary water means ‘the aquifers, and lake and river basins shared by two or more countries – support the lives and livelihoods of vast numbers of people across the world (UN, 2015). There are several cases of conflicts in history when it comes to cooperation and mutual understanding for sharing benefits and cost on the transboundary River. In terms of power, population, economic strength, some countries show reluctance for abiding themselves by the international laws on water resources. And it becomes more complicated for co-operation for flood management. In this regard, the Koshi River which is shared by India and Nepal is one of the unique cases of a trans-boundary river which hasn’t gained so much attention internationally. The livelihood of millions of people in Nepal and India depend on this Koshi River. However, in lack of proper management, people have suffered repeatedly due to several disasters in the Koshi River.

All the rivers in Nepal ultimately flow towards the south to meet the Ganga River in India. India, a rapidly developing big country in South Asia and Nepal, a developing and small country has been agreed for cooperating for better use of water resources they share from the 19th century. There are several treaties between these two countries for flood management, irrigation and power generation.

With the aim to share similar benefits, Nepal and India

agreed for the execution of a project called Koshi project. Although, several cases of river disasters have occurred in these years. The recent and the most devastating was the event of August 18, 2008, which devastated the lives of millions in Nepal and India.

Various studies have been performed in the past which highlighted the drawbacks of Koshi treaty and the institutional mechanism. However, only a few have proposed the modified mechanism based on the lessons from the past drawbacks as well as considering cases of a similar transboundary river around the world. In this context, this study aims to analyze the different institutional aspects of Koshi River management, analyze the technical and managerial cause of recent flood event, analyze Koshi treaty and current institutional mechanism and their shortcomings and finally propose the new institutional mechanisms to comprehend the unique and dynamic nature of Koshi River.

2. STUDY AREA AND KOSHI TREATY

(a) Study Area Description

The Koshi River, which originates in the Tibet region of China, traverses Nepalese territory, crosses India and after flowing in the Indian Territory for about 200 km meets the Ganga River at the confluence of Kurusela in the state of Bihar, India. The total catchment area at this outlet is nearly 70,000 sq. km

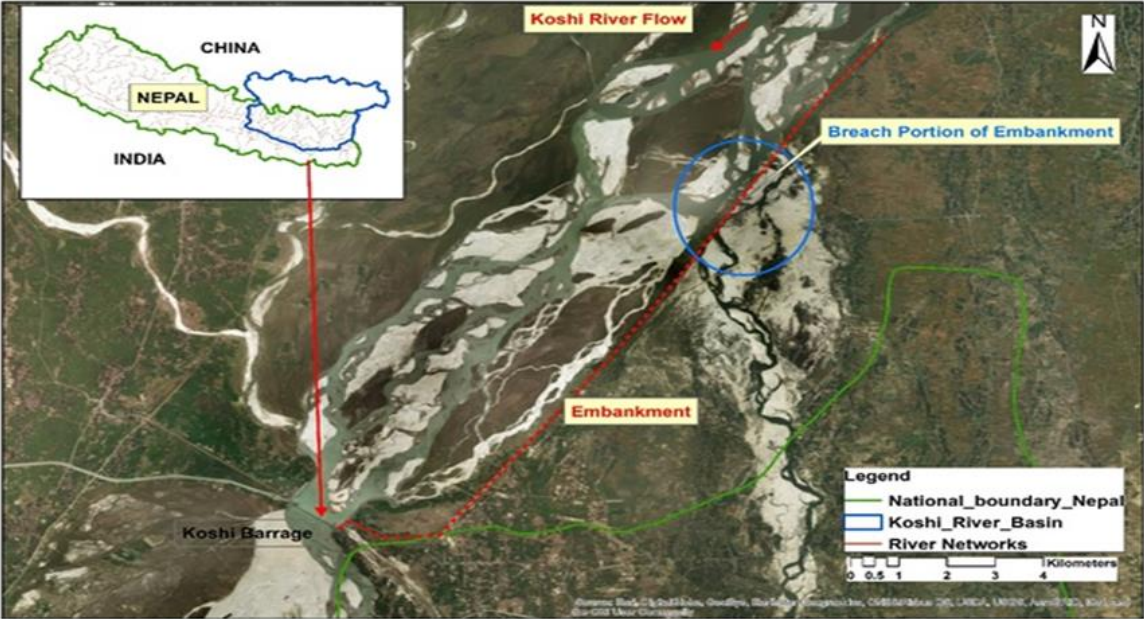


Fig. 1: Location map of the study area including the Koshi Barrage and the embankment

while the total length of the Koshi River is 720 km. The Koshi is a perennial river with the variation in the discharge of water. The sediment load of the Koshi is very high. The maximum observed annual silt load at Barahakshetra, just before entering the Terai is found to be in the order of 229, 860 ac. Ft (Upadhyaya, 2012). The Koshi River oscillates over a vast tract of land forming numerous channels with the result that built up property and vegetation are destroyed, which causes immense suffering and instability of life. During the period from 1936-1950, the river moved westward at the rate of 0.54km per year on average. These traits of the river combined, present an effect which causes heavy damage to life and property. This was the reason that the Koshi River was called the ‘sorrow of Bihar’.

(b) Koshi Treaty

After severe floods in 1953-1954, social and political pressure led the Indian government to prioritise the issue and negotiate the Koshi treaty. This project was meant to render irrigation and flood control benefits to

India and Nepal (Upadhyaya, 2012). Fig. 1 shows the details of barrage, embankment and the breached portion in the 2008 disaster. The Koshi Project comprised a barrage, headworks and other appurtenant work about 3 miles upstream from Hanuman Nagar town on the Koshi river with afflux and flood banks, and canals and protective works on land lying within the territories of Nepal for the purpose of flood control, irrigation, hydroelectric power and prevention of erosion of Nepal areas on the right side of the river upstream of the barrage.

But immediately after its conclusion, the agreement was heavily criticized in Nepal, not only by the

political party in opposition but also by the public at large. The agreement has been taken as ‘envisaging enormous benefits in India but for insufficient and even some negative consequences to Nepal’. It has cast a shadow on all subsequent negotiations for India-Nepal riparian cooperation.

3. KOSHI FLOOD DISASTER 2008

(a) Technical cause

Confining river channel by the implementation of embankments was not the appropriate measure given the highly dynamic nature of Koshi carrying high sediment load as argued by technical personnel at the time of construction and some even opposed that proposal (Mishra 2008a; Dixit 2008). The details of the embankment on the Koshi River is presented in Table 1.

These embankments are primarily made from earthen materials (clay, sand or silt) which cannot withstand the high stress that the river flow exerts. So to prevent potential erosion and damage to these embankments, structures called spurs are constructed. These structures protect the embankment by deflecting the high-velocity flow away from the embankments toward the channel. However, during this process, there is a high risk that these spurs will themselves get eroded because they too are made from earthen materials with some gabion protection around the tip where the impact of flow is maximum. Once these spurs start eroding, there is a high possibility that they will be washed away in no time (Acharya and Karki, 2018).

Table 1 Details of the flood control embankment on Koshi River in Nepal and India

S.N.	Name of Embankment	U/S or D/S of Koshi Barrage	Length in Nepal portion	Length in India portion	Total Length
1	Eastern afflux bund	U/S	32.0 Km	-	32.0 Km
2	Western afflux bund	U/S	12.0 Km	-	12.0 Km
3	Eastern Koshi Embankment	D/S	0.5 Km	125.0 Km	125.5 Km
4	Western Koshi Embankment	D/S	16.0 Km	101.0 Km	117.0 Km
Total length:					286.5 Km

Contrary to the long-term westward shifting trend of the Koshi, the flow had been concentrated along the eastern embankment for a couple of years. Being a wide river (as wide as 11km at some sections), Koshi contains multiple channels (braided) across its width and the river discharge is not uniformly distributed among these channels. One of the channels acts as a primary channel with a major proportion of the river discharge flowing through it. Between 11km to 14 km upstream of Koshi barrage, the majority of the flow was concentrated along the eastern embankment in the early August of 2008 as shown in Fig. 2. Some damage to the spurs at these locations were noticed a few days ahead of the disaster (Sinha, 2008). In fact, these locations were identified as vulnerable a year before the disaster.

Since no concrete and prompt action was taken by any responsible authorities in that stage, the embankment breached on 18th August 2008 around noon. Koshi started flowing from a new channel that displaced thousands of people in Nepal and Bihar.

In Nepal, this caused displacement of some 107,233 people, damaged about 5,500 ha of farmland and about 14 km of east-west highway. About Rs.300 million worth of crops were destroyed. The scale of the damage was even higher in India which was obvious being a downstream nation and densely populated.

In short, the flood disaster that claimed many lives and millions of properties was due to the embankment failure. Since the completion of the embankment in 1963, a total of eight major incidents of embankment failure have occurred. And 2008 was the first instance where the embankment upstream of the barrage was breached.

(b) Institutional and Administrative Cause

The disaster of 2008 occurred at a discharge four-five times below for which the embankment and the barrage are designed for. The embankment has already crossed its effective lifespan while excessive sedimentation has further increased the risk of embankment failure. On top of that, the lack of timely monitoring and repair works resulted in a severe disaster. A timely repair could have averted this tragedy, experts say. Prof. Sinha from IIT, Kanpur

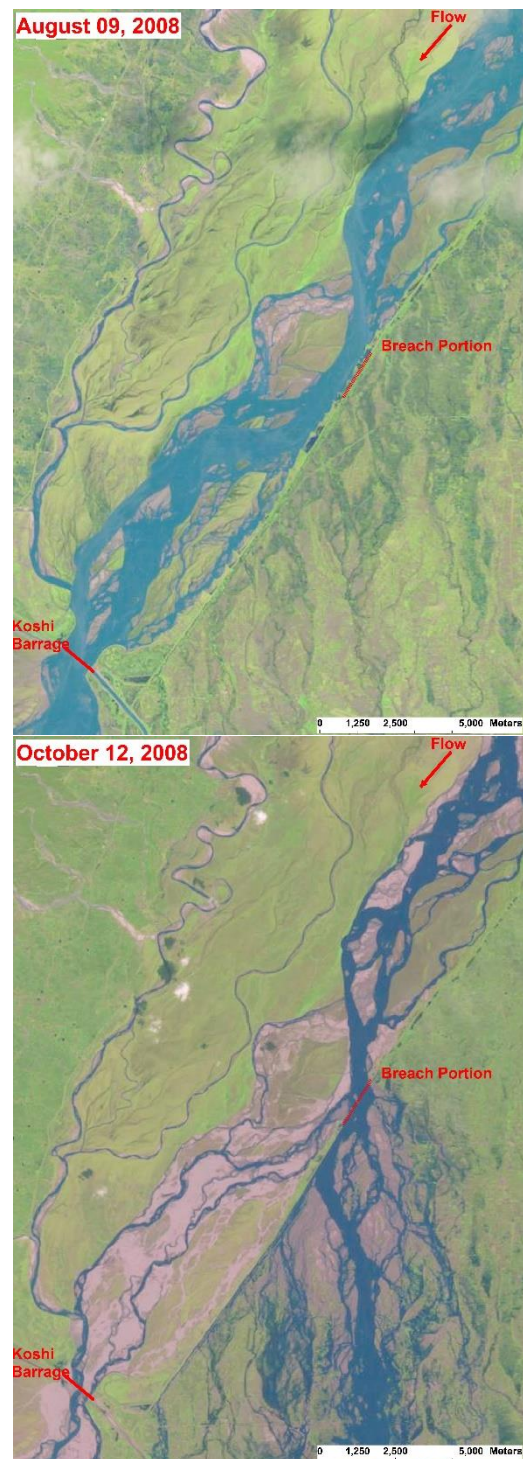


Fig.2: LANDSAT images of Koshi River before and after the 2008 flood

termed it more as a technical and administrative carelessness rather than a disaster (Sinha, 2008). Many researchers and experts have given their view on technical drawbacks of the embankment, limitation of the function of the embankment and even sought embankment was not the ultimate solution for the Koshi River (Shrestha et. al, 2012).

Several studies have highlighted the fact that lack of priority in carrying out the monitoring and lack of urgency in embankment maintenance, as well as the communication gap between the responsible institutions, led the 2008 disaster (Mishra 2008b; Dixit 2009). Some point out institutional dysfunction and governance deficit allowed the 2008 flood to happen while others argue it was the outcome of “an unholy marriage of wrong technological choice, bad institutional arrangements and half a century of political misconduct” (Gyawali, 2008). Lack of negligence of duty and accountability of different officials at the different level of the responsible institutions were the major reason for the 2008 disaster to occur (Thakkar, 2009). In general, it was the failure of the overall institutional mechanism assigned to the management of the Koshi flood problem.

4. EXISTING POLICIES AND ORGANIZATIONAL ARRANGEMENT

The Koshi treaty signed between India and Nepal in 1954 (and revised in 1966) forms a base for the setting up of a bilateral mechanism for the overall management of Koshi River flood. The treaty on Koshi consigns the overall management (including the maintenance and repair) of the barrage and embankment (including in Nepalese territory) to the Government of India (GOI).

(a) Indo-Nepal Mechanisms for Bilateral cooperation on the Koshi River

Several bilateral committees and commission at the different political level have been set up consisting of the officials from both the countries to look after the issues of co-operation in the water sector including the Koshi flood management. In response to the 2008 flood disaster, India and Nepal decided to establish a number of mechanisms, including a Joint River Committee at minister level to prevent such catastrophes in future. The two sides also decided to reactivate a Secretary-level Joint Committee and set up eight technical committees to be in regular touch over various issues concerning the sharing of common river waters (Uprety and Salman, 2011).

However, the nexus of such bodies has itself created a problem in the proper and timely communication from field level to the upper institutional body and subsequent execution of the necessary works. The current institutional framework between Nepal and India for the management of the Koshi River is presented in Fig.3. The governments of Nepal and India have set-up a three-tier bilateral mechanism to manage, discuss and coordinate on water sharing issues (www.asiafoundation.org). Joint Ministerial Commission for Water Resources (JMCWR) headed by Minister of Water Resources of India and Nepal commissioned after the 2008 flood is the highest level

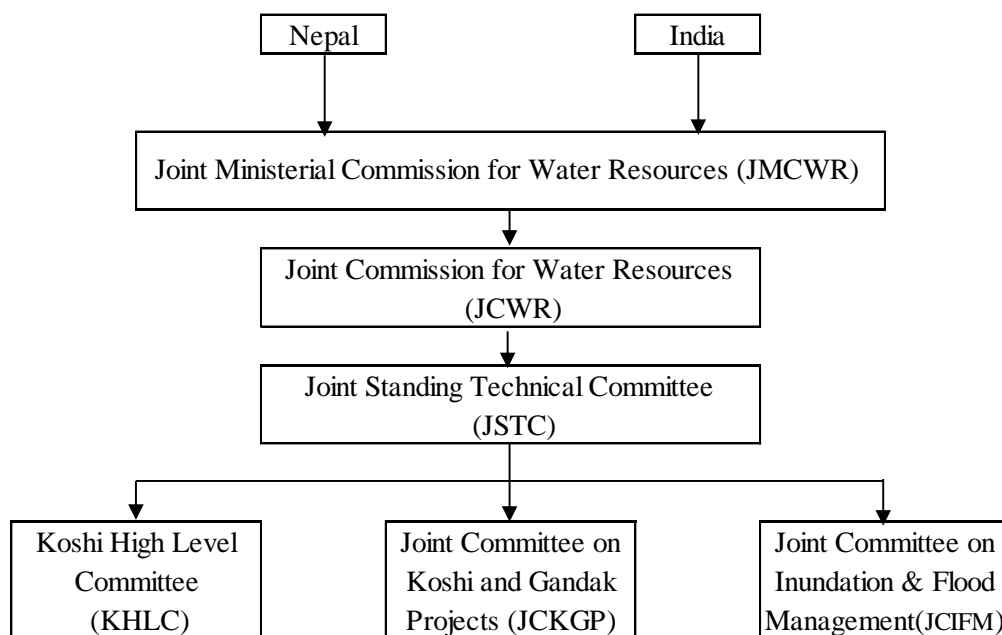


Fig.3: Current Institutional framework between Nepal and India for the management of Koshi River

body which is meant to meet at least once a year. The JMCWR is responsible for discussing and deciding plans for maximizing the benefits of water resource development through bilateral cooperation. It takes policy decisions on bilateral cooperation, investment in joint projects and further recommends public investments required for projects and activities jointly identified. JMCWR is followed by Joint Commission for Water Resources (JCWR) headed by the secretaries of the respective ministries of India and Nepal which was set up in 2000. It is responsible for assessing the compliance of provisions of all the agreements reached between the two countries on water-related issues, monitor the progress of different committees and groups and approve and/or recommend necessary action by the concerned governments to expedite progress or to meet agreed objectives. Seven meetings have taken place since its establishment. The third one formed after 2008 flood is the Joint Standing Technical Committee (JSTC) which was constituted to rationalize technical committees and sub-committees existing between India and Nepal related to flood management, inundation problems and flood forecasting activities. The JSTC coordinates all technical committees and sub-committees under JCWR and has met on five occasions till date. The two specific committees concerned with the management of the Koshi flood are also shown in Fig.3. Despite the formation of these committees and commissions, little has been achieved in the management of Koshi flood and their effectiveness is often questioned.

According to the Koshi treaty, the Koshi project office of the Water Resources Department (WRD) of Bihar state government undertakes the implementation of the repair and maintenance works of the embankment and other related structures (Shrestha et. al, 2010). Koshi High-Level Committee (KHLC) headed by the chairman of Ganga Flood Control Commission (GFCC) is responsible for the monitoring and review of the repair works carried out by WRD and also recommend protective measures to be taken before the next flood season. KHLC constitutes of members from Bihar government, Central government of India as well as the government of Nepal. The complex communication and administrative

mechanism often hinder the effectiveness of these responsible institutions. The 2008 Koshi flood disaster was the outcome of such a communication gap. Various reports state that the high-level committee on Koshi failed to monitor maintenance work through meaningful inspections.

(b) Gaps in the current institutional mechanisms

In the current institutional mechanism, Nepalese institutions don't have the authority to undertake any works, although the barrage and embankments lie in Nepalese territory. However, two of the Nepalese members of the KHLC can communicate and put their views with the KHLC but only after taking approval from the Ministerial or Secretary level. Since Nepal can't directly interfere at the field level for advising maintenance and repair works, they don't prioritize regular field monitoring. But it is the moral responsibility of Nepal to be concerned about the issues and act in the best possible way as Nepal will be first affected if come the disaster.

On the other hand, Koshi treaty is signed between GON and GOI while the execution of the Koshi Project is assigned to WRD, Bihar. There is no direct connecting medium between the Bihar government and Nepalese authority at the same political level (Shrestha et. al, 2010). For any consultation related to flood control works with the Nepalese side, the Bihar government should first consult with the Central government, India which in turn communicates with the Nepalese side. Even the communication and coordination among the concerned institutions in the Indian side is not always smooth and prompt. Such a complicated network of connections often impedes instant decision-making.

Similarly, representation of the related field level officials and local government is not included nor do they have any direct access in the current institutional set-up while it is the local level which is the most affected in case of disaster and they have the better knowledge and idea of the field situation.

In addition to these gaps, the absence of common data sharing mechanism, regular joint monitoring, lack of flood management action plan, etc. are some of the other factors which might be responsible for the

ineffective functioning of the current institutional mechanism.

5. REVISITING INSTITUTIONAL MECHANISM

There are several cases of a transboundary river and flood management around the world which have effectively functioned like Danube river protection commission, Rhine river protection commission, Mekong River Commission, etc. (Dieperink, 2000; Gerlak and Haefner, 2017). Although each case is unique, lessons can be taken from around the world for the better management of the Koshi River from transboundary perspective. Based on the gap on the organizational structure at present for the Koshi River, here we try to propose the need of improvement in some key elements that lie within the broader institutional framework of a transboundary river and flood management.

i) Institutional Restructuring

The institutional mechanism should be structured in such a way that one can complement the other. One important aspect of the institutions is the clear definitions of the roles and responsibilities which is lacking in the current institutional set up in Koshi River.

Considering several transboundary river commissions around the world, generally, three levels of institutions are considered with clear allocations of their roles and work divisions as well as ensuring better linkage between each of them (www.mrcmekong.org). As shown in Fig.4, at the topmost level, a policy-making body mainly political

and at the bottom, an implementing or working body consisting of technical personnel while in between these two, an intermediate body which can act as a bridge and formulate strategic plans based on the working groups, can be set up. Each level of the institutions should comprise of the members from each state. National River basin organizations of the respective countries should be set-up which can solely concentrate on the overall planning within the basin. For example in the case of Mekong River Commission (www.mrcmekong.org), each of the member states have their national committees within their state. At present, Nepal and India both don't have such national level basin organizations. National River basin organizations should include people from the central as well as the state and the local level so that a proper chain of the flow of information is maintained. At the same time, the members of these national organizations should be included in the working group of the transboundary committee so that the actual field scenario could be discussed in the committee.

ii) Data and Information Sharing

Collection and sharing of data are vital for any planning and policy making. Within the larger institutional framework of transboundary flood management, there are several elements which dictate their effectiveness. Water resources data and information exchange can be viewed as one element of the larger institutionalization framework and interactions around transboundary waters. For example, before the legalized formation of Rhine River protection commission, the countries spent more than one decade, just for sharing information which

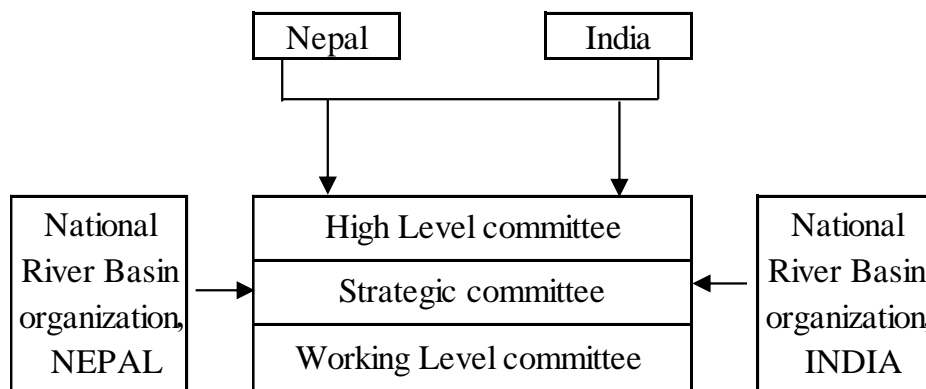


Fig.4: Proposed Organizational Structure

helped the involved countries to understand the issues and problems and incorporated (Gerlak and Haefner, 2017).

Several studies have shown that the exchange of water resources data and information can provide the first step toward broader transboundary cooperation and agreement formation (Myint, 2007).

In this regard, in the case of Koshi River, a common portal for the collection and sharing of necessary data like hydro-meteorological data, topographical data, and other relevant data need to be established. China is upstream, India the downstream and Nepal is at the middle reach. Thus, if possible all three nations can be included in a data sharing mechanism.

Having said these, there should be an improvement in the data measurement system and increase the network of measuring stations for better understanding the spatial heterogeneity of the river basin. Without the appropriate and enough data, research and analysis couldn't be performed which are needed for deciding future management plan.

iii) Integrated Flood Management Action Plan

Most of the discussions and decision of the different committees on the Koshi River have focused only on the short term action plan like the preparation for the next year seasonal floods. However, the effective management of the flood requires both the short term and the long term action plan. In Europe, European Union Flood directives were forced into action in 2007 with clearly defined goals which guide the member states for the reduction and management of flood risks (EU, 2007). Most of the transboundary river commission in Europe follow these guidelines. For example, in the case of the Rhine River, by implementing several measures, the commission has set a clear goal of reducing the flood risk by 25% by the year 2020. In the case of Koshi River, other than repair and maintenance work, no such clear action plan has been set for the long term flood risk reduction. Development of a comprehensive flood action plan addressing prevention, protection, preparedness and response and providing for common objectives, joint action, contingency plans, information policy, and floodplain management and financing mechanisms

needs to be included in the integrated flood management plan.

iv) Public Participation and Awareness

The inclusion of the local people in the development process is one of the major requirement for the sustainability of any kind of development and management work. The locals will be the most affected one and at the same time, they have the clearest knowledge about the on-field situation. Participation of the public will ensure the ownership among the people and motivate them for the proper actions including better on-site monitoring (Sopheak, 2018). Thus participation of the local people and local authorities with clearly defined roles and responsibilities might be one of the key components for the better management of flood in Koshi River.

Another important issue is the awareness among the local people. Many people are uneducated and don't understand the complicated technical aspects. Therefore, they need to be trained about the flood risk by preparing flood risk maps, regular communication to share the progress in the maintenance work, etc. Preparation surveys and studies, floodplain maps, flood risk assessments and flood risk maps, taking due account of local knowledge and the exchange of relevant national data and documentation might also be helpful in reducing and understanding the associated flood risk.

6. CONCLUSIONS

Experiences from the past five decades on the management of Koshi River has long proven the incompleteness of the Koshi treaty and the pitfalls of the current institutional arrangement. One decade after the 2008 disaster, the chances of happening similar events cannot be denied unless we rethink our approach and organizational restructuring for the management of Koshi River. The sooner we act, the better it will be for both the nations. Evidence and studies have pointed out the lack of clear roles and responsibilities, accountability and coordination among different institutions as one of the major reason for the 2008 havoc. Of the many aspects of the

management of Koshi River, the institutional mechanism is the pivotal one as it dictates all other direct and indirect actions that will be taken. It is evident, that the current provisions of the Koshi agreement and the complicated institutional set-up have hindered the proper management. It is well agreed that rather making the management process simpler, too many institutions have only made the process complicated and increased the gap between the implementing agency and the higher body. In this regard, as a part of the broader institutional framework, various key components need to be reconsidered for the smooth and effective management of Koshi River floods. Thus it is recommended to restructure existing institutions with clearly defined roles and responsibilities and make the inter-linkage between them more smooth and simple. Similarly, improvement in the data collection and sharing mechanism is sought which are valuable for the better understanding of the river basin characteristics and conducting research work for formulating a future plan. Development of integrated flood management action plan which considers the short-term and long-term actions for the reduction of flood risk should be immediately formulated. Involvement of local people and local authorities in the flood management process is most for ensuring the ownership as well as the sustainability of the plan. Finally, awareness building and information sharing with the local level can also prove to be vital in minimizing the risk of the flood disaster. There are many shreds of evidence of successful management of transboundary river floods around the world larger than Koshi. The collective effort and actions with long term planning can certainly help reduce and manage the flood in Koshi.

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