

# Mahakali Treaty: delay in implementation and resulting impacts from Nepal's perspective

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## Abstract

The Mahakali Treaty concluded between Nepal and India, on February 12, 1996 is said to be on an 'equal footing' unlike other agreements/treaties on water resources before. However, the provisions of the treaty have not been implemented even after more than two decades of its enforcement. This paper, written following a study involving key informant interviews, direct field observations and study of documents, looks for the reasons behind the delay in implementation of the treaty and the resulting impacts from Nepal's perspectives. The study shows that the controversies of the treaty are around: (1) India's strategy to legitimize its unilateral construction at Tanakpur; (2) interpretation of the Article of the treaty concerning equal entitlement to water; and (3) the extent of existing irrigation use on the Indian side having its direct implication on benefit assessment, which, in turn, has its implication on proportional cost sharing. The delay in implementation of Mahakali Treaty has created a deadlock in Nepal–India water cooperation. If an agreement could be worked out and the project could be implemented, that would set a very good precedent, useful for many other storage projects like Karnali Chisapani, Koshi High Dam, etc., in the future.

*Keywords:* Mahakali Treaty; Nepal–India water relation; Transboundary water sharing

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## Introduction

The fresh water of the world, which itself is a small fraction of the whole water resource, is facing intense stress to meet increasing demands. Water conflicts between and within nations are endemic all over the world and Nepal is not an exception (Upreti, 2012). According to the [World Commission on](#)

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Dam (2000), conflict over transboundary rivers usually results from a power imbalance among riparian states where one state is sufficiently influential to exert its authority over others. Hydro tensions in sharing water of Koshi, Gandaki and Mahakali between India and Nepal are reflections of this (Upreti, 2012).

Since the beginning of the 20th century, Nepal and India have signed a number of agreements for the utilization of transboundary water. They include Exchange of Letters for the construction of Sarada Barrage in 1920, Kosi Agreement in 1954, Gandak Agreement in 1959 and the Mahakali Treaty in 1996. In all these agreements, Nepal despite having abundant water resources, has been unable to secure its benefits (Adhikari *et al.*, 2015). Therefore, dissatisfaction persists within Nepal about the sharing of water resources/benefits between the two riparian countries. Water-related items, therefore, always carry significant weightage in the agendas of the Nepal–India bilateral meetings (MoFA, 2019).

Gyawali & Dixit (1999) wrote that Mahakali Treaty between India and Nepal was signed and pushed through the Nepali parliament in extreme haste, putting aside all the serious doubts that were raised about the treaty, and there was an unseemly scramble among Nepali politicians immediately to take credit for the treaty. Contrary to such urgency shown in concluding the treaty, it is nowhere close to realization. This article attempts to discover the reasons.

### *Mahakali Treaty*

The Mahakali Treaty was signed between Nepal and India on February 12, 1996, concerning the Integrated Development of the Mahakali River including Sarada Barrage, Tanakpur Barrage and Pancheshwar Project. As per the provisions of the then constitution of Nepal, it was required to be ratified by a two-third majority of the combined session of both the houses of the parliament. It was done in a dramatic manner, amidst strong disapproval from many parliamentarians (Thapa, 2017). The instrument of ratification was then exchanged during the visit of Indian Prime Minister Indra Kumar Gujral, to Nepal on June 4, 1997; and the agreement entered into force from June 5, 1997 (Lama, 2019).

The treaty gives Nepal 28.35 m<sup>3</sup>/s and 4.25 m<sup>3</sup>/s of water, from Sarada Barrage, in the wet and dry season, respectively. This quantity of water is to be supplied from the Tanakpur Barrage if the Sarada Barrage turns out to be non-functional. The treaty also directs that not less than 9.91 m<sup>3</sup>/s should flow downstream of the barrage, to maintain and preserve the ecosystem of the river. The treaty reaffirmed the Nepalese sovereignty, on Tanakpur, over 2.9 ha land needed for building the eastern afflux bund, as well as the 9 ha of pondage area. In lieu of this, the treaty gave Nepal the right to 28.35 m<sup>3</sup>/s of water in the wet season and 8.5 m<sup>3</sup>/s in the dry season; and 70 million kilowatt-hours (kWh) of electricity ‘free of cost’ annually, against the earlier agreed 20 million kWh from the Tanakpur facilities.

As stated in the treaty, Pancheshwar Multipurpose Project (PMP), a bi-national project, which is to be located on the Indo–Nepal boundary has some general principles applicable to transboundary rivers, ‘equal entitlement in the utilization of the waters of the Mahakali River without prejudice to their respective existing consumptive uses of the waters’. When the project, after completion, augments the availability of water in the dry season at Tanakpur, Nepal would be provided with additional water and additional energy bearing a proportion of the cost of generation of incremental energy.

The treaty has a term of 75 years with provisions of review after every ten years and arbitration for dispute settlement. However, the implementation process has been too sluggish with no sign of making any headway. The Detailed Project Report (DPR), which was to be prepared within six months of ratification of the treaty (Kunwar, 2014), has not been finalised even after more than two decades because of certain unresolved issues. The details of the components of the Mahakali Treaty are discussed as follows.

*Sarada Barrage.* The Sarada Barrage on the Mahakali River (known as Sarada River in India) was built in the 1920s through the Letters of Exchange dated 23 August 1920 and 12 October 1920 between British India and Rana Prime Minister of Nepal to exchange 4,000 acres (1,618 ha) of land. Before 1920, Mahakali was a border river with the left bank in Nepal and the right bank in India, but with the exchange of land in the vicinity of the barrage, the Sarada Barrage now completely lies in India. Although the agreement was made in 1920, Nepal could utilize her share of the water only after the construction of the Mahakali Irrigation Project in 1975. According to Water and Power Consultancy Services (WAPCOS) Limited (2016), India has diverted 326 m<sup>3</sup>/s of water from the barrage to the Sarada Main Canal for irrigation, and electricity is also generated with an installed capacity of 41 MW at Lohia head power plant. This agreement has been subsumed in the Mahakali Treaty signed in 1996.

*Tanakpur Barrage.* The Tanakpur Barrage was constructed unilaterally by India in the 1980s on a common border river, the Mahakali, as an ‘alternative’ to the ageing 1920 Sarada Barrage, to irrigate 1.61 million hectares of land in India and for power production (Pun, 2009). On December 6, 1991 a controversial agreement was signed between Nepal and India as a ‘memorandum of understanding’ which was hugely criticized in Nepal and later, declared by the Supreme Court of Nepal as a ‘treaty’ which needed to be ratified by the parliament as per the then Constitution of Nepal. In the agreement, the Government of Nepal agreed to make available about 577 metres in length (with an area of about 2.9 ha) of land on the Nepalese side, for tying up of the Left Afflux Bund to the high ground while the Indian Government agreed to construct the head regulator of 28.3 m<sup>3</sup>/s capacity near the left under sluice of the Tanakpur Barrage, and also the waterways up to the Nepal–India border to irrigate land on the Nepalese side. Similarly, Nepal would get electricity of an amount equal to 10 million units (kWh) ‘free of cost’ which was later increased to 20 million units. However, due to the lack of severe misunderstanding among the political parties and within the parties, the treaty was unable to be ratified. Later, the issue of the barrage was normalized by including it in the Mahakali Treaty. In the Mahakali Treaty, the amount of free electricity to Nepal from Tanakpur Barrage is increased to 70 million units.

*Pancheshwar multipurpose project.* PMP is a bi-national project to be developed in the Mahakali River bordering Nepal and India for accruing benefits including power, irrigation, flood control, etc. PMP has been identified as a huge storage project to be developed so as to maximize peak power benefit in the order of 5,040 MW (Pancheshwar High Dam 4,800 MW and Rupali Gad Re-regulating Dam 240 MW) with an annual average energy production of 11,885 GWh (WAPCOS, 2016). The cost of the project was agreed to be borne by both countries in proportion to the benefits accruing to them, and a proportion of Nepal’s share of energy shall be sold to India. According to Gyawali & Dixit (1999), Pancheshwar was a dam that India had wanted all along for over two decades, but for which, the Nepalese had not shown much interest.

#### *Implementation of Mahakali Treaty: review of progress*

Implementation of PMP is the centrepiece of the Mahakali Treaty, but the differences on the understanding of the provisions of the treaty started surfacing as the progress of some studies was made for preparation of the DPR of the PMP (Upadhyay, 2012). After signing the treaty, realizing the need for additional investigations on previous independent and joint studies, a Joint Project Office (JPO-PI) was set up in Kathmandu with field offices at the project sites in 1999. The required field investigations for the project were completed in 2002 but both countries were unable to finalize a mutually acceptable DPR of the Pancheshwar Project. The

JPO-PI was closed in July 2002 and the relevant data/records were transferred to Central Water Commission, New Delhi. During the third meeting of the Joint Committee on Water Resources (JCWR) held in September/October 2008 in Kathmandu (Nepal), it was decided to set up Pancheshwar Development Authority (PDA) at the earliest opportunity for the development, execution and operation of PMP. However, due to the differences on the TOR, the mutually agreed PDA was set up only in September, 2014. In the second meeting of the governing body of PDA held on 18/19 November 2014 in New Delhi, it was decided to award the work of updating of DPR including the additional field investigations, if necessary, to M/s WAPCOS Limited, an undertaking of the Indian Government. The draft final DPR of the project was submitted in November 2016 at the fifth meeting of the governing body of PDA (GoI, 2017).

The irrigation water from Tanakpur Barrage to the Nepalese side has been delayed due to differences on the sill level of the head regulator. The sill level for the Nepal canal was set at an elevation level (EL) of 245 metres, which was 3.5 metres higher than the sill level for the corresponding regulator for India. India stresses that the specified quantity of water flow for Nepal will be assured as the pond level of the barrage for power generation will be maintained at EL 246.7 metres. Pun (2009) reported that such promises were also made on the Gandak Barrage, which also has a powerhouse on the canal, but as the pond level was not maintained, Nepal never received the specified quantity of water from the barrage. With Nepal contending to lower the sill level to 241.5 metres (the same as the level on the Indian power canal head regulator), after 15 years of discussion, at the sixth meeting of JCWR held on 24/25 November 2011 in New Delhi, it was proposed to lower the sill level of the head regulator to EL 244.25 metres instead of EL 245.00 metres proposed earlier and directed the technical committee to finalize the level reviewing the technical details. The issue of the sill level was resolved during the fourth meeting of the JSTC in 2013.

The canal length of 1.2 km to be built by the Indian side from Tanakpur Barrage to the Nepal–India border is yet to be started. However, Nepal is receiving the amount of 70 million units of electricity free of cost annually from Tanakpur hydropower plant (NEA, 2018). Similarly, the DPR of the Irrigation Project for Dodhara-Chandani area, where water is to be released from Sarada Main Canal of India, is yet to be finalised despite the issue being discussed several times in different bilateral forums.

## Methods

### *Study area*

The Mahakali River is a border river in most of its reaches, and forms the western border between Nepal and India. However, there exist differences between the two nations about its origin. Nepal strongly believes that the longer tributary of the Mahakali River originates at Limpiadhura, hence, it is the main stem of the Mahakali River, while India claims that Mahakali River originates from Lipulekh Glacier. The total catchment area of the Mahakali basin (Figure 1) is 15,260 km<sup>2</sup> and 34% of the catchment area lies in Nepal (WECS, 2005). In Nepal, it lies entirely in four administrative districts of the Sudurpashchim Province: Darchula, Baitadi, Dadeldhura and Kanchanpur.

### *Data collection*

Primary data were collected through (1) key informant interview (KII) and (2) direct field observation. A checklist was prepared for KII to get information about reasons for the delay in

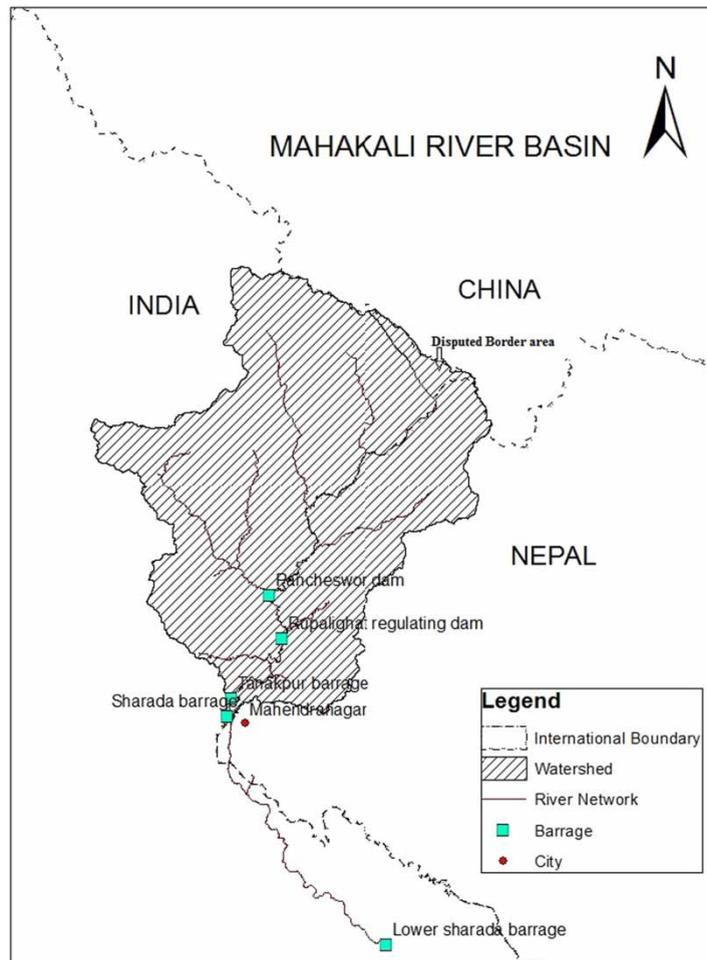


Fig. 1. Mahakali River basin upstream of Sarada Barrage (Source: Bagale, 2019).

implementation and resulting impacts. The key informants were mainly the Nepal–India water relation analysts, high-level government officials including those involved in projects like PMP, Mahakali Irrigation Project (MIP) Stage-III, Mahakali Management Division Office, etc. Direct field observations were carried out in the areas with problems from flooding in Mahakali River and the command area of MIP Stage III. Different reports related to PMP and MIP were also reviewed to assess the resulting impacts on the Nepalese side.

#### Data analysis

Qualitative approaches were used to analyse the data/information collected during the study. Framework analysis was used to explore the reasons for delay in implementation of the Mahakali Treaty. It involved a five-step process: familiarization, identifying a thematic framework, indexing, charting, and mapping and interpretation.

## Results and discussion

### *Performance of bilateral institutions on water resources*

India seems to have a long-term strategy in her water resources-related dealings with Nepal, and is moving with the aim of getting hold of all the major rivers of Nepal and to pick up projects as and when the necessity is felt (Dhungel, 2009). Nepal is, however, yet to develop a strategy in relation to India, and the former has so far been only responding to the actions and proposals of the latter. Furthermore, water has been made a very sensitive and highly politicized issue in Nepal. The relationship is far from satisfactory, despite the fact that there exists a host of committees at different levels to deal with various aspects of water resources (Dhungel, 2009). The meetings of the institutions are not held on a regular basis, even when very important issues need to be taken up for resolution. Resolutions of many issues are contingent upon joint political decisions, and without them, it is almost certain that the impasse will not be broken. Therefore, we can safely say that the Nepal–India joint institutions on water resources, in the context of implementation of the provisions of Mahakali Treaty, are not performing effectively.

### *Detailed project report of Pancheshwar multipurpose project*

Various studies of the Pancheshwar Project were conducted independently and also jointly by the two countries in different years. These include WAPCOS initial studies 1971, Nepal DPR 1995, Joint Investigation by JPO-PI 1999, Indian Draft DPR 2003 and draft DPR by WAPCOS Limited 2016. Based on the field investigations that started in the 1960s, India prepared a feasibility report on the Pancheshwar Project in November 1971. It suggested a 247 metre high concrete gravity dam at Pancheshwar with a dam toe powerhouse of 1,000 MW installed capacity. Likewise, Nepal, making use of the Indian investigations and carrying out its own studies, prepared a draft DPR of PMP in 1995 and forwarded it to the Indian side for consideration. The report suggested a 315 metre high dam and a powerhouse of 6,480 MW.

After signing of the Mahakali Treaty, realizing the need for additional investigations and studies to be carried out jointly, for the main dam as well as for the re-regulating dam at an optimal location, it was decided to set up a JPO-PI at Kathmandu with field offices at the project sites in 1999. The required investigations and studies were carried out by JPO-PI between 2000 and 2002 for locating the downstream re-regulating dam either at Rupaligad or at Purnagiri. After completion of additional surveys and investigations at Pancheshwar dam, Rupaligad and Purnagiri dam sites, JPO-PI tried to finalize a mutually agreeable DPR in 2002. However, it could not be completed due to differences in opinion on certain issues; mainly, power generation unit size and installed capacity of Pancheshwar power plants, non-finalisation of location of downstream re-regulating dam, assessment of irrigation benefits to India, apportionment of the project cost to each side, etc. However, a draft report was prepared unilaterally by the Indian side in 2003. That report envisaged a 184 metre high rock fill dam at Purnagiri site, as a re-regulating dam, to intercept the intervening basin area of around 3,000 km<sup>2</sup> and make optimal use of hydro power potential of the Mahakali River. The Indian draft report of 2003 had retained many project parameters related to the main dam at Pancheshwar as suggested in the Nepal DPR of 1995. In the final draft DPR prepared by WAPCOS Limited in 2016 as awarded by PDA, it suggested the capacity of Pancheshwar project as 4,800 MW with dam height of 311 metres and a re-regulating

dam at Rupaligad with installed capacity of 240 MW. There is no convergence between the two countries on the 2016 DPR.

#### *Sill level of Tanakpur*

As described earlier, Nepal agreed on the revised sill level of 244.25 metres and withdrew itself from its position of equal sill level of 241.5 metres, after 15 years. The issue significantly delayed the implementation of Mahakali Irrigation Project Stage III.

#### *Irrigation water in Dodhara-Chandani*

Although 10 m<sup>3</sup>/s of water is allocated to Dodhara-Chandani area of Nepal from Sarada canal in accordance with Article 4 of the Mahakali Treaty, the details of the water withdrawal arrangement have not been finalized yet. Initially, the Indian side maintained that Article 4 would be implemented only after the implementation of Article 3 that deals with PMP. Later, although they tended to show some flexibility by agreeing on a joint survey and design of the structure that facilitates release of such water from Sarada main canal, but of late, no progress has been made even in survey and design, leaving aside the implementation and operation of the facility.

#### *Reasons for delay in implementation*

According to Rai *et al.* (2017), the major reason for very low hydropower potential being tapped so far from the transboundary river between Nepal and India is that there appears to be wide differences in the priorities of the two countries and sharing of project benefits. Nepal was quite keen to initiate the Karnali Project while India wanted to take up the Pancheshwar Project (Dhungel, 2009; Rai *et al.*, 2017). The reasons for delay in implementation of the Mahakali Treaty are mainly based on the controversies in signing and ratification of the treaty leading to differences in understanding the provisions of the treaty. Those reasons are explained in the following sections.

*Controversial agreement and its ratification.* The purpose of Mahakali Treaty was to resolve the controversy of the Tanakpur debacle and take the cooperation of the two countries on water to a new height. However, the controversy started immediately after the conclusion of the treaty. When the treaty was placed for ratification in the parliament, the main opposition party expressed various points of reservation and asked for clarification in the treaty. Letters between the Prime Minister and the leader of the main opposition party attempted to sort out the difference of opinion among the main political parties. The Government of Nepal also wrote a letter on 10 September 1996 to seek the views of the Government of India on several issues including the Mahakali Treaty. The same day, the Indian Ambassador responded, saying that it would be inappropriate to comment on any aspect since ratification was purely Nepal's internal affair (Upadhyay, 2012). After several rounds of discussions to sort out their differences, the political parties seem to have reached an understanding that the various points raised by the opposition and the response of the government be as a 'national commitment' and to form a monitoring committee to guide the Nepalese side to implement the project with a view to fulfil those commitments (Upadhyay, 2012).

Finally, at nearly midnight of 20 September, 1996, the Joint Session of the Nepalese Parliament overwhelmingly ratified the Mahakali Treaty. It was widely believed that ratification was done together with the four '*rashtriya sankalpas*' (national strictures): (1) export of energy and its pricing principle, (2) formation of Mahakali River Commission, (3) equal sharing of waters of the Mahakali River after the Pancheshwar project and (4) status of the Mahakali River (Pun, 2012). However, several efforts to investigate the strictures revealed that such strictures were neither registered nor passed by the parliament. The experts claimed that the word '*sankalpa*' used by the then Water Resource Minister while addressing the queries of the members of the parliament was rumoured as passing of '*national stricture*'. The treaty was communicated by the Government of Nepal to the Embassy of India on 22 November, 1996. In that communication, the setting up of a monitoring committee to guide the Nepalese side was also mentioned. But the instrument of ratification was exchanged between the two countries on 4 June, 1997 without any reservations (Chimni, 2005). Thus, the ratification of the treaty was unconditional. Hence, the treaty itself was never far from controversy, which is evidenced by the splitting of the main opposition political party, and the Maoists even demanding that it should be scrapped (Rai *et al.*, 2017).

Sufficient study and homework were not done regarding the parameters of sharing of benefits and existing use before signing and ratification of the treaty. Therefore, the issues of the Mahakali as a border river, the prospect of equal sharing and existing consumptive use arose soon after the treaty came into force. The major difference that exists is regarding the protection of existing consumptive use, or at least, determination of the existing use benefits that is subtracted while computing project benefits. According to Upreti (2006), Nepal's consumptive use has been specifically defined in the treaty, while India's consumptive use was not defined, and in the later stages was disputed (Nepal recognized 248 m<sup>3</sup>/s while India argued for another 201 m<sup>3</sup>/s), against the spirit of the treaty. Furthermore, as per the treaty (Article 3), the sharing of the capital cost of the Pancheshwar Project would be proportional to the incremental benefit which has to be considered after setting aside or subtracting historical consumptive use of water of the river. Nepal's concern is that the two million hectares of land irrigated from the lower Sarada Barrage is outside the scope of the agreement, as it is mostly dependent on the contribution of the catchment downstream from the Sarada Barrage and also water from Ghagra or Karnali River for most parts of the year. However India's position is that the system is very much under the treaty. Similarly, the difference in the interest of both nations was seen in the site for re-regulating structure. A site was needed below the Pancheshwar Dam to store and subsequently regulate the flow to meet the irrigation requirements downstream. Two locations came into discussion for construction of the re-regulating structure. First was at Rupaligad, which Nepal preferred, and would generate about 240 MW of electricity owing to the low height (of about 60 metres) and have limited storage capacity. For India, the site did not offer much interest owing to lower production of energy and little of her irrigation demand. India feels that the site further downstream at Poornagiri would enable construction of a re-regulating structure of 180 metres' height which would produce up to 1,000 MW of electricity as well as provide adequate storage. Nepal's concern on this issue is that a dam at this site would inundate a considerable amount of agricultural land and also displace people from the Nepal hills. Rupaligad re-regulating dam site has now been more or less accepted as the agreed option.

*India's strategy to legalize the unilateral construction.* Pun (2009) claimed that it is India's strategy to construct first, then wrangle over it in slow bureaucratic fashion to ultimately legalize it. Similarly, Upreti (2006) also noted the criticism that the intention of India was never to execute the Pancheshwar

project, but the treaty was signed rather to ensure the continuity of the defunct Sarada Barrage and legalize the unilateral construction at Tanakpur entirely for India's benefit, ignoring Nepal's legitimate half-entitlement with respect to such a boundary river. Furthermore, the Indian side is delaying the supply of water to Nepal as per the treaty.

*Nepal's unclear stand for securing benefits.* Gyawali & Dixit (1999) stated that for the major political forces in Nepal and their leaders, international treaties have value more for their outward form than for their internal substance, more for show for 'development-oriented' politicians in the short term than to have national benefit from their substance in the long term. The debate of the sill level of the Tanakpur Barrage to supply 28.35 m<sup>3</sup>/s of water to Nepal continued for 15 years but India ignored the request of Nepal stating that the head regulator was already constructed before the treaty and finally agreed to reduce the sill level only by 0.75 metre. In this way, the 'nationalist' logic of equal sill level with India, irrespective of the technical facts, had created a deadlock in the implementation of the treaty. As per Article 1 of the treaty, in the case of non-function of the Sarada Barrage, 28.35 m<sup>3</sup>/s of water provided to Nepal from the Sarada Barrage is to be provided from Tanakpur Barrage. In 2009, viewing the above provision, Nepal had requested India to construct the head regulator and link canal for a capacity of 56 m<sup>3</sup>/s but India denied this saying that such arrangements would be made only when the Sarada Barrage ceases to function. Since then, Nepal has not raised the issue again. Therefore, it is seen that Nepal has to wait for years to get water for existing Mahakali Irrigation Project Stage I and II, in the case that Sarada Barrage becomes defunct, but India will not face any problems as the tailrace of Tanakpur Hydroelectric Plant can easily feed the Sarada Main Canal.

### *Benefits of Mahakali Treaty*

Both Nepal and India can benefit from the implementation of the Mahakali Treaty in terms of energy generation, irrigation facilities and flood control.

*Power and energy benefits.* Reservoir simulation studies were carried out by WAPCOS Limited in 2015 (WAPCOS, 2016) for preparing the DPR to compute the firm power (MW) and annual energy production (GWh) from the PMP with the re-regulating dam at Rupaligad site. The annual energy benefits are assessed as 7,678 GWh on 90% dependable basis with a total installed capacity of 4,800 MW in two identical power stations, one on each side of the river. In addition, the annual energy generation benefits from Rupaligad Dam would be in the order of 1,438 GWh on 90% dependable basis with a total installed capacity of 240 MW having equal capacity power stations on both banks of the river. The power production from the Pancheshwar Dam could be increased if the 5% allocation for future consumptive use in the upstream is also used in power computation. Article 7 of Mahakali Treaty has provision for such future use; however, the records of the last 20 years show that there is no increasing trend of consumptive use in the upstream.

*Irrigation benefits.* The irrigation benefits from Mahakali River include both the existing consumptive use and future benefits from irrigation facilities. The existing consumptive uses of Nepal, as agreed under Articles 1 and 2 of the Mahakali Treaty, in a year are 451 million cubic metres (MCM) from Sarada Barrage and 529 MCM from the Tanakpur Barrage, respectively (WAPCOS, 2016). Under Article 4 of the treaty, India shall supply 10 m<sup>3</sup>/s of water for irrigation of Dodhara-Chandani area of

the Nepalese Territory. Further, as per Article 5 of the treaty, water requirements of Nepal are given prime consideration in the utilization of the waters of the Mahakali River. WAPCOS Limited (2016) has assessed a maximum crop area of 170,720 ha can be brought under irrigation (including 6,040 ha of Dodhara-Chandani area) in Nepal with the available additional water on implementation of the PMP. For development of this command, additional water requirement will be of the order of 3,073 MCM. Thus, total water use by Nepal will be 4,053 MCM. The existing water use of India through Upper Sarada Canal system and Sarada Sahayak system are of the order of 7,071 MCM and 4,790 MCM, respectively, totalling 11,861 MCM per annum (WAPCOS, 2016). Considering the power releases from Pancheshwar and water available in the intervening catchment from Pancheshwar to the Tanakpur Barrage, after meeting the existing requirement of Nepal and India and future requirement of Nepal, an additional 1,905 MCM of water would be available to India in the post-Pancheshwar scenario (WAPCOS, 2016). Thus, total water use of India will be of the order of 13,766 MCM on implementation of PMP.

Although the total beneficial cultivable land of India is much more than that of Nepal, the difference in water use volume is only around three times. This is because in the assessment carried out by WAPCOS Limited, irrigation water in the Sarada Sahayak system in the monsoon period has been considered as an existing use. However, Nepal denies this, stating that it is not mentioned in the treaty. India claims it as historical use since water from Mahakali has been used from the Lower Sarada Barrage during the monsoon season since 1975. Thus, that amount of water should be ensured as a right at Sarada (Banbasa) Barrage.

*Flood control benefits.* Since no dedicated storage is proposed for flood control, benefits on account of reduced floods are incidental. Without the project, the average annual flood damage in Nepal was computed to reach US\$ 0.81 million, that would be reduced to US\$ 0.15 million per year after the project implementation during the 50 years economic life of the plant as stated in the draft Indian DPR of 2003. The potential annual flood control benefits in India and Nepal were estimated by WAPCOS Limited (WAPCOS, 2016) as INR 740 million and INR 160 million, respectively, at 2015 price level. The cost of the protection works done by Nepal on both banks of the river downstream of Sarada (Banbasa) Barrage is not considered in this assessment.

#### *Resulting impacts on benefits for Nepal*

The resulting impacts on benefits on the Nepal side due to delay in implementation of the Mahakali Treaty can be assessed based on the potential annual benefits. The impacts may be tangible or intangible. Tangible impacts can be easily quantified, whereas intangible impacts cannot be.

*Tangible impacts.* The tangible impacts are that the economic benefits from energy production, irrigation facilities and flood damage reduction are forgone for years. It has already been 23 years since the ratification of the treaty. The construction period of the Pancheshwar Project has been indicated as eight years in the treaty. In addition, a period of two years will be required for preconstruction activities. As such, a total ten-year period is required for commissioning of the project. Therefore, the annual benefits have already been foregone for at least 13 years. Similarly, at least eight years will be required for completion of the Pancheshwar Project if construction is started immediately.

*Intangible impacts.* Pancheshwar is the landmark project of the Far West region of Nepal, so the development that would have been achieved after the implementation of the project has been lost. Similarly, the present situation of regional imbalance would have been minimized to a great extent.

## Conclusion and recommendations

### *Conclusion*

This study shows that the implementation of PMP, and for that matter, that of the Mahakali Treaty, is entangled in interpretation and mostly misinterpretation of the treaty in the political and bureaucratic processes of both Nepal and India. Defining existing consumptive use for benefit evaluation and the resulting cost apportionment and establishing water rights accordingly have been found to be the main bones of contention between the two countries. There are several other issues also, such as supply of irrigation water to Nepal's Chandani-Dodhara area, estimation of available water itself, the price of surplus electricity in Nepal's share, etc., waiting for resolution. The following are the major unresolved issues:

1. whether or not to consider irrigation waters from Lower Sarada Barrage to the Sarada Sahayak system for the monsoon period as existing consumptive use;
2. whether or not to consider irrigation waters to Dodhara-Chandani area as a post-Pancheshwar scenario;
3. whether or not to include 5% of average annual flow allotted for future consumptive use by the local community as resources in planning and design of the PMP.

Due to the delay in implementation, a significant amount of tangible benefits has been foregone while the intangible benefits like overall development of the Far West region of Nepal, opportunity to minimize the regional imbalance to a great extent, and further cooperation in water resources between two nations have been missed.

As downstream benefit has been acknowledged formally in the form of a treaty between Nepal and India for the first time in a storage project at Pancheshwar, if an agreement could be worked out and the project could be implemented, that would set a very good precedent, useful for many other storage projects like Karnali Chisapani, Koshi High Dam, etc., in the future.

### *Recommendations*

To break the current impasse in implementation of the treaty, the following pathway is recommended:

1. Agree on cost apportionment at political level, without engaging in debate as to whether or not Lower Sarada system is within the treaty's scope.
2. Go immediately for the implementation of the Chandani-Dodhara irrigation system.
3. Ensure that Nepal reserves rights to withdraw water as much as it requires in future, apart from the projects that are identified.
4. Ensure that India reserves rights to use the flow available in the downstream without any hindrance and controversy.

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