Socio-economics and hydrological impacts of melamchi intersectoral and interbasin water transfer project, Nepal

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Abstract

To mitigate the drinking water crisis in Kathmandu city, the Government of Nepal has recently initiated the Melamchi project, which will divert water from the Melamchi River to Kathmandu city’s water supply network. In the first phase, the project will divert 170,000 cubic metres of water per day (at 1.97 m³/s). There is a plan to triple the volume of water using the same infrastructure as city water demand increases. This paper illustrates the complexities involved in planning and implementing the intersectoral (interbasin) water transfer project, and the socio-economic and hydrological implications of the project in the basin of water supply. This project potentially generates huge economic benefits, mostly accrued to the urban sector. An already resource-poor water-supplying basin bears all the opportunity costs of the water transfer. The project compensation scheme has focused more on local public goods and has not much considered third party effects such as traditional water mill owners and tenant farmers who may unduly bear the brunt of the project. Effective participation of stakeholders and early negotiation for compensation could minimize such third party effects. The absence of such negotiation has raised some concerns about the effectiveness of the Melamchi project to meet the social obligations in the basin of water origin.

Keywords: Compensation of water project; Economics of urban water supply; Hydrological impact; Impact of intersectoral and interbasin water transfer; Nepal; Urban water supply system

1. Introduction

The Government of Nepal has recently initiated an intersectoral and interbasin water transfer project to alleviate a drinking water supply crisis in Kathmandu city by transferring water from the nearby
Melamchi River. The project called Melamchi Water Supply Project (MWSP) plans to divert 170,000 m$^3$/day (cubic metres per day) of water (or 62 million m$^3$/year) to the Kathmandu city water supply network through a 26 km long tunnel structure in the high Himalayas. The volume of water diversion can be tripled, using the same tunnel infrastructure, as the city water demand grows in future. The project represents both a case of intersectoral allocation from rural to urban use and interbasin water transfer, from the Melamchi River to the Bagmati basin. The total cost of the project, including the rehabilitation and expansion of Kathmandu water distribution systems, is estimated to be US$464 million, spread over 8 years (2001–2009).

This paper illustrates the key issues involved and evaluates some of the likely socio-economic changes and hydrological consequences of the water reallocation decision with a focus on the basin of water origin. This is done by synthesizing the key findings of several short case studies carried out earlier in the water-supplying basin, the Indrawati River basin, in relation to the Melamchi project. These case studies include, process documentation research of the Melamchi project (Devkota & Bhattarai, 2001), a water accounting study (Mishra, 2000), a formal and informal institutions study (Pant & Bhattarai, 2001) and the International Water Management Institute–Water and Energy Commission Secretariat (IWMI–WECS) Indrawati project synthesis report (Bhattarai et al., 2002).

The field level information compiled in these short case studies is again supplemented by secondary sources of information adopting a thorough desktop study by review and analysis of broad level institutional changes, economics and financing aspects of the Melamchi project. This also includes reviewing issues and controversies in relation to the project financing, project compensation and project implementation activities from the latest Melamchi project documents, other policy documents and grey literature (local publications) in Nepal.

This study is expected to add important new information to the literature about intersectoral and interbasin transfers in the context of developing countries. Most of the past studies on the topic are focused on the developed country experience. Yet, these transfers are increasingly discussed and debated in the developing world, and more recently in South Asia where the economic, social and institutional settings are rather different.

1.1. Demand for water transfer in Kathmandu city

The population of Kathmandu city is more than 1.2 million residing in an area of 50 km$^2$. The piped drinking water supply system covers less than 70% of the city residents with 3–4 hours of water supply during the monsoon and 1–2 hours on alternate days during the rest of the lean season. Furthermore, according to a Melamchi Water Supply Board study (MWSB, 2000a), the city’s population is expected to be more than 3 million by 2015 and the city water demand by then is projected to increase to more than 500 million litres per day (MLD); whereas, the city water distribution network has got a capacity now to supply only 120–140 MLD, or 100–115 litres$^1$ per capita per day (MWSB, 2000a, b). The remaining

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$^1$ This is estimated based on the Kathmandu city population of 1.2 million in 2000 which is growing at the rate of over 3% per year.
30% of the city population (0.36 million) outside of the pipe network are using private tube wells, ancient stone water spouts\(^2\) and supplies from tankers. Water scarcity has adversely affected the urban poor most because they cannot afford the private investment in terms of deep tube wells, water pumps and a large-scale household storage tank to siphon water from the piped network of the city water supply system.

Because it transfers water from a relatively water-abundant area of Melamchi sub-basin to the water-scarce area of Kathmandu city, the Melamchi project is expected to generate large-scale economic benefits, mostly to the urban sector. However, a key question is whether the additional benefits generated by the project, mostly captured by the urban sector in terms of increased water supply and sanitary facilities and increased urban property value, will be shared with the water-supplying basin, already a poverty-stricken region. Hence, the nature and process of benefit sharing are important issues for effective management of the water transfer decision and equitable utilization of the national resources across the regions and across the basins. The equitable benefit sharing across the sectors (basins) and compensation for those adversely affected are pertinent issues, not only to the Melamchi project, but also to all intersectoral (interbasin) water transfer decisions. In fact, a decision on intersectoral and interbasin reallocation of water should take into account all these benefits in the recipient region (basin) and cost imposed on the water-supplying region (basin), and a mechanism should be in place to compensate those who are adversely affected by the water transfer project.

This intersectoral water reallocation scheme should increase allocated efficiency of resources use by transferring water from lower-value use in the rural sector to higher-value use\(^3\) in the water-scarce urban area. This process also imposes direct economic losses, opportunity costs and third party effects (negative externalities) in the water-supplying region (basin). Therefore, this gain from intersectoral water reallocation can only be meaningful and socially acceptable when there is a provision in place to ensure that the net welfare and livelihoods of the communities of the water-supplying basin would also be increased after the water diversion. However, there is no clear blueprint of how to share the increased project benefits of intersectoral (interbasin) water transfer fairly across the sectors (basins), and what process will yield an optimum solution that is efficient, equitable and also socially acceptable to all. Rather, institutions related to intersectoral reallocation of water are now evolving in Asia\(^4\) and are under much pressure to readjust owing to the rapid pace of urbanization and increasing urban water scarcity.

1.2. Objectives

The major objective of this paper is to evaluate some of the recent concerns raised about the Melamchi water transfer project in Nepal, as also noted earlier. The specific objectives of this study are:

\(^2\) Stone spout schemes (stone tap water) are centuries-old urban water supply schemes found in the Kathmandu valley. Some of them are more than 300 years old and are still functioning well. They are based on traditional water-harvesting techniques facilitated by mountain topography, and are unique to the Kathmandu valley (Dixit, 1997).

\(^3\) This is based on the economic value of the water resources in use; but the case would be different when we use the social value of water resources because of the multiple uses of resources in a region.

\(^4\) Some of the on-going other intersectoral water transfer cases and community innovations in managing water resources locally in South Asia can be found in Moench et al. (1999).
to evaluate the hydrological, economic, social and institutional consequences of the Melamchi water diversion project in the basin of water origin;

- to analyse how the rural livelihoods in the Melamchi basin (basin of water origin) are going to be affected by the water diversion project;
- to assess the scale of total economic benefits and economic values generated by the water transfer project and to compare the project generated benefits with the project-imposed direct costs in the Melamchi basin; and
- to analyse the scale and nature of the project compensation schemes to mitigate the adverse impact in the basin of water origin.

2. Project description and characteristics of the water-supplying basin

2.1. Melamchi water transfer project

As mentioned earlier, the MWSP is a comprehensive interbasin and intersectoral water transfer project designed to meet the long term (over 30 years) water demand of Kathmandu by diverting water from the Melamchi River located upstream of the city. This will be done by constructing a 26-km long tunnel along the high Himalayan range, with a total capacity to transfer water up to 6 m³/s to meet the long-term water demands of the city. In addition to the infrastructure development for water transfer and expansion of city water supply systems, this project also aims to develop a comprehensive institutional framework for water supply in the Kathmandu valley. The changes that will be brought about by the Melamchi project in terms of institutions and water governance in Kathmandu city also have significant implications for the water supply systems in other urban areas in Nepal.

The Melamchi comprehensive project comprises of three main components, as listed below:

- **Physical infrastructure development.** This program includes development of infrastructure components such as physical intake and river diversion structures, a 26-km tunnel, 25 km of access roads, 15 km of main access road, 22 km of approach roads, a water treatment plant with a capacity of 170,000 m³/day in Kathmandu, bulk distribution systems (a number of bulk transmission pipe lines and reservoirs around the Kathmandu valley), improvement of the city water distribution network, improvement of the wastewater system and construction of wastewater treatment plants.

- **Social and environmental support.** This includes three major sub-components: social upliftment programs (SUPs) in the Melamchi valley communities; a resettlement action plan (RAP) and an environmental management plan. The project compensation programs also come under this scheme.

- **Institutional reforms.** This includes major changes in the present institutional and management framework of the water distribution system in Kathmandu city and ultimately in the other urban centers in Nepal. Some of the major changes are: the establishment of a National Water Supply Regulatory Board (NWSRB) to carry out regular functions and fix a water rate; establishment of a

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5 This short description of the Melamchi project is prepared based on the recent update and publications of the project. The authors greatly appreciate Suman Sharma, senior project engineer of the Melamchi project, for his assistance and cooperation in giving access to project-related updated information.
water authority (WA) to be the owner of assets and responsible for developing and overseeing policies for the water supply and wastewater services in the Kathmandu valley; establishment of an autonomous and commercially operated Water Utility Operator (WUO) to operate and manage the city water distribution system; enactment of groundwater licensing in the Kathmandu valley; introduction of a private sector participation (PSP) modality for the urban water supply and wastewater service management.

For effective implementation of all of these project components and better coordination between these separate agencies, the Melamchi Water Supply Development Board (MWSDB) has been established, which will oversee and coordinate the functioning of all of these separate project entities.

2.2. Characteristics of water supplying basin and water availability

The water-diversion intake of the Melamchi project is located about 42 km to the northeast of Kathmandu city, in the interior mountain range. The Melamchi River is a part of the larger Indrawati River basin, which originates from the high snowy range of the Himalayas. Of the 124,000 hectares of the catchment area of the Indrawati River basin, crop cultivation covers less than 2%, the rest is natural forest cover and rugged mountains.

The annual average rainfall in the Melamchi basin is about 2,800 mm, which is concentrated mostly during four months of the monsoon of mid-June to mid-September. The high seasonal fluctuation of the river flows and the low level of water infrastructure in the basin have created localized water stress and water scarcity, particularly from February to May, when the river flows reduce substantially.

At present, the major water uses in the donor basin include: irrigation, traditional water mills (Ghattas) and mill water turbines for electricity generation. Typical water use patterns in the Melamchi River basin are illustrated in Figure 1. There are considerable numbers of small-scale diversions for irrigation and small tributaries in the area.

The results of water accounting exercises are shown in the water accounting finger diagram in Figure 2, which shows that less than 22% of the available water evaporates from the sub-basin, and only 4% of available water goes to crop evapotranspiration and the rest (78%) flows out of the basin as river outflows (Mishra, 2000). Considering the present level of water uses, the Indrawati is a huge water surplus basin. The high seasonal fluctuation of the monsoon-dependent river flow is a major consideration for development and management of water resources in the region.

As shown in Figure 2, even in one of the driest years (1979) over the last 20 years, an average of 2,300 million cubic metres (mcm) of water flowed out of the Indrawati basin. Based on the annual availability of water, the proposed level of water diversion (62 million m$^3$/year) by the Melamchi project would probably not even be noticeable in the downstream of the Indrawati basin. The Indrawati River joins the Sunkoshi River downstream and eventually supplies water to the larger Ganga basin in the south.

The availability of suitable flat land for farming limits agricultural water uses in the Indrawati basin rather than the availability of irrigation water. This fact has great implications for assessing the opportunity costs of the transferred water in the water-supplying basin, equitable sharing of water resources (benefits) across the basins and balanced regional development because the level of present and potential water uses determines the nature and scale of project compensation and the nature and
Fig. 1. Schematic diagram of water uses followed in Melamchi river, Nepal. Note: The names are in local language. Khola = river tributary.

Fig. 2. Finger diagram showing summary of water account results in the Indrawati river basin for the dry year of 1979 (units are MCM). There is very little depletion of water by crop evapotranspiration (process depletion) relative to outflow and for uses such as forest and grassland evapotranspiration (non-process depletion).
structure of water rights\textsuperscript{6} attached to each of these water uses. Village water supply typically comes from catchments upstream of the village rather than the Melamchi or Indrawati rivers, so the water transfer project will have a minimal adverse impact on the drinking water requirements of the Melamchi basin community.

3. The project impacts

3.1. Hydrological consequence of water diversion

Our analysis shows that the reduced water flows would be mostly confined within a 1–2 km stretch of the river immediately downstream of the project intake site. Other smaller tributaries join the Melamchi River 1.5 km downstream of the project intake site (Figure 1) providing more water and limiting the adverse effects of the diversion immediately downstream of the water diversion point. The water accounting study shows that the proposed water diversion is less than 10\% of the annual average of the existing total outflows of the Melamchi sub-basin (Mishra, 2000).

A comparison of average monthly flows of the Melamchi River around the project intake site, collected from different previous studies, is presented in Figure 3. The average river flow is more than 25 m\textsuperscript{3}/s during the three months of the monsoon from July to September (Figure 3), whereas, it reduces to about 3 m\textsuperscript{3}/s during March and April, when the impact of water scarcity is mostly felt in the basin. The proposed water diversion during the first phase (1.97 m\textsuperscript{3}/s) is slightly less than the average dry-season river flows (January–April) measured at the proposed intake site, as shown in the Figure 3.

The community located immediately below the project diversion point will be the most adversely affected by the project water diversion, particularly from January to May. Therefore, equity over resources use of this water diversion decision almost entirely depends upon how effectively the project can minimize damage and compensate the adversely affected communities and households located downstream of the project diversion point. According to the Melamchi project plan, the project is designed to release 0.4 m\textsuperscript{3}/s of water as a “minimum river flow”, even during the dry season, to maintain the environmental and aquatic ecosystem\textsuperscript{7} in the river (MWSB, 2000a; IUCN, 1999). Because of the conditions attached to external funding, the project has also met the requirements for the environmental and social impact of an infrastructure project-financing guideline from several donors including the Asian Development Bank (ADB), the World Bank and other bilateral donors involved in financing the project (see details in MWSB, 2000a).

\textsuperscript{6}The nature and structure of water rights issues are very important for managing the intersectoral water reallocation decision. Further discussion of water rights in intersectoral reallocation of water can be found in Meinzen-Dick & Pradhan (2002).

\textsuperscript{7}We have only analysed here the socio-economic and hydrological consequences of the water transfer. Several environmental impact assessment (EIA) studies of the project were carried in the past by each donor agency involved in the project financing (for details, see IUCN, 1999). The water diversion dam is 6 m high and the water diversion project is basically designed as a river run-off type of project.
3.2. Institutional changes in the water supply schemes

The supply of adequate drinking water to Kathmandu city, diverting it from the Melamchi River, has been one of the major public policy issues and political agendas in Nepal for more than 15 years. However, the project financing was a major hurdle for the Government of Nepal to initiate the project. This project needs almost half of the annual budget of the country and is almost equivalent to the country’s annual developmental budget. After several years of consideration of the project ideas and exploring the possibilities of funding with external donors and lending agencies, the project financing has now been secured with the involvement of several external donors, led by the ADB in Manila. There are several prerequisites and requirements for institutional and policy reforms in water sector required by the funding agencies. Some of these institutional reforms, though initiated by the project, could also change the water governance and institutional/managerial framework of the urban water supply system in Nepal as a whole and not only in the Kathmandu water supply.

For example, there is a prerequisite attached to the project funding by multilateral agencies to change the country’s water acts and to allow the involvement of the private sector in the management of the Kathmandu city water supply and distribution system. Other major institutional reforms required for the external donor financing include: 50% cost recovery of the project cost (component of external debt) from Kathmandu valley water users; appropriate compensation given to those adversely affected households and communities by the water diversion project; involvement of local stakeholders in project implementation; and formation of an independent water service fees assessment regulatory board to regulate the city water distribution systems and the water and wastewater services fees.

The government has recently enacted legislation towards privatization of the Kathmandu water distribution system. Nevertheless, the privatization process is not moving ahead as planned.
The plan of privatization\(^8\) of the Kathmandu city water supply system has been hotly debated by some civil societies, many water stakeholder, and within the political process. There is a lukewarm response even from the private sector to participation in this process owing to the unstable political governance, policies and programs of the government over the past few years, and also due to the recent deterioration of the law and order situation.

Because of all these difficulties, instead of complete privatization as planned during the project final document in 2000, the city water supply management system has recently been modified to a management contract (MC) system of arrangement to manage day-to-day operations of the city water supply. Here, the MCs pay is linked to its set of performances (based on improvement to the water supply and management system, measured by the agreed key performance indicators).\(^9\) In fact, the Kathmandu city water supply system, under the comprehensive Melamchi project system, is planned to operate as a public–private-participation type of a project with a provision to establish MC-based private sector participation, an independent regulatory body for setting water-services fees and another independent body of the water authority as owner of all the water infrastructures and project assets. This is to ensure better incentives for privatization\(^10\) of service-delivery systems by minimizing the governmental interference in setting the water fees and managing the systems. The lessons learnt and the process followed in this project are most likely to be followed in the other urban water distribution systems, and the future water sector project financing in Nepal.

The Melamchi comprehensive water supply project is planned to recover 50% of the project investment costs and full recovery of the payment of the external debt service, through the increased water service revenues collected from the city residents (MWSB, 2000a). The independent water fees assessment regulatory body, the water authority, a custodian of the water supply system and the Melamchi Water Supply Development Board are supposed to ensure the cost recovery objective of the project by gradually raising the water service fee from US$0.11/m\(^3\) in 2000 to US$0.40/m\(^3\) by 2009,\(^11\) when the Melamchi water arrives in the city distribution network. To avoid any political backlash during the process of increasing the water fees, there is a plan first to improve the city water distribution service and management by handing over the present government entity to a private operator (water utility operator) under a management contract arrangement and then to raise the water service fee gradually over the coming years. There is considerable scepticism among the water professionals in Nepal

\(^8\) A call for privatization of the Kathmandu valley water supply scheme was announced in 2001/2 but the response was not enthusiastic even within the private sector. Therefore, instead of complete privatization, a performance-based management contract (MC) system of arrangement was finalized to manage the water utility operator (WUO) in the Kathmandu valley. The prequalification bidding process has already been started early in 2004, and as per the plan, this MC would be in functional mode within 2005. Following the external funding requirement, the tunnel constructions can only be started after the transfer of the management of the Kathmandu valley water supply system to the private sector (now MC) management.

\(^9\) Detailed information on the recent changes on project plan can be found on the project updates and project information at web page http://www.Melamchiwater.org.

\(^10\) Equity in resources use and ability of poor households to pay the water fees of the city drinking water system under privatization are important issues here, which also depend upon how the water-service will be improved and at what scale the water rates will be set up in the future. The limited scope of this paper precludes us from analysing all these equity-related issues. But, they are important from the point of view of privatizing a crucial sector like the drinking water sector for more than one million of the population.

\(^11\) This is estimated based upon the project plan of raising the water service fees to Rs 30/m\(^3\) in 2009 (in the constant price equivalent of 2003. The average exchange rate in 2003) was US$1 = Rs 75.
regarding the willingness and capability of the Kathmandu residents to pay this three-fold increase on water fees and the government’s willingness, level of commitment and efficiency in enforcing such new rules and regulations.

Moreover, from a detailed survey on the willingness to pay at the household level among the Kathmandu city residents, Tiwari (2000) reported that the urban households in certain locations (about 20–40% of the sample surveyed households) of the city are willing to pay up to US$0.25/m³ for the piped-supply water, if it comes with reliable and improved services and regular water supply. Likewise, the study by Whittington et al. (2002), sponsored by the World Bank, reported that approximately 70% of the Kathmandu city population are willing to pay even a five-fold increase in the current average water bills (i.e. US$8.50 per household per month), if improved water services are provided. At present, because of irregular water services, the costs to the households (e.g. electric pump costs, monthly electric charges, large storage tank, etc.) in Kathmandu for securing water from the public supply system are very high. However, during this process of increasing the service fees, adequate provision is needed to ensure the basic human rights for drinking water and the social obligation to provide the minimum, basic needs of water for all, including the city’s urban poor and lower income households at a reasonable cost.

4. Project financing and economics of the water transfer

Of the total project costs of US$464 million, about US$290 million (62.5%) is covered by loans from the ADB, the World Bank and other bilateral donors. Bilateral donors like the Japanese International Cooperation Agency (JICA), Swedish International Development Co-operation Agency (SIDA) and Norwegian Agency for Development Co-operation (NORAD) have jointly agreed to finance about 12.5% of the total project costs (for different components) and the Government of Nepal finances the remaining 25% of the project costs (see MWSB, 2000a and Bhattarai et al., 2002). More than 75% of the Melamchi project costs are planned to be spent in improving bulk water distribution in the city, its expansion and the rehabilitation of the city’s already busted pipe network. In fact, less than 25% of the total project costs will actually be spent for the construction of the project intake and tunnel (MWSB 2000a) for carrying the water. But, these tunnel and intake constructions are the major public issues and concerns so far discussed in relation to the Melamchi project in Nepal, by local stakeholders as well as the international agencies/donors involved.

4.1. Project benefits

According to the project feasibility study, the projected financial internal rate of return (FIRR) of the project is 4.7% and the economic internal rate of return (EIRR) of the project is 13.5% during the first phase of the project. The EIRR will be increased to 15.5% in the second phase when additional water will be diverted to the same project tunnel from two nearby tributaries, the Yangri and Larke (MWSB, 2000a), as the city water demand increases.

Our rapid assessment on the scale of the project benefits shows that there will be a considerable level of economic benefit generated by the project but accrued to the national accounts and mostly realized by the urban residents. For example, the economic value of water, considering only the additional city water
revenue collected by the utility company, will be around US$22.3 million per annum by transferring an additional 62 million m³ of water at 1.97 m³/s into the city supply network during the first phase of the project. This is based on the projected planned increase in water service fees in the city to US$.40/m³ or Nepali Rs 30/m³ (at the constant price of 2,000) by 2008/9 and under an assumption of 10% of distribution losses of the water in the city’s supply network. When the project starts to operate at full capacity, (i.e. 0.5 million m³ per day or 5.9 m³/s) by 2015, the gross revenue collected from the project-diverted water will be approximately US$67 million/year. This is the direct economic benefit of the project to the water utility company without considering other forms of socio-economic benefits of saving on the opportunity costs of the city residents. The total economic benefits generated by the project, including the secondary benefits (public health benefits) of improved water and sanitary supply in the city, however, would be much higher than the financial rate of returns and direct economic returns, as noted earlier. Of course, this also needs a huge investment in infrastructure construction and adequate operation and maintenance costs, and the scale of project benefits also greatly depends on the efficient management of the city water distribution system.

At present, the poor households in Kathmandu city are forced to bear more costs of the drinking water scarcity in the city than the better-off households. One recent survey of the city water supply has revealed that poor and marginal households are currently paying 2.5 times more for an incremental additional cubic metre of water from the piped drinking water distribution system than the relatively well-off city residents are paying (the Rising Nepal — a daily newspaper, July 26, 2000). For example, those with private drinking water connections have to pay only Nepali Rs 4 per additional cubic metre above the minimum limit of 10 m³/month. Whereas, those with shared connections—mostly with the marginal income and lower income households—have to pay Nepali Rs 10/m³ of water for the additional quantity of water (MWSB, 2000a). Therefore, the existing water-fee system relatively penalizes the poor and marginal households in the city more, who mostly depend on the shared connection of tap water. In addition, unlike the better-off households, these poor households also bear most of the opportunity costs of irregular and reduced water supply, as they cannot afford an individual storage tank and electric pump to steal (siphon) water from the public distribution system.

Recently, the sale of water from public and private tankers has been put in place in Kathmandu city, largely because of the acute scarcity of drinking water. These tankers bring water from the surrounding rural areas, mostly from the community resources, or sometimes even purchase water from farmers (from their private tube-wells) from certain locations where the water quality is perceived to be satisfactory. The price of water from the public sector tanker during the dry season (December to June) of 2001 was NRs150–180/m³ of water (i.e. US$2–2.4/m³ of water) depending on the size of the tanker used. The water rate charged from the private sector tanker was, however, about 25% higher than the

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12 We have estimated this level of project benefit as per the projected water diversion planned and the water service fees that will be set by the city water distribution authority as per agreement with the external project financing agencies. This is also based on the assumption that the water services rate in Nepali currency (Rs) is maintained at a constant US$ value over time. This survey of the city water service fees was done by Lumanthas Support Groups for Shelter, Nepal Water for Health and Water Aid, located in Kathmandu. A brief news item on the findings of this survey was published in the Rising Nepal — a national daily newspaper in Nepal, July 26, 2000).

13 In another city in South Asia, Chennai (India), where the private sector tanker supply of water and private water maker are operating at vibrant, the private sector tanker water is being sold at US$1.25–1.5 per 1,000 litres of water (as per the authors’ estimates during the dry season of 2003).
water rate charged by the public sector operated water tankers (based upon the author’s communication with the tanker owners supplying water in the city).

Considering the present level of water scarcity, the total economic benefits (at the opportunity cost level) of the Melamchi water transfer project will be about US$37 million per annum during the first phase of the project. This is based on the assumption that the opportunity cost of the water is US$1/m³ (half the tanker supply rate) and valuing the water transferred into the city for 8 months of the non-monsoon season from November to June, with the assumption of 10% loss of water in the distribution system. This alone is about 8% of the total project cost and about 30% of the total project investment cost incurred for the project intake and tunnel construction for transferring water from Melamchi valley into the city distribution system. Setting a zero value of water for the other four months of the monsoon is a reasonable assumption because of an adequate supply of water during this period. The project benefits (economic) will however be increased to about US$111 million\(^{15}\) per year after 2015 when the project (tunnel) is operating at its full capacity (i.e. water transferring at 5.9 m\(^3\)/s or 510,600 m\(^3\)/day). This level of project benefit (direct tangible economic benefit) is estimated at the present level of opportunity costs of providing water services in the city.

4.2. Project adverse impact

Information on financial costs and opportunity costs of the project, including present and future losses of water-use options in the Melamchi basin, are important while evaluating the net project impact upon the society. Some of the economic and social costs that will be temporarily imposed by the project in the Melamchi sub-basin during the construction period include: the influx of a large number of people, disturbances to the local livelihoods, health hazards caused by the construction work, temporary forced displacement of community/households, temporary acquisition of more than 60 ha of agricultural land (IUCN, 1999), and so on. The large volume of soils and gravels disposed of during the project construction (tunnel) also degrades the local watershed.

The major permanent setback will be the socio-economic costs (direct and tangible costs) that would be imposed by the project in the basin of water origin. They are the loss of productive farmland owing to permanent acquisition of about 80 ha of farmland and displacement of about 75 households from their community (Pant & Bhattarai, 2001). In addition, owing to the reduced flow in the Melamchi River after the project water diversion, about 110 ha of spring paddy production and nearly 15 traditional water mills (Ghatta) along the Melamchi Khola downstream of the project diversion site are likely to be adversely affected during February to May. According to the present project compensation plan, some of these direct and visible costs and loss of livelihoods (land acquisition, assets damage like house, tree, etc.) caused by the water transferred project would be compensated as has been done in the other infrastructure projects in the past. But, there are no clear and transparent provisions in the present project plan to compensate for the third party effects (externalities) of the water diversion in the basin of water origin such as the loss of income of

\(^{15}\)This is estimated by multiplying 111 million m\(^3\) per year (assuming an 8 month dry season and a distribution loss of 10%) of water diversion by US$1/m³. This level of project benefits is consistent with level of water scarcity in the city now and the private household costs for procuring the drinking water supply (see Tiwari, 2000; Whittington et al., 2002).
fishermen, traditional water mill owners and other minority water users. This could be because of the prevailing strong land-based property right institutions and the relative absence of water rights in the region.

The opportunity cost attached to the loss of gross returns of paddy from one Ropani (0.05 ha) of land is about Nepali Rs 1,320 (at 2,000 prices), which is equivalent to US$350/ha/per crop season.\(^{16}\) Because of the water stress, the total loss of spring paddy for 110 ha downstream of the project intake would be about US$39,000 per year.\(^{17}\) This loss is a third party effect of the water diversion downstream, if the farmers there would not grow any other spring crops on the 110 ha of croplands because of the acute water scarcity. In addition, other indirect negative impacts of the project in the basin of water origin include the loss of agricultural food production in the community, deteriorated food security and loss of local employment and deteriorated rural livelihoods. The water-supplying basin will be a further loser in this process, if other employment substitutions and rehabilitation programs are not provided for those communities and households adversely affected by the project.

The project also adversely affects the traditional water mill owners (Ghatta owners), who are relatively the poorest members and a minority group with low socio-political status and low bargaining power in the community. As seen in the case of other infrastructure projects in Nepal in the past, in the absence of Ghatta owners’ (and other minority users’) water rights in society, their concerns may not be heard during the process of project compensation and disbursement. Following the prevailing norms in the region, compensation for the land-based and other tangible damage would get first priority. Therefore, the project may lead to the displacement of these owners if the project rehabilitation program does not provide timely consideration of their needs and livelihood requirements. Displaced villages/communities caused by infrastructure development are common in South Asia. This is one of the reasons for mass protest and local opposition to such mega water projects in Asia and in other developing countries in the recent past (for details, see \textit{WCD}, 2000). Therefore, there is a clear need for a transparent project compensation scheme in the case of the Melamchi water transfer project. The compensation is needed not only for the direct losses caused by the project, but also for the secondary and tertiary level third party losses caused during the process.

5. Project compensations

In water-transfer decisions, compensation usually includes existing right holders of land and water resources who are adversely affected during the process of the water transfer. But, unlike in the developed countries where the water markets are relatively well developed, due compensation for the loss of water rights holders during the water transfer process is not established in the case of developing countries. Water rights are crucial issues and they should be intrinsically embedded in designing the scale and process of compensation structures, however, land rights-based compensation is usually adopted because of the difficulty in enforcement and the fugitive nature of the water resource. Project compensation based on land rights does not address the other externality and third party negative effects

\(^{16}\) 1 ha = 20 Ropany.

\(^{17}\) During the spring season, some of these crop-fields may be, however, shifted from paddy to less water-requiring crops such as potato, wheat or maize, etc. Then the level of project adverse effects downstream will be certainly less than this.
of the water transfer in the basin of water origin such as employment losses and other water-based business opportunities. For example, the water diversion prohibits construction of new water mills, irrigation and hydropower generation in the downstream of Melamchi sub-basin.

The Melamchi project compensation scheme has a plan to spend about US$18.5 million for general welfare improvement activities in the Melamchi basin, as compensation to mitigate some of the adverse effects of the water-transfer project. The two major components of the project compensation package are: (a) RAPs with a budget of US$15 million and (b) SUPs with a budget of US$3.5 million (MWSB, 2000a, b). The RAP is designed for land acquisition, resettlement of the households displaced by the project and for provision of local infrastructure. This includes a village connection road (8–10 km), a secondary school and a hospital in the Melamchi valley. Under the SUPs, there is a plan to spend US$3.3 million in the Melamchi sub-basin for poverty reduction and social and rural development sectoral programs. The SUP program will also receive part of funding from the additional water service levy (from gross revenue) collected by the Kathmandu city water supply operator in the post-construction stage, which is set at Nepali Rs 0.25/m³ of water. This comes to about Nepali Rs 15 million per year (or US$200,000 per year at the 2,000 exchange rate). This is equivalent to about 1% of the total incremental water revenue generated by the project from the amount of water transferred from the Melamchi sub-basin to the city distribution network.

This type of compensation based on volume of water transferred is more meaningful and has an inbuilt incentive mechanism for strengthening cooperation across the basin communities. But, what percentage of the water revenue (water levy) should be shared between the two water sharing basin communities is a question that needs to be decided with equity on resources use and benefit sharing across the regions (basins). The proposed rate of benefit sharing of less than 1% of water levy collected in Kathmandu certainly seems a bit low considering the scale of benefits accrued to the city residents and the permanent loss of water and other water-use related opportunities in the Melamchi valley. In contrast to the case in the past, the recognition of benefits sharing based on the volume of water transferred (additional water levy charged in the city) has provided an opportunity for the percentage of water levy shared to be changed (increased) in the future as the bargaining power of the Melamchi valley community increases vis-à-vis the power of the central authority in the Kathmandu valley. In fact, a large amount of benefit sharing (water levy) with the rural community would also encourage intersectoral water reallocation schemes in other regions, with minimum opposition from the local communities and an efficient utilization of the water in alleviating urban water scarcity.

Recently, the Melamchi Project Compensation Fixation Committee (CFC) has set up criteria to pay for permanent land acquisition based on some factor multiplications of the land price recorded at the District Land Revenue Office. Moreover, there are some concerns among the local communities about the process of determining land prices for acquisition and the bureaucratic process adopted for setting

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18 This comes to about 4% of the total project costs (MWSP). Considering the current development stage and socio-economic activities in the Melamchi basin area, this level of compensation package represents a considerable sum.
19 During the project consultation meetings, the Melamchi basin communities had demanded about 5% of revenue sharing with the city water supply system from the incremental benefits generated from the transferred water (Devkota & Bhattarai, 2001; Bhattarai et al., 2002).
the compensation level without any involvement and consultation of local stakeholders during the process.

In spite of the apparently generous compensation program, there was initial discontent amongst many of the basin residents. This was due partly to inadequate information flow from the project propagator—the project authority, the concerned ministry and the government line agencies—to the other stakeholders. For a long time, the stakeholders in the water supplying basin were ill informed about the project, its likely hydrologic and socio-economic impact in the water-supplying basin and the compensation package. There was little negotiation on issues of compensation. The compensation package was developed by central agencies and external donors in Kathmandu and offered to stakeholders without their participation in the process. This is in contrast to situations where there are well-recognized water rights and rights holders are involved in negotiations and in deriving what they consider a fair settlement.

In the absence of clear water rights for smallholder water uses, it is less likely that the smallholder water users (e.g. Ghatta owners, fishermen, landless tenant farmers) will be fairly and duly compensated for the loss of their rural livelihoods caused by the water diversion. Despite a huge scale of aggregate level additional benefits created by the project, accrued to the national account and mostly captured by the city residents in terms of increased land and property value, the rural livelihood and occupation of a few households (about 100 households), already a poor and marginal community, are at stake. These 100 households and about 15 Ghatta owners in the Melamchi basin may end up being large scale losers in the water transfer project, if adequate project rehabilitation programs are not implemented in time to mitigate some of the adverse impacts of the project.

In fact, the huge scale of additional benefits generated by the project, in terms of increased water revenue and related other benefits to the city, sufficiently justifies compensation for both the direct and third party losses in the water-supplying basin. Some of these concerns about the adverse effects of an intersectoral or interbasin water transfer project are also in principle similar to the concerns and project assessment criteria recommended by the World Commission on Dams Report (WCD, 2000) for due compensation of the welfare losses caused by a large dam project.

6. Conclusions and implications

In the context of increasing urban water scarcity and the increased pressure for intersectoral reallocation of water, the Melamchi water transfer project presents a classic case of reallocation of water across sectors, transferring water from a water-abundant rural setting to a water-scarce urban area.

20 The past record of the Government of Nepal in providing compensation for the communities affected by the infrastructure project are worse than the proposed compensation schemes in the case of Melamchi project. More detailed discussion of the past records of infrastructure project-related compensation followed in Nepal can be found in Dixit (1994) and Gywali (2001).

21 About 25 households would be permanently displaced from their present location owing to construction work and another about 60–75 households in the Melamchi basin would be most adversely affected during the dry seasons owing to reduced river flow after the water is diverted from the basin by the project.

22 Some of the criteria identified and recommended by WCD report are, equity, efficiency, participatory decision-making, sustainability and accountability. These evaluation criteria and the issues involved are also equally useful for the evaluation of a large-scale intersectoral (interbasin) water transfer project.
Despite generating a sizeable scale of benefits, the rural to urban water transfer project is not free from controversy because of the level of economic, social and environmental disruption caused by the project. It also produces differential impacts across the sectors (basins). In this context, the effectiveness of Melamchi water transfer decision is assessed here by considering the additional benefits generated by the project and its distribution across the regions, the process adopted and the nature of benefits sharing, and level of compensations provided for the adversely affected households in the basin of water origin.

Kathmandu city residents would capture most of the project benefits from the Melamchi comprehensive water transfer project, in terms of better availability of drinking water and sanitation services and increased property value, while the opportunity costs of the water transfer decision have to be borne by the upper catchment basin community. Therefore, compensation and benefit-sharing issues are important in assessing the effectiveness of the project in its totality.

Inadequate involvement of local stakeholders (both formal and informal institutions) during the project planning and fixing of the benefit-sharing are some of the negative aspects of the Melamchi project, which could have been easily avoided by the project proponents. Despite the large scale of the project compensation package (4% of the total project costs), the existing compensation package is not specific and not targeted to the needs of households directly affected (adversely) by the project, such as Ghatta owners, fishermen, tenant farmers and irrigation systems immediately downstream of the river diversion. Rather, the project compensation gives more emphasis to the construction of local public infrastructures such as schools, hospitals, roads, etc., serving the rural society, but probably keeping out the most affected people. This compensation procedure contrasts with other cases where there has been much more negotiation, especially with present or future water users or right holders.

Despite the appearance of a beneficial project at the project formulation stage, the real success of the Melamchi project can only be judged when it is implemented in practice, and the success achieved in institutional reform and improvement in the water service delivery in Kathmandu city. Therefore, other equally critical issues here are project authority responsiveness to the concerns of local urban and rural communities, the functioning of the project implementation authority and overall the effectiveness of the water-sector governance in Nepal. Because of the scale of the funding requirements and the institutional changes adopted, this project would also bring several other institutional and managerial reforms in urban water supply systems in Nepal.

Water institutions for intersectoral water transfer in South Asia are evolving very rapidly owing to increasing urban water demand caused by the rapid pace of urbanization. This sudden increase in relative economic value of water in the urban area compared to the rural sector is one of the major stimulating forces for this recent surge in reallocation of water resources from rural to urban sector uses, including the recently emerged policy debates on large-scale interbasin water transfer schemes in the region. Therefore, some of the issues discussed and the case study findings illustrated here are not only confined to Melamchi project case but they are also equally applicable to other ongoing intersectoral (interbasin) water transfer discussions and policy debates in South Asia.

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