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NEWS UPDATE

Barrage and Power House of BBDMP started

Minister of Energy, Water Resources and Irrigation honorable Barsha Man Pun has laid foundation stone of the barrage and power house of Bheri Babai Diversion Multipurpose Project (BBDMP) at Chiple of Ward no 11, Bheri Ganga Municipality, Surkhet on 2nd December, 2019 (2076/8/16). On the occasion, honorable minister Pun expressed for its timely completion. He also acclaimed the completion of 12.2 Km long tunnel before its target deadline, and thanked to the team of BBDMP for such a memorable achievement. Minister Pun expressed his believe that the project will contribute the government national goal of "Prosperous Nepal: Happy Nepal" in future. Honorable Minister Pun also mentioned that the Government initiates to form a company, involving Central, Provincial and Local government and ensure the investment of project affected people with the concept of "People's Hydroelectricity" for its sustainable operation after its completion.

In the occassion, Chief Minister of Karnali Province honorable Mahendra Bahadur Shahi, and Mr. Rabindra Nath Shrestha, Secretary, MoEWRI were attended as special guests. Director General (DG) of Department of Water Resources and Irrigation (DWRI) Mr. Madhukar Prasad Rajbhandary and other high ranking officials were also present in the function.

The construction of civil parts of Headworks and Powerhouse is being conducted by Guangdon Yuantian & Raman J/V as a contractor. The contract was signed on 29th July, 2019 with the period of 48 months. The contract amount is NRs. 6.16 Billion. It is expected that a total of NRs. 7.1 Billion per annum returns will be achieved from the completion of the project with increase in agriculture production and electricity generation.

Monitoring of Sikta Irrigation Project

The secretary of Ministrsy of Energy Water Resources and Irrigation, Mr. Rabindra Nath Shrestha visited Sikta Irrigation Project (SIP) on 4th December, 2019 to monitor the on going activities. High level officials including Director General Mr. Madhukar Prasad Rajbhandary and DDG Mr. Shiva Kumar Basnet and DDG Mr. Pradip Thapa also accompanied the secretary. The team has visited most of the western main canal. Recently the main canal has been suffered by a problem of dispersive soil, particularly in the mid reach of western main canal from ch 17+000 to 25+000 Km. . The team has also interacted with the chairman Mr. Shalikram Dangi and other members of Water Users Association of SIP.

New Executive Committee formed in INPIM/Nepal

International Network on Participatory Irrigation Management Nepal (INPIM Nepal) organized its Annual General Assembly on the 14th of February 2020 (1st of Falgun 2076) at the premises of the Department of Water Resources and Irrigation, Jawalakhel. INPIM Nepal has been organizing this kind of general assembly on an annual basis as per is statute.

INPIM Nepal Secretariat timely circulated information to this effect to all its members and the event was also participated by most of its member. The General Assembly this time also included an election because the Executive Committee had completed its tenure.

During the program, Mr. Ram Prasad Khanal, treasurer, INPIM Nepal, welcomed all the participants and requested the President of INPIM Nepal, Mr. Suman Sijapati to brief the assembly on the activities of INPIM Nepal during the past one year period. Mr. Sijapati presented a brief overview of INPIM Nepal. The presentation comprised of three parts. First, the activities and achievements during this tenure; second, the vision he has for INPIM/Nepal and third, the way forward.

After that, the treasurer, Mr. Khanal, presented that financial report of income and expenditures during the last fiscal year. He read out in detail the report prepared by the appointed auditor.

The third and last activity of the GA was to elect the new Executive Committee (EC). In this concern, it was decided by all the members present that election should be on voluntary basis. Hence, the EC was elected through a consensus. The newly elected EC comprises of the following:

Highlights of the Issue

Editorial

Covid-19 Pandemic and new prospects

Currently, Most of the people around the globe including in Nepal are undergone lockdown to be safe from Covid -19 pandemic as there is still no other way to cope with and prevent its epidemic effect. Due to the nature of rapidly spreading Covid-19, only effective way to cope the pandemic is to remain people isolated in their home. As the effect of corona virus remain last longer, the period of lockdown imposed are getting longer and its drastic and negative effects upon daily life is becoming painful and most of the marginal poor who are depending on their daily life upon labor are directly affected much by the lockdown, due to less effective measures of reliefs towards such people. On the one hand peasants are directly affected with their harvested products could not get usual price and also could not harvest timely. On the other hand peasants are affected much by the lack of seeds and fertilizers for seasonal new crop to cultivate are fading away. Some cases are so severe that products are getting perished with standing crops in the field and there are no market facility for fresh meat, milk and eggs. Farmers are in huge loss due to such acute effect of health disaster in broad aspects. Losses are everywhere as the people can perceive as almost economic activities in factories and mean of transports suddenly become closed and it adversely affected industries and other professions of the people like pub, market, cinema, restaurants, schools, stock markets and gradually its negative effects are appearing to the national economy as well. As the period of lockdown is getting longer, such negative effects are getting complex and condensed. It is also expected that there is no immediate lift up of lockdown as increased cases of covid-19 or risk of rapid spread of Covid-19 disaster.

As of the current situation, coping with this problem is challenging as vaccines and other preventive measures for Covid – 19 are still to be discovered. It is now necessary to rethink the way of tackling with this pandemic by the individual, community, local to national government. Social distancing and creating healthy environment and use of self-preventive measures like masks and sanitizers could reduce the chances of spreading the diseases. Such practices should be continued in coming whole year or more. So the safe measures we adopt will change our life style while coping with Covid-19.

Now, we will have to follow modern techniques to irrigate our field and cultivate crops with developed modernized techniques, which may enhance the situation of few numbers of farmers continued to be involved in crop cultivation activities which may dramatically reduce the unnecessary gathering of people and will continue the profession with safety measures. Similarly, a newly developed situation of returning a large number of Nepali from foreign soil with certain new technology may be useful in agriculture practices in Nepal, which obviously creates employment opportunities in Nepal. Newly completed hydel power projects and those being completed in near future may provide certain portion of surplus hydroelectricity to consume the power in modernized irrigation technique to achieve year round irrigation facility in the farmers' field and also in the agro processing industries, which may run regularly with increased volume of crop production as outcome of systematized irrigation facilities. This may expand the agro processing industries with increased employment opportunities through rural electrification facilities and other agro based industrial infrastructures in villages, ultimately enhancing improved economic situation. ●

President:	Mr. Suman Sijapati
Vice-president:	Mr. Bashu Dev Lohanee
Secretary:	Mr. Roshan Pradhan
Joint Secretary:	Mr. Chetman Budthapa
Treasurer:	Mr. Ram Prasad Khanal
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	Dr. Dhurba Raj Pant
	Dr. Bandana Pradhan
	Mr. Piyush Kumar Sharma
	Mr. Kumar Raj Shahi
	Mr. Purshottom Timilsina
	Mr. Santosh Kaini

This Executive Committee will remain effective for the next three years.

Training/Workshops/ Seminar

12th National Irrigation Seminar 2076 Organized

National Irrigation Seminar, 2076 was successfully organized at Dhulikhel Lodge Resort, Kavre on 6th - 7th Falgun, 2076 (February 19th -20th, 2020) under the banner "Water Resources Development and Management in Present and Future Nepal". Honorable Minister of Energy, Water Resources and Irrigation Mr. Barsha Man Pun, as a chief guest inaugurated the seminar by watering a plant and lightening in Panas. On his inaugural speech, honorable minister Mr. Pun put forth his view on people's perception on the low performances at some of national pride projects.. He emphasized timely completion of under construction projects to gain confidence of the people of the corresponding regions. Mr. Rabindra Nath Shrestha, Secretary of the Ministry of Energy, Water Resources and Irrigation during his speech as a special guest wished the seminar may play role as a platform to bring forth an opportunity for new development concepts in water resources and irrigation sector with exchange of knowledge of various expertise. Further development of water resource and irrigation sector should be rendered to serve farmers.

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	Sadiksha Rai

Ms. Niru Dahal, Director General of Department of Agriculture during her speech indicated irrigation facilities play major role to enhance agriculture production assuring food and nutrition security in the nation.. She also emphasized the investment by state in irrigation sector is ultimately to improve economic situation through increment of agriculture production. President of National Federation of Water Users Associations of Nepal (NFWUAN), Mr. Gajadhar Rohita Yadav expressed his wishes for the success of the seminar and all these activities are rendered to the welfare of water users.

At the beginning of session, Deputy Director General of Department of Water Resources and Irrigation (DWRI) Mr. Kaushal Kishor Jha welcomed chief guest and special guests including all experts and the participants. Deputy Director General Mr. Shiva Kumar Basnet of DWRI presented the upcoming vision of the department on water resources and Irrigation sector of Nepal. At the end of inaugural session, the Director General of DWRI Mr. Madhukar Prasad Rajbhandari expressed special thanks to the minister for his august presence in the function to encourage all the participants. He wished success of the seminar with invaluable outcomes of solid ideas and its implementation in the future. Finally he wished that seminar will fulfill the expectations of participants with the papers being presented in the various sessions and will be beneficial to water resources and irrigation sectors and all stakeholders as well.

After the inauguration, the program proceeded with Technical sessions. The program was subdivided into six technical sessions with different sub theme and with three papers in each sessions. A plenary session, The first technical session entitled with Multipurpose Projects: Scopes and Opportunities was chaired by DDG of DWRI Mr. Shiva Kumar Basnet. He was facilitated with SDE Dr. Rajan Bhattarai as rapporteur. The first Paper of the session I was on Institutionalization of Multiple use water System (MUS) in Nepal : Learning from Anukulan Project presented by IWMI Nepal Director Dr. Vishnu Prasad Pandey. Second paper was presented by SDE Er Aashish Bhadra Khanal on Large Dams, an Overview in Water Resource Sector in Nepal.

The second technical session entitled Modernization and Commercialization of Water Resources/Irrigated Agriculture was chaired by Ex DDG of DWRI Mr. Bashu Dev Lohanee and was assited by SDE Er. Ajaya Raj Adhikari as rapporteur. During the session first paper was presented by Dr. Krishna Chandra Prasad on Irrigation Development and Evolution of Technology and Institutions in Nepal. Second paper of the session was presented by SDE Er. Tika Ram Baral on Estimation of Economic Loss due to Irrigation Water System inefficiency in Nepal Gandak West Canal Irrigation System.

The session III entitled " Climate SMART Water Resources/ Irrigation " was chaired by DDG Mr. Krishna Nepal. He was assisted by SDE Er. Mitra Baral as rapporteur. In the session, the first paper was on Climate Change & its Impact on Agriculture and Water Resources: A Case Study of Panchkhal Municipality of Jhiku Khola Watershed by Er. Sanchita Kaduwal. The second paper was by Er. Sadiksha Rai on Estimating of Discharge Using Glacio-Hydrological Degree Day Model in Seti River Kaski Nepal. Similarly third paper was on Climate Change Impact in Snow and Spring Fed River: A Comparision Between Bheri and Babai Rivers by SDE Dr. Yogendra Mishra .

The fourth session entitled "Models and Tools in Water Resources/ Irrigation Development " was chaired by Joint Secretary of MoEWRI Er. Sushil Chandra Tiwari. Mr Tiwari was assisted by SDE Er. Tika Ram Baral as a rapporteur. In the session, first paper was on Ice Thickness Estimation of Glaciers of Tamor Dudhkoshi and Marshyangdi River Basins, Nepal Using Surface Velocity by Mr. Aman Thapa. Second Paper was presented by Anushilan Acharya Flood Hazard Assessment of Nawalparasi District and the last paper was presented by SDHG Dr Ananta Man Singh Pradhan on Geo-Statistical Modeling to Capture Groundwater Potential Zones in the Mountainous Terrain. The last paper of the last session of the Day 1 was presented on Solar Powered Irrigation System by Er. Manoj Panta

The fifth session entitled " Private Sector Intervention in Water Resources/Irrigation " was haired by Irrigation Management Expert Dr. Krishna Chandra Prasad and was assisted by SDE Basudev Timilsina of MoEWRI as a rapporteur. The first paper in this session was presented by Water Resources and Irrigation Management Expert and Chairman of INPIM Nepal Er. Suman Sijapati on The Evolving National Irrigation Policy of Nepal. The second paper on Water Scarcity and its Impact on Rural Livelihoods in Eastern Mid-Hills: A Case Study of Kurule Village, Dhankuta District, Nepal by Ms. Sumana Parui. Similarly, the second and the last session of the day 2 entitled as Governance and GESI in Water Resources/Irrigaiton/ Agriculture was chaired by Joint Secretary Mr. Kalanidhi Paudel of MoEWRI and was assisted by SDHG Ms Pramila Shrestha. The first paper of the session was presented by Sociologist Ms. Manju Sharma on Water Pricing and Sustainable Irrigation Management: Prospects and Problems in the Context of Nepal. The second and the last paper of the session was presented by Mr. Sunil Pariyar on Inclusive Water Policy and Practices contributes for Healthy Watersheds of Nepal's River: An Experience from Tila Watershed of Kalikot/ Jumla Districts. At the end of each sessions there was open floor discussion for each papers presented for queries of participants and answer of the paper presenter. Shouvenirs are also presented to the chairman and the rapporteurs of all the sessions and paper presenter were decorated with letter of appreciation.

After the completion of technical sessions, Plenary session was organized on the topic "Issues, Identification and Way Forward in Irrigation Sector " and was facilitated by Director General of DWRI

Mr. Madhukar Prasad Rajbhandary. Rapporteur for the session was SDE Dr. Rajan Bhattarai. Senior Water Resources Expert Mr. Bhubanesh Kumar Pradhan; Water Resources and Irrigation Management Experts Dr. Krishna Chandra Prasad, Mr. Suman Sijapati; Professor Dr. Khem Raj Sharma; Water User and Innovative Farmer, Mr. Ramashraya Prasad Sah were the Panelist in the plenary session.. The session was focused on how to address the issues on water resources and irrigation management and make way forward, in the future with the past experiences and present efforts. After the session all the panelist and the facilitator with rapporteur were presented with token of love by the secretary of MoEWRI, Mr. Rabindra Nath Shrestha.

At the end of the seminar, the closing session was chaired by Director General, Mr Madhukar Prasad Rajbhandary. The chief guest of the session and the secretary of MoEWRI Mr. Rabindra Nath Shrestha expressed that he was delighted much by the success of the seminar with enthusiastic presentation of valuable papers as the outcomes of development and research activities in the water resources and irrigation sector. He also wished the seminar in future will even widely cover the issues regarding the development of water resources and irrigation sector. President of NFWUAN, Mr. Gajadhar Rohita Yadav made remarks that the ideas generated in the seminar should also be implemented in the field with direct involvement of farmers and other stakeholder specially in developing irrigation infrastructures with creating space in acts and rule of newly set federal structures.

Mr. Pradip Thapa, DDG, DWRI expressed vote of thanks to all the participants for their lively discussion with active participation. Further he thanked the organizing committee and all other supporting agencies for the overall management of the seminar.

At the end of the seminar, the director general of DWRI offered a token of love to the Chief guest for his continuous support and cooperation from the beginning to the end to make the seminar a success. He also thanked to all the paper presenters for their invaluable contribution to the seminar. With his brief speech DG Mr. Rajbhandary concluded the program and announced the closing of the seminar.

Technical Staff Training Organized

During FY 2076/77 two TST programs have been organized at two sites. The first three days' Technical Staff Training (TST) was organized by Integrated Crop and Water Management Program (ICWMP) in the meeting hall of Hotel Sita Sharan of Janakpurdham the capital of Province No. 2 from January 19th to 21st, 2020 (Magh 5 – 7th, 2076) to cover five irrigation systems namely Chandra Nahar Irrigation System, Koshi Pump Canal Irrigation System and Koshi Western Canal Irrigation System, Kamala Irrigation System and Hardinath Irrigation System, to train the technical staffs including Engineers, sub-Engineers, Association Organizers (AOs) from Irrigation offices and Subject Matter Specialists (SMS), Junior Technicians (JTs) of District Agriculture Offices, Regional Agriculture Research Stations (RARS) and Agriculture Directorates under Ministry of Land Management, Agriculture and Cooperatives of Province No. 2.

Inaugurating the training program, Deputy Director General (DDG) of Department of Water Resources and Irrigation (DWRI), Mr. Kaushal Kishore Jha, expressed the importance of training program to the technicians involved in Integrated Crop and Water Management Programme. He expected that the participants will take an opportunity to gain knowledge to make the programme implementation fine at farm level for improving crop production situation. As the chairperson of the training, SDE and chief of ICWMP Rajendra Bir Joshi briefly presented the course content and design of training program. On the first day of the program, , DDG Mr. Jha gave brief overview of the training programme and discussed about correct way of irrigation water application in agriculture. SDE Mr. Joshi instructed on water measurement as well as building of irrigation schedules. Water Resources and Institutional Development Expert Dr. Krishna C Prasad instructed about the modernization of Irrigation in Nepal and its historical perspective.. Sr. Scientist Ramnath Jha instructed on the newly developed tillage implements in crop cultivation and water saving techniques during cultivation and its recording technique. On the second day of the program Senior Agriculture Development Officer, Mr. Manish Kumar Pal discussed on off season vegetables production techniques. Sr. Scientist Mr. Kashi Kant Jha Discussed on Agriculture development Processes. SDE Mr. Rajendra Bir Joshi instructed on hydroponic of leafy vegetables and its further preparation for livestock feed. Sr. Scientist Mr Ramnath Jha discussed about the conservation tillage technology. WRIM expert Dr. Krishna Prasad discussed on multiple water uses. On the third day of the training program, SDE Mr. Joshi discussed on water harvesting technology and its application in irrigation. WRIM Expert Dr. Prasad briefly discussed on modernization of irrigation system.

Similarly, next three days' TST has been organized from 28th-30th, January, 2020 (Magh 14 to 16th , 2076) at the meeting hall of Hotel Rainforest of Sauraha, Chitawan. The training was organized for 16 technical staffs working at Narayani Irrigation Management Office, Narayani Lift- Khageri Irrigation Management Office and Nepal Gandak Western Canal System SDE Mr. Rajendra Bir Joshi inaugurated the training program. Mr. Joshi after inauguration highlighted the overview and training objective of TST workshop. Chief guest of the training program and the chief of Nepal Gandak Western Canal Management Office, Nawalparasi, Mr. Tika Ram Baral welcomed all the participants and expressed that the training program will meet its success if the trainees understood its importance and implementation of knowledge in the field. 1st day of training session has begun with introduction of training and concept of water measurement and allocation of water into the field by SDE Mr. Joshi. Mr. Joshi also discussed about the sprouted fodder for livestock which was experiment in Jestapur Agricultural Farm in the next session. Chief Guest, Mr. Baral briefly discussed about the agriculture & Irrigation in Nepal; he gave the background, concept, how to manage water and available water resources in Nepal according to National Water Plan, 2005.

On the second day of TST, Irrigation Management Expert, Mr. Suman Sijapati discussed his experiences on irrigation management. Senior Agriculture Development Officer Mr. Jhalaknath Kandel explained about the different climate change and climate variation needed for the vegetables and crops production and off-season vegetable cultivation and seed production technology. He also explained about the types of off-season vegetables and the methods of doing off-season vegetables. Similarly, Senior Agriculture Scientist from Agricultural Machinery Testing & Research Centre (AMTRC) at Nawalpur, Sarlahi Mr. Ramnath Jha discussed on newly developed farm equipments for tillage, farm mechanization, and water saving technology for crops cultivation. He further added his presentation with different types of modern tillage technologies. Irrigation & Water Resources Management Expert, Dr, Krishna Chandra Prasad explained modernized and automated irrigations systems. SDE Mr. Rajendra Bir Joshi shared his experiences of rain water harvesting at Jestapur Farm of Lalitpur.

Consequently, on the third day of TST, Dr. KC Sah explained the types of irrigation systems and the varied sources of water and their uses. SDE Mr. Rajendra Bir Joshi introduced home hydroponic units enabling people to produce their own food which can easily be extended.

During the training programs group discussions among the participants were also organized. On every next day of the program started with previous day's reviews. At the end of the training program certificates of attending training were distributed to the participants. All the training events were coordinated by SDE Mr. Rajendra Bir Joshi of ICWMP, Jawalakhel.

FEATURE ARTICLES

Holistic Water Resource Management for Climate Resiliency and Economic Prosperity

* Udhab Raj Khadka, PhD

Background

The earth surface is largely (71%) covered with water. However, the the freshwater available and suitable for life is very limited (0.01%) making it very rare and precious resource (Shiklomanov, 1993). Furthermore, distribution of the fresh water varies spatially and temporally making some regions water stressed and scarce compared to other regions. In the present days, the per-capita freshwater that is accessible for human consumption has become the symbol of wealthy living. At the same time, the freshwater resources are threatened by increased demand, over-consumption and increased discharge of wastewater, polluting the remained water resources due to the population growth, increased urbanization and economic development.

The population growth is of great importance for managing the earth's natural resources like freshwater. In the last 200 years, the world population has increased by more than seven folds, i.e. from one billion in 1800 to 7.7 billion in early 2000 (Roser et al., 2020). With the increase in population, rate of urbanization has also increased substantially due to of technologies advancement and facilities in cities. Consequently, there has been growing demand for water for domestic use, agriculture production and development activities. Thus, the shrinking freshwater resource in one hand and growing demand over the period on the other has created fierce competition between the sectors in grabbing the available freshwater resource inviting local to international conflicts. The freshwater is not only essential for human survival, existence and well being, but is also required for well functioning of natural ecosystem and for delivering ecosystem services to the human benefit (Fig. 1). However, in the course of exploiting water for human use, the ecosystem use aspect seems to be ignored leading to water related hazards making the ecosystem and community vulnerable. The current trend of developmental activities, and over-use and alteration of freshwater resources without due consideration of their ecological implication and sustainability has become the major public concern. The issue seems to be further exacerbated in the recent days and the global projections have indicated that demand for freshwater will increase significantly over the next decades for satisfying increased sectoral demand for freshwater under the pressure of population growth, economic development, international trade, urbanisation, diversifying diets, cultural and technological changes, and climate change (Hoff, 2011).

The possible consequence of freshwater depletion and competition for use has already been realized globally. Considering the severity of the situation, the then World Bank Vice-president, Ismail Serageldin had expressed that "the wars of the next century will be about water" (New York Times, 10 August, 1995). The severity of issue was further supported by the then UN General Secretary, Kofi Annan (March, 2001) saying "fierce competition for freshwater may well become a source of conflict and wars in the future" indicating the severity of water crisis and related issues. The relevancy of the issue has further been justified by the statement "too often, where we need water, we find guns instead" by the former UN General Secretary Ban Ki Moon in 2008. Thus, keeping in view the severity of the freshwater issues experienced across the globe, more holistic and integrated approach to policy, science and practice has been urged over the existing sectoral approach of water resource management (Hoff, 2011; Dodds & Bartram, 2016).

Nepal, contrary to the above statements, is gifted with abundant amount of freshwater flowing from mountains to the hills and plains over 6000 rivers and rivulets with 33 rivers having drainage areas greater than 1000 km^2 within the total drainage area 147,181 km^2 (WECS, 2002; WECS, 2011). The total surface water available in the country is estimated to be about 225 billion cubic meters per annum (WECS, 2002). In addition, there is huge ground water potential in valleys and flood plains of Tarai region of Nepal. Despite having such a huge potential, the country has not been able to harness well these resources. In contrary, these resources seem to be diminishing due to the present climate variability.

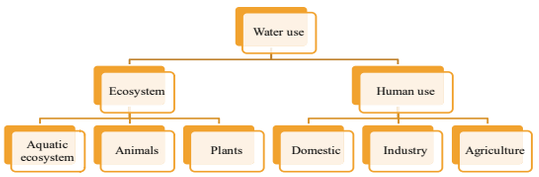

Figure 1 Water uses in the various human and ecosystem components

Water Use Scenario

Despite having the huge water potential, the country has been able to exploit very small proportion (about 15 BCM) for socio-economic purposes (WECS, 2011). Out of the total water used, 95.9% is used for agriculture, around 3.8% for domestic purpose and only about 0.3% for industrial purpose (ADB/ICIMOD, 2006). The major irrigation facilities are primarily concentrated in the Tarai region and most of the irrigation comes from surface flows. However, during the winter (dry) season, surface flow is reduced drastically and groundwater becomes the main source of irrigation. As a result, the intensity of irrigation in Nepal varies considerably between summer and spring seasons. Consequently, there is an increasing trend of groundwater utilization for irrigation. It is estimated that about 756 MCM (million cubic meters) of groundwater resources are being used for irrigation purpose and 297 MCM for domestic uses. Hence, there is huge potential of groundwater use in Tarai areas (WECS, 2005). Even in domestic sector, by the end of MDGs and baseline year of SDGs (i.e. 2015), though country's basic water supply coverage is 87%, less than 49.5% households have access to piped water and 62% households are using water contaminated with *E. coli*, though the data varies with social groups and geographic regions (NPC, 2017a, 2017b) indicating relatively worse countryside condition. Likewise, with respect to sanitation, the households with sanitation coverage account 80%, however, households using improved sanitation facilities account only 60%. This suggests that, in terms of water and sanitation (WASH), Nepal is still behind and needs to put hard effort to achieve the SDGs target. In terms of energy sector also, country is lagging far behind harnessing its potential. Among the used rivers, mainly the medium and small rivers seem to be used for domestic use, irrigation and hydropower and the larger perennial rivers have remained untapped (WECS, 2011). In terms of water users, though agriculture is the major sector that even account only small fraction. The country has a cultivated area of 2,642,000 ha (18% of its total land area), of which 1,766,000 ha is potentially irrigable. However, by the fiscal year 2075/076 (2019/2020), 14,83,150 hectare (56%) of the total lands and about 84% of the total irrigable lands have been brought under the irrigation infrastructure (DoWRI, 2020). However, as most the irrigation projects are based on the run-off-river, year round irrigation coverage is still very low. The present irrigation schemes use only available surface-water or ground-water as the water resources without recognising the possible benefits of using other forms of the freshwater such as rainwater, storm water and grey-water. Moreover, in the present irrigation schemes, there seem no due water resource conservation provisions.

Climate change impacts on water

The climate change and global warming has become ubiquitous phenomena across the world, leaving Nepal as country of no exception. The increase in temperature, which is more pronounced in the Himalaya, is causing rapid melting of snow exposing the rocky mountain diminishing aesthetic beauty adversely affecting recreation business. Likewise, the warming is causing upward shifting of vector species causing diseases in crop plants and human health. The accelerated melting of snow and glaciers in the Himalaya region has been resulting into reduced water storage capacity in the mountains and Himalayas leading to decreased melt-water contribution to river flows, particularly during non-monsoon season with having negative impacts on the run-of-river hydropower, irrigation and municipal water supply. Furthermore, the increased temperature is reported to widen the gaps between water supply and demand for irrigation affecting adversely the age-old livelihood option, agriculture. In Bagmati River basin of Kathmandu Valley, it has been reported that a one-degree centigrade rise in annual temperature is likely to increase water demand by 3.7% and simultaneously 1.5% reduction in the annual river flow (Chaulagain, 2007). The climate variability and uncertainty is likely to cause the small landholdings, subsistence farmers and the poor to face the adverse impact on agriculture production ultimately leading to famine (Chaulagain, 2015). Besides, the rapid melting of snow and glaciers, and formation of glacial and supra-glacial lakes has increased water induced disasters (MoEST, 2012). Therefore, the impact of climate variability in water sectors has multi-facets implication in agriculture, energy generation, disasters, socio-economy and livelihood, leaving no sector unaffected. As climate change impacts on water sector has cross-sectoral implication, management of and investment in water resources often visualize as the basis for broad regional and national development (Malik, 2008).

National Development Plan

In the present context of poor water resource development scenario and climate implication in the water sector, the country has almost missed utilizing its water potential for the national development and social well being. Amidst this scenario, the Government of Nepal has put forward the 15th five-year plan (2076/077-2080/081) with the view of complementing the long-term vision of "Prosperous Nepal and Happy Nepali" complying with the Sustainable Development Goals (SDGs). The plan has set three national goals and eight national strategies (NPC, 2019). The national goals include;

i. Building foundation for prosperity by providing easily accessible, qualitative and modern infrastructure, productive and respectable/dignified employment; high, sustainable inclusive economic growth and poverty alleviation.
ii. Make people realize dignified and improved livelihood by strengthening federal system of governance providing quality health and education, healthy and balanced environment and maintaining social justice and responsible social service.
iii. Protect national dignity, sovereignty and national benefit by ensuring socio-economic transformation and building self-dependent national economy.

The national strategies include;

i. Adopting fast pace, sustainable and employment oriented economic growth.
ii. Ensuring easily accessible and quality health service and education.
iii. Developing inter-state inter-dependent sustainable cities/ settlement.
iv. Increased production and productivity.
v. Availing complete, sustainable, productive social security and protection.
vi. Alleviating poverty and building justice based society with equality.
vii. Conservation and mobilization of natural resources building resiliency
viii. Strengthening public service; maintaining provincial balance with national integrity.

Almost all of these strategies are linked with water resource. The plan has recognised "Agriculture and Livestock Development",

"Food Security and Nutrition", "Forest, Biodiversity and Watershed", "Disaster Risk Reduction", "Environment", "Climate Change", and "Hydrology and Meteorology" as the sectors of the key importance in the national economy and development. For enhancing the performance of all these sectors is not possible without adequate provision of water resource management.

Water Resource Management Policies in Nepal

In terms of development policy in Nepal, the periodic development plan of the country is the major guiding policy document. In addition, the country has several policies pertaining water resource development and management. However, the most of the policies are based on the sectoral approach of water resource development. For, instance, the Nepal Environmental Policy and Action Plan, 1993 is primarily focussed on pollution control or regulation; Hydropower Development Policy, 2001 mainly considers hydropower development; Water Resource Strategy, 2002 expects to achieve short, medium and long term supply of and benefit from water resources; Rural Water Supply and Sanitation Strategy, 2004 seeks to address drinking water and sanitation related issues; Irrigation Policy, 2014 considers the development of irrigation facility using the existing water resources; and National Wetland Policy, 2003 seeks sustainable utilization of the wetlands. Likewise, the National Water Plan, 2005 seeks integrated and comprehensive water management for developing and managing the water resources and water services engaging all the stakeholders, albeit it does not well recognizes the linkages between the water use sectors. Following the policy provisions, there are several implementation and operational level institutions including Department of Electricity Development (DoED), Department of Water Induced Disaster Prevention (DWIDP), Department of Water Supply and Sanitation (DoWSS), Department of Agriculture (DoA), Department of Hydrology and Meteorology (DHM), and Department of Soil Conservation and Watershed Management (DSCWM) for water resource development and management. However, these institutions have been mandated for their exclusive function to work in their priority area. As a result, they are working independently without due consideration of interconnected linkages of water resource making the sectors and institutions competitive to each other without recognizing synergy and trade-off which can arise from the holistic or integrated management of water resource with due consideration of cross-sectoral uses and linkages. Therefore, in context of Nepal, though water resource development is still lagging behind, the holistic water resource management offers great potential for water resource conservation and development, agriculture development, tourism development, disaster risk reduction and management, and building climate resiliency. However, this can only be achieved shifting from the current sectoral management approach towards more holistic integrated approach in policy, science and practice. Therefore, in order to achieve national goal of "Prosperous Nepal and Happy Nepali", in the present context of climate change, the problem associated with water resources and consequently to agriculture, food security, tourism, health, forest and biodiversity, and the overall well being of public at large, robust policy provisions with adequate institutional arrangement and practices need to be ensured.

In connection to the climate adaptation and mitigation in Nepal, the Government of Nepal has put forward the several legal or policy provisions to address the climate change issues. The major climate related policies include; the National Adaptation Program of Action (NAPAs) (GoN, 2010), the National Framework for Local Adaptation Plans for Action (LAPA) (GoN, 2011a), the National Adaptation Plans (NAPs) (GoN, 2017) and the National Climate Change Policy (NCCP) 2019 (GoN, 2019). The NAPA has identified nine urgent and immediate climate change adaptation priority programs related to agriculture, forest biodiversity, water resources, health, infrastructure, and disaster. It is the first comprehensive government response to the climate change which has also specified a coordination mechanism and implementation modality for the climate change adaptation programs in Nepal. The NAPA has established a Multi-stakeholder Climate Change Initiatives Coordination Committee (MCCICC). Likewise, the National Framework for Local Adaptation Plans for Action (LAPA) (GoN, 2011) is an operational instrument to implement NAPA prioritized adaptation actions. Similarly, the National Adaptation Plans (NAPs) (GoN, 2017) gives opportunity for designing effective governance mechanisms that can facilitate the climate change adaptation and livelihood activities at the local level. Likewise, the National Climate Change Policy (NCCP), 2019 aims in improving livelihoods by building ecosystem resilience, and mitigating and adapting to the adverse impacts of climate change. The policy has realized the interconnectedness of the cross-sectoral policies, strategies and working polices.

In the present context of climate variation, the water resource has been greatly affected with it repercussions in all the socio-economic sectors and livelihood option. Therefore, in order to enhance the performances of these production sectors and for building community and ecosystem resiliency, water plays pivotal role. This urges the need of the umbrella policy for the water resource development and management that acknowledges the cross-sectoral linkages and be harmonious with across the sectors/ sub-sectors like agriculture and livestock, forest and biodiversity, environment, climate change and disaster, and hydro-meteorology.

Conclusion

Freshwater is a very precious, finite and vulnerable resource. The present trend of population growth, fast pace of urbanization and economic development have tremendously increased the water demand, in the one hand. In the other hand, climate change, over exploitation and pollution has becoming the major cause of shrinking the water sources resulting into aggravating water related problems. Amidst this scenario, the Government of Nepal has put forward long term vision of "Prosperous Nepal and Happy Nepali". In order to achieve these national goals, the sub-sectors like agriculture and livestock development, food security and nutrition, forest and biodiversity, disaster risk reduction, climate change, environment and hydrology and meteorology are considered to be the areas of the key importance. For the better performance of these sectors, various policy provisions have been framed. However, most of these policies are sectoral and thus institutions provisioned for achieving the objectives of the policy work independently without acknowledging linkages between the sectors. In addition, as the water has pivotal role for the development of these sectors, an umbrella policy with holistic approach of water resource management is urged for the holistic management of the available water resource in accordance with the present federal structure. The policy should ensure the re-use of water from various sources which can reduce pressure on freshwater resource that help building resilience against the present climate change and variablity.

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FORTHCOMING EVENTS

10th International Conference on Environmental and Agriculture Engineering (ICEAE 2020) 5th to 7th June 2020, Bangkok, Thailand, Website: http://www.iceae.org,Contact person: Ms.Emma Chen, Organized by: ICEAE, Deadline for abstracts/proposals: 25th March 2020

22nd PORTUGAL International Conference on, Agriculture, Biological and Environmental Sciences (PABES-20), 9th to 11th June 2020, Lisbon, Portugal, Organized by: Excellence in Research & Innovation, Website: http://ffabs.org/conference/250, Contact person: Kim Torres

23rd International Water Technology Conference, 18th to 21st June 2020, Sharm Elsheikh, Egypt, Website: http://iwtc2019.website2.me, Contact person: Walaa, Deadline for abstracts/proposals: 14th January 2020

5th International Conference on Water Pollution and Treatment (ICWPT 2020), 14th to 16th July 2020, Frankfurt, Germany,Website: http://www.icwpt.net/, Contact person: Ms. Emma Chen, Organized by: University of Applied Sciences, Deadline for abstracts/proposals: 5th April 2020

4th International Conference on Structure and Civil Engineering Research (ICSCER 2020), 28th to 30th June 2020, Budapest, Hungary, Website: http:// www.icscer.org/, Contact person: Ms.Shell Xiao Organized by: ICSCER, Deadline for abstracts/proposals: 20th March 2020

14th International Exhibition "Water: Ecology and Technology" ECWATECH-2020, 8th to 10th September 2020, Krasnogorsk, Russian Federation, Website: http://go.evvnt.com/475749-1?pid=80 Contact person: Pavel Demin, Organized by: Reed Exhibitions

International Symposium on Urban Water and Wastewater Management (UKSAY), 22nd to 24th October 2020, Kayseri, Turkey, Website: https://uksay2020.erciyes.edu.tr/, Contact person: ?brahim Uyan?k, Deadline for abstracts/proposals: 30th April 2019

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