Lost Century of the Hydropower Generation in Nepal: A Closer Look at the Principal Factors

Reservoir of Chandra Jyoti, 1911

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Abstract

Nepal is blessed with the abundant rivers and has the glorious history of being one of the pioneering states of the hydropower. Unfortunately, after one century of the first generation, Nepal is suffering from the acute shortage of energy where 3/4th of the total population is struggling to escape from their dependence on traditional sources of energy. Some managerial and procedural deficiencies are blamed for this situation, where the root causes of energy impediments are not uncovered. This paper is about the substantial elements persistent throughout the history as obstacles to exploit of hydropower in Nepal. The persistent political instability, the resource constraint, and the foreign influences are the principal detrimental factors. In an average, governments change in every 1.5 years for past 65 years showing that the only stable character of Nepalese politics is instability. Small base of the national economy with sluggish performance is another obstacle. The mounting competition and rivalry for the water resources between India and China are posing threat to Nepal. Implicit but substantial role of India regarding the Nepalese hydropower always seems notable. However, the internal instability is at the top of the list which knocks the economic stagnation and external interests.

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1. Introduction

1.1. Background

Availability of natural resources is supposed to be the minimum condition for the development of a country. If the resources are renewable, it is added strength. However, there are countries hitting the peak of the prosperity despite the scarcity of natural sources. Meanwhile, there are the countries blessed with abundant natural resources but trapped in the poverty and underdevelopment. This research paper explores the condition of Nepal which is in the latter category.

Nepal is a mountainous country with total geographical area 147181 sq km and home to 28 million people[1]. Insulated by the power-hungry India and the China, Nepal is gifted with more than 6000 fast-flowing rivers running throughout the year. The total theoretical capacity of hydropower in Nepal is 83000 megawatts and 43000 megawatts is technically and economically viable (GON, 2017). Similarly, Nepal is one of the pioneers of hydropower generation in Asia. Electricity generation in Nepal started in 1911 AD with a 500 KW project. Unfortunately, after the century, Nepal is suffering from the acute shortage of energy where the traditional sources of energy account for more than 75% of total energy consumption leaving more than 7 million people out of access to electricity.

1.2. Statement of the Problem

There are expert views backed by the public grievances that the political instability, resource constraints, and external interventions are the principal factors leading to the failure to exploit the hydropower. However, it is not clear that how unstable the politics is and what level of the international interference is in domestic issues. In this context, the primary objective of this research paper is to identify whether these claims are true or not over the Nepalese history.

1.3. Research Methodology and Sources of Data

I have used the descriptive method of analysis with some empirical proofs. The change of the government has been taken as the proxy of political instability. The macroeconomic indicators are used to show the resource situation. The expert views,

[1]According to the Census 2011, total population is 26,494,504

scholarly articles, and project-specific experiences have been studied to test the external interference. By exploring the answer of following questions, this paper identifies whether the claims are true;

- How frequent the government changes?
- What is the situation of macroeconomic indicators?
- Are there any evidence of international interferences regarding hydropower or rivers?

This study is based on the secondary sources of data. The reports and studies published by the different institutions of government of Nepal have been extensively used. Various scholarly articles have also been accessed.

1.4. Limitations of the Paper

This paper deals especially with the public policy related issues. The technical parts and individual project are not revealed here. Similarly, this paper does not claim the causality.

2. Hydropower Development in Nepal

2.1. Brief History

The first hydropower of Nepal 'Chandra Jyoti' was constructed in 1911 AD just after 29 years of the world's first hydropower power plant, the Fox River in Appleton, Wisconsin in 1882. Compared to bordering countries, Nepal lags India by 13 years, where the first hydropower was generated in 1989 and senior to China by one year, where the first hydropower in Yunnan province was constructed in 1912. These were the glory days for Nepal.

Nepal had to wait for 28 more years to pocket its second hydropower plan. In 1939, Sundarijal hydropower plan was built having the capacity 640 KW. In first 50 years, Nepal could excel only 1 MW hydropower which is an embarrassing statistic to know.

In 1956, the first development plan was announced and the development process institutionalized. As of today, Nepal has implemented the 14 development plans including five-year plans and three-year plans[2]. In terms of the electricity generation, every plan set a target but the progress is not encouraging. Followings are the figures:

[2] Out of 14, 10 plans are 5 years plans and 4 plans are for 3 years. There was no plan during 1990-1992

Table 1:

Projection vs Achievement of hydropower generation

S. N	Plan	Period	Projection: MW	Achievement: MW	%
	Before	1911-1955		1.1	
1	First	1956–1961	20	0	0%
2	Second	1962–1965	22	2.4	11%
3	Third	1965–1970	60	20	33%
4	Fourth	1970–1975	40.3	10	25%
5	Fifth	1975–1980	59	16.5	28%
6	Sixth	1980–1985	145	75	52%
7	Seventh	1985–1990	107	103	96%
8	Eighth	1992–1997	320	20.6	6%
9	Ninth	1997–2002	580	260.2	45%
10	Tenth	2002–2007	315	41.2	13%
11	Eleventh	2007-2010	105	77	73%
12	Twelfth	2010-2013	184	64	35%
13	Thirteenth	2013-2016	668	146	22%
14	Fourteenth	2016-2019	1450		

Sources: Compiled from NPC

The figure shows that the average achievement is 20%. The seventh plan can be marked as the highly successful plan followed by eleventh.

2.2. Institutional Development

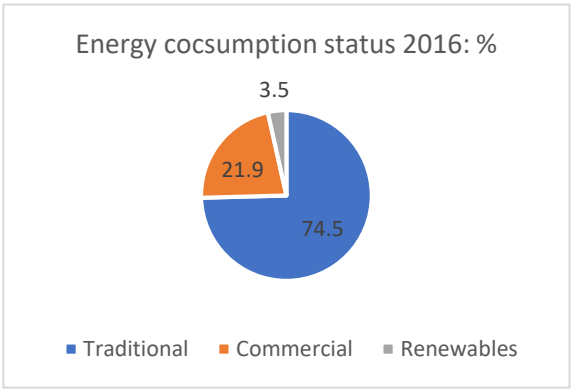
Nepal Electricity Corporation was established in 1962. The Eastern Electricity Corporation was established in 1974 followed by Small Hydropower Development Board in 1977. In 1985 Nepal Electricity Authority, was created as a public enterprise by merging the Electricity Department, Nepal Electricity Corporation and all the electricity development institutions (NEA, 2017). The NEA has been responsible for the generation, transmission, and distribution of electricity. The Water and Energy Commission constituted in 1975 as a policymaking body. The independent power producers (IPP) are also emerging as an important player in the hydropower development.

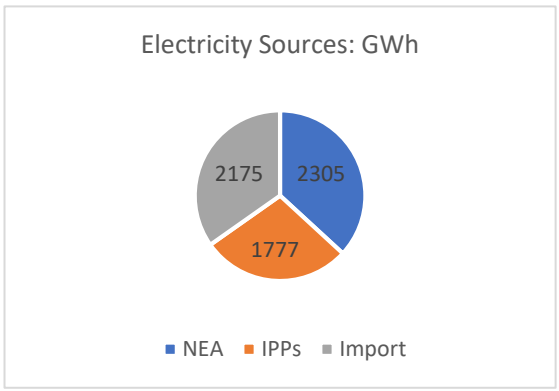
In 1992, Water Resource Act, Electricity Act, and Hydropower Development Policy were enacted. The Hydropower Development Policy (HDP), 1992 was replaced by Hydropower Development Policy 2001. This policy highlighted to establish alternative arrangement to meet the interim demand before the construction of large size projects, construct the small hydro for the hilly region, expedite the

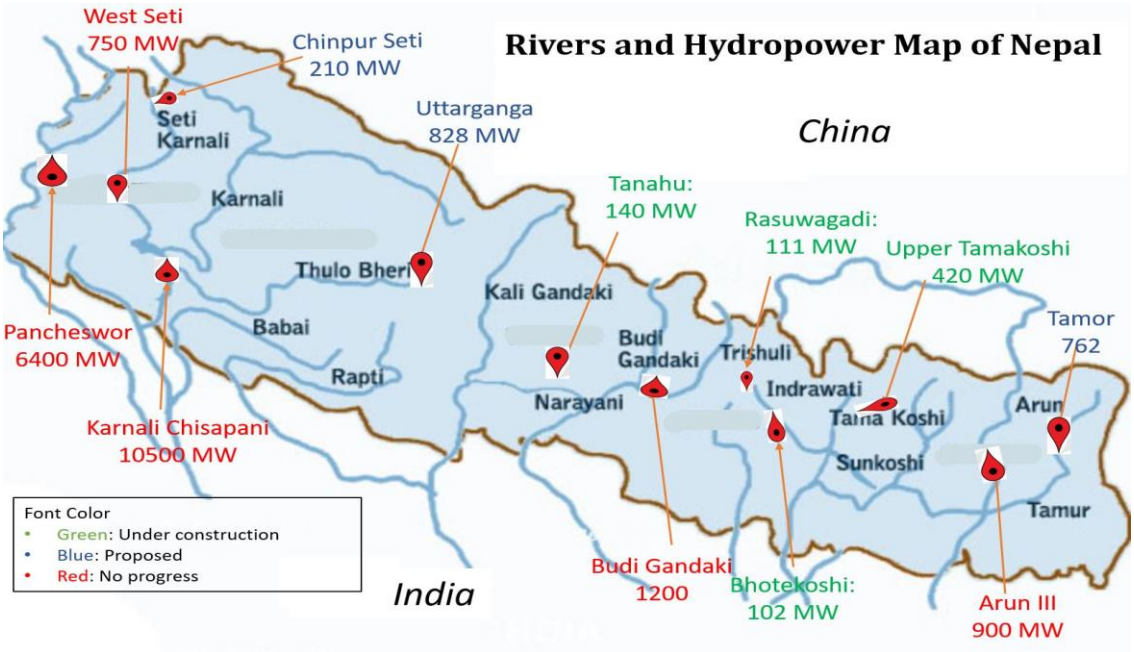
electrification, and motivate the foreign and private investment in hydropower sector.

2.3. Present Situation

Out of the total energy consumption in the year 2016, 75% was supplied by the traditional sources of energy like firewood and dung, 22 % by the commercial sources whereas hydro accounts only 3% of the total consumption (MOF, 2017). More than 25% people are still out of the coverage of the electricity. The annual report of the NEA states that, as of July 15, the total hydropower generation capacity including IPP is 918 MW which is 1.1% of total theoretical capacity and 2.1% of technically feasible capacity. The total power available in NEA system is 6257.7 GWh comprising 2305 (36.84%) produced by NEA, 2175 GWh (34.76%) imported from India, and 1777 GWh (28.4%) produced by IPPs (NEA, 2017). Total domestic generation is.







The same report states that there are 11 projects under construction and 9 more proposed. Once the under-construction projects are complete, additional 1047 MW power will be added to the national grid and extra 2770 MW will be available if the proposed plants are successfully constructed. The above map shows that most of the rivers start from China and travel to India through Nepal.

3. Factors Affecting the Development:

It is difficult to enlist all the factors which are responsible for the failure of hydropower production in Nepal. Moreover, establishing the causality between the factors and failure of production demands some rigorous econometric modeling. However, the real situation of some principal factors indicated by various experts and project experiences are as follows:

3.1. Political instability

One of the Harvard study conducted by Alesina, Özler, Roubini, N. et al. in 1992 throughout the 113 countries on 'Political Instability and Economic Growth' concludes that the higher propensity of government collapse significantly lowers the economic growth. Which indicates that the instability can disrupt the development.

In the Nepalese context, Nepal has gone through various political setups during the unified history of 250 years [3]. Active monarchy, family-led dictatorship, and a constitutional monarchy are some of the key governing practices.

Roughly the regimes after 1911 can be divided as follows:

i. Rana regime: Rana family run tyrannical regime in Nepal for more than 103 years from 1847 to 1950. King was there but a puppet. From 1911 to 1950 there were five rulers from Rana dynasty.

ii. First democratic era: Once the democracy was announced in 1950, new political development started. However, it could survive hardly for 10 years witnessing six prime ministers and direct rule by the King for two times. Altogether eight governments in ten years which busted the budding democracy.

iii. Panchayat era (direct rule by the King): In 1960, the then king took over the power banning the political parties and started direct control which lasted for 30 years. However, there was a persistent conflict between the King and banned

[3] Though the word 'Nepal' has been coined in the Hindu scriptures believed to be written before 5000 years, in 1768, the late king Prithivi Narayan Shah unified Nepal by merging more than 50 small states.

political parties so the whole period was spent in political battle. This period had 15 governments.

iv. Second democratic era: The democracy was re-gained in 1990 but faced unprecedented instability and civil war. In another 10 years, Nepal saw ten governments heating the peak of instability. The hung parliaments were the main source of instability. The frequent swing of a small party in parliament from one block to another altered the majority in parliament resulting in the collapse of the government.

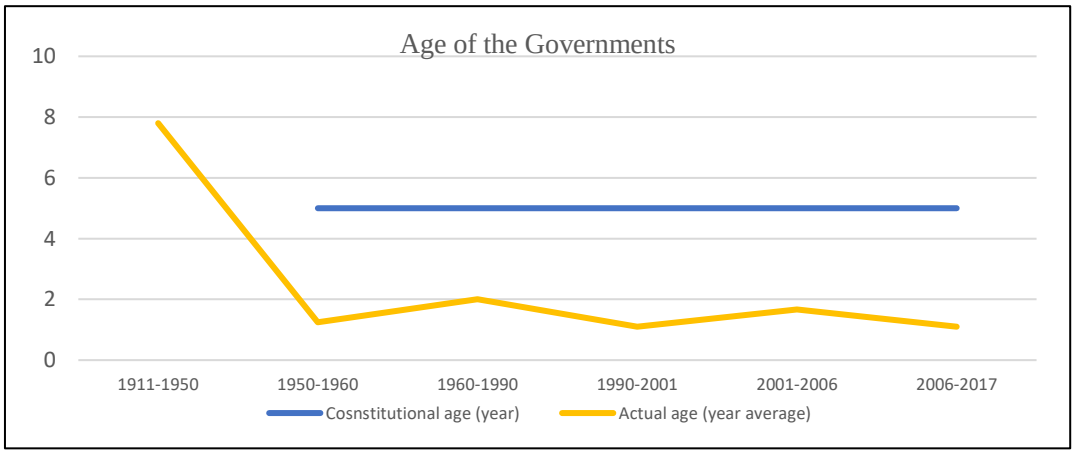
v. Second direct rule by King: The King took over the government second time in 2001. This rule survived for four years with three governments.

vi. Republic era: After the abolition of monarchy in 2006, the democracy was declared the third time. Currently, Nepal has a 10th republic prime minister. This period is also a factory producing prime ministers and ministers due to the hung parliament situation.

Table 2: The governments in Nepal

SN	Period	Nature of regime	No. of Governments
1	1911-1950	Rana family autocracy	5
2	1950-1960	1st democracy	8
3	1960-1990	Panchayat (1st direct rule by the King)	15
4	1990-2001	2nd democracy	10
5	2001-2006	2nd Direct rule by the King	3
6	2006-2017	3rd democracy (Republic)	10

Source: Office of Prime Minister and Council of Ministers



Overall, the instability remained the fundamental stability of the country. The

average age of the government is less than 1.5 years after 1950 against the constitutional age of 5 years. Furthermore, these changes are backed by the change in the political ideology from communism to democracy and dictatorship and vice versa.

The Arun III and Budigandaki projects are representative examples showing how the hydropower projects are suffered due to change in the government. In Arun III, Nepali Congress Party[4] led the government during the agreement phase and United Marxist and Leninist Party[5] was leading the government during cancellation. Similarly, Communist Party Nepal (Maoist) and Nepali Congress Party were leading the government when the Budigandaki was awarded to and scrapped from the Chinese company respectively.

3.2. Resources Constraints

Hydropower generation is capital-intensive production process. The initial financial cost of hydropower is higher and the human resource required for the hydropower is also highly capable. Despite the absence of data, it is not difficult to estimate that the size of the economy before 1960 was very small and the highly skilled manpower was almost absent. The brief-situation afterward is explored as follows:

i. **Financial resources**: The gross domestic product (in current price) of Nepal in 1960 was US$ 508 million which reached to US$ 21 billion in 2016 (World Bank, 2017). Similarly, the economic growth rate of Nepal is sluggish and always oscillates below 5 % (NPC, 2017). In addition, the government allocation for the energy sector is always less than 4% of its national budget (MOF, 2017). These indicators show that the mobilization of the fund for the hydropower is nominal for the entire period. The private sector is late and weak to sufficiently finance the large projects. Most of the big hydropower plants are either funded by the foreign governments or international financial institutions.

Table 3: Major projects and sources of financing

Project	**Capacity- MW**	**Financiers**	**Status**
Kaligandaki	144	ADB, JICA	Under operation
Madhya Marsyangdi	70	KfW Germany	Under operation
Marsyangdi	69	KfW Germany	Under operation
Kulekhani I	60	JICA, IDA	Under operation
Khimti	60	ADB, IFC, Norway	Under operation
Kulekhani II	32	JICA	Under operation
Debighat	14	India	Under operation

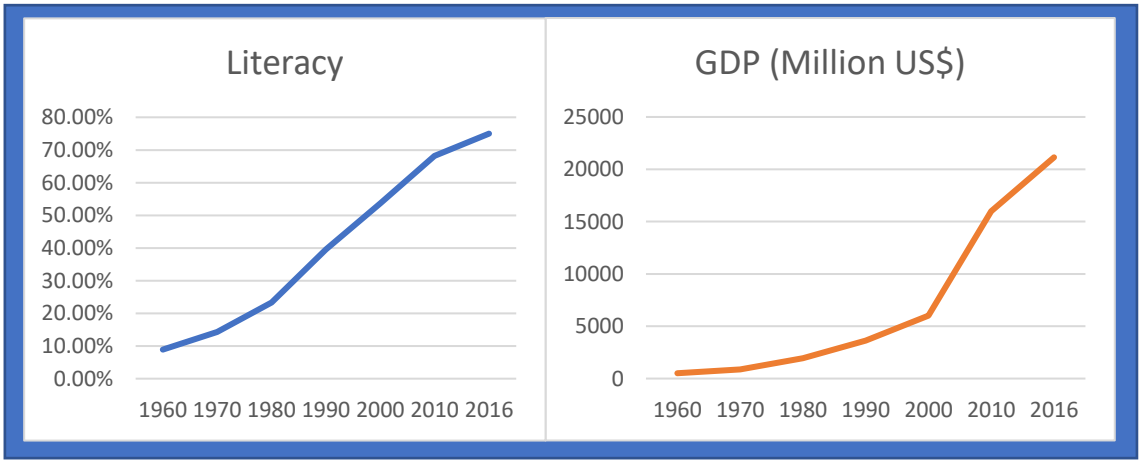
[4] Claims itself as pro-democratic party
[5] Claims itself as pro-communist party

Trisusli	20	India	Under operation
Tanahu Hydropower	140	ADB, JICA, EIB	Under construction
Budigandaki	1200	China	Proposed
Arun III	900	India	Proposed

Source: ADB & NEA

The 1st five-year plan comprised of only NPR 330 million (US$ 3.3 million as of now) allocation. Similarly, the capital budget of Nepal for FY 2017/18 is US$ 3.3 billion; whereas, the estimated cost of 1.2 GW Budigandaki hydropower project is US$ 2.5 billion, indicating that even if whole capital budget is spent for hydropower, it is not possible to construct a 2 GW project.

ii. **Human Resources**: Another dearth ever is the capable human resources. Nepal is still lagging the skilled manpower. The literacy rate of 1950 was around 2% which reached to 68% in 2011 (CBS, 2011). Before 1991, there was only one university established in 1959 and started its first graduate program of Engineering in 1996. Currently, there are 4 universities conducting the graduate program of engineering where, in total, around 500 engineers graduate every year. Among them, graduates majoring in energy are less than 100. Therefore, even today, Nepal does not have alternatives to hire a foreign consultant to design even a small hydropower project.



3.3. External Influence

Nepal is shielded by two giants India and China. The total population of Nepal is less than 2% of each of the countries. The area is 1/65th of China and 1/22nd of India. The economy is nominal as 1/530 times of China and 1/107 times if India (World Bank, 2016)[6],

[6] In 2016, GDP of China, India, and Nepal are US$ 11.2 trillion, US$ 2.264 trillion, and US$ 21.14 billion respectively.

and development is far behind. These countries are global centers financially and politically as one is known for world's largest democracy and another for pioneering the communism. The big rivers start from China, pass through Nepal, and consumed in India. In this contest, Nepal is under extreme pressure because of negative externalities of the water war of these power centers as well as from their disruption targeted to Nepal.

i Pressure due to externalities

20 % of the Indian population (250 million)[7] is out of electricity access and 8% (100 million) do not have access to clean drinking water (World Bank, 2016). Though China has a better situation, however, both countries want to secure water for their future need and replace the fossil fuel-fired electricity to hydro or renewables. Time and again, they have pronounced different plans related to utilization of rivers which are objected by another.

These two countries seem to play a pivotal role in the global prosperity, yet they have substantial reservations and rivalries in many issues. The landscape of such rivalry is changing to water sources. Prof. Brahma Chellaney, in his famous book 'WATER: Asia's New Battleground'[8] states,

> *"The battles of yesterday were fought over land. Those of today are over energy. But the battles of tomorrow may be over water. Nowhere is that danger greater than in water-distressed Asia"* (Chellaney, 2011).

This book indicates that the epicenter of conflict will be the Himalayan region which is the water basin for more than 40% of the world drinking water.

Grumbine & Pandit, (2013) state "India, Nepal, Bhutan, and Pakistan are engaged in a huge "water grab" in the Himalayas… Taken together, the countries have plans for more than 400 hydro dams". Since other countries except India are just witnessing as they have a nominal role to play compared to India, these dams are the symptoms of how condensed the efforts are in channeling the water by India. The Guardian states "China has plans for around 100 dams to generate a similar amount of power from major rivers rising in Tibet" (The Guardian: Aug 10, 2013). This is the transparent answer to Indian activity.

[7] This population is almost 10 times of total population of Nepal.
[8] Winner of the 2012 Bernard Schwartz Book Award of the Asia Society.

Hongzhou Zhang from China Program at Institute for Defence and Strategic Studies states,

> *"As water scarcity in both China and India worsens, the competition over shared water resources in their transboundary rivers, particularly the Brahmaputra River, is set to intensify. … water conflicts could potentially become a serious challenge to Sino-Indian relations* (Zhang, 2016)".

Nepal is affected by the act of either of the country rather if the conflict is in between these two countries, the problem of Nepal will be multiplicative. Due to the principle of 'Might is Right', Nepal is prone to risk due to externality.

ii **Pressure due to acts targeted to Nepal**

Nepal imports 100 % petroleum from India and India is the only country which has Nepal's trans-border connectivity. The relation with China regarding rivers is not so pressing. But with India, it is always insistent and controversial. Nepal has the bitter experiences of interferences in many issues. The recurring border blockades, including petroleum, regarding the internal political developments in Nepal, are some of the proofs. In case of water and electricity, some of the key incidents can be listed as follows:

In 1947, Nepal prepared the detail design and cost estimate to generate 22 MW electricity from Kaligandaki river. But the role of Indian ambassador was vital to convince the prime minister for canceling the project. The Water Resources task force report, 2008 reads "Once the project preparation completed, to disrupt the project, the contemporary Indian ambassador said to the prime minister 'Your Excellency, you are making a big mistake as the Indian government is soon executing a large Koshi[9] high dam project at Baraha that will avail the electricity at 2 paisa/unit[10] for Nepal, north Bihar, and Bengal. Then why are you wasting money that can be used for other activities?'. Believing his baseless influence, this project was abruptly dropped by the prime minister" (Ministry of Water Resources, 2008). But this Baraha project never materialized.

Another sad story of Nepalese hydropower generation regarding the international influence is the Arun III. This project was one of the carefully designed projects during 1990. The 900 MW project capable to be the game changer of the Nepalese energy market

[9] Koshi is a biggest river of Nepal.
[10] Proposed cost of project was 6 paisa/unit. 100 paisa ≈ 1¢

was abandoned by the World Bank in the middle of the designing of the access road. Indicating to the powerful state's influence over the World Bank, the vice-chairman of National Planning Commission (NPC) of that period and former finance minister Dr. Ram Sharan Mahat writes:

> *"…the Bank had virtually led the country to a 'no option trap'…This only indicates how a small and poor country tends to fall victim to the changing approach of mega-institutions influenced by a network of interest-groups" (*Mahat, n.d*).*

The WB in its Status of Project Implementation at Credit Cancellation Note (1996), along with the reasons like lack of political consensus, changes in the alignment, admits the Indian interest that was ignored during the designing of the project as a lesson to the bank that reads as " Political changes in Nepal and relation between Nepal and India almost ignored...". The Vice President Joseph Wood quoted "the signal we would send out is that the Bank no longer supports infrastructure projects like this."[11] Ironically, just a few months after this decision, the World Bank approved a mammoth 1450-MW Ghazi-Barotha hydroelectric project in Pakistan (Mahat, n.d). Arun III resurfaced in 2014 signing the power purchase agreement between Nepal and India. Now India is going to construct this project.

The power project- Karnali has a similar story. In this project, IDA funded $ 11 million for the study but the achievement is again only a lesson to the bank that IDA should not fund in the mega project in Nepal without a green signal from India. World Banks report admits the same facts in its own word as:

> "*The project confirmed that the Karnali (Chisapani) Multipurpose Project (KMP) scheme (10,800 MW at a cost of US$ 5 billion in 1988 dollars) is technically feasible and economically very attractive...the study did not succeed in raising India's interest...When IDA supports preparation of a binational project, arrangements need to be made to ensure that IDA has an effective dialogue with both countries...*" (World Bank, 1991: p.-iii)

One of the proposed national pride project 1200 MW Budigandaki hydropower

[11] Joseph Wood during the press release by River Network, August 4, 1995.

project is under dilemma. This project had been identified during the 1970s but the government announced this project as a national pride project in 2008. In 2017, the government signed an agreement[12] and awarded the project to the China Gezhouba Group Corp. to construct. But the contract was cancelled by new government[13] and subsequently the project has been awarded[14] to Nepal Electricity Authority. But Times of India, after cancelation but before awarding to NEA, announces that the project might go to Indian NHPC[15] (Bagchi, 2017)[16]. In the meantime, the chairpersons of communist parties have publicly announced that the project will be given to same Chinese company once the government is formed after the election[17].

These are some of the representative cases where the force, fund, and functionaries have paralyzed the Nepalese hydropower.

4. Findings, Conclusions, and Recommendations:

Findings

- The political instability seems persistent. The average age of the government is ranging from 1-2 years against the constitutional provision of 5 years. The codified policies in hydro sector appear only in 1992 indicating the policy absence in this sector for long period of time.
- In terms of the resources, it is true that the internal resource is insufficient to finance any of the large hydro projects including the deficiencies of technical skill. Nonetheless, Nepal is a Least Developed Country and many international organizations and countries are supporting Nepal which can fill the gap.
- As far as the external influence is concerned, it is one of the most important factors prevailing forever. The escalating global influences of India and China and their growing concerns over water have the negative externalities to Nepal. History is not encouraging, especially in Indian context.

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[12] May 23, 2017 by the government led by pro-communist party: Communist Party Nepal-Maoist
[13] Nov 13, 2017 by the incumbent government led by pro-democratic party: Nepali Congress
[14] Nov 24, 2017 by the incumbent government led by pro-democratic party: Nepali Congress
[15] NHPC stands for National Hydroelectric Power Corporation
[16] The article starts as "In a decision which could have far reaching consequences in the region and for China, Nepal cancelled the Budi Gandaki Hydropower Project which had been contracted to Chinese Company. Unconfirmed reports said the project might go to India's NHPC instead."
[17] Parliamentary election is under progress. Communist coalition has been anticipated to lead next government in few weeks.

Conclusions:

The resources unaccompanied by adequate efforts and environment to tap are the sources of vulnerability. Starving holding delicious fruits in own garden is the fate of today's Nepal. There are multiple factors responsible for this situation, but the internal political factor is the primary one. The struggle for political gain has the snowball effects on the resources and external intervention creating interconnected trap. People are obsessed by these factors, however, there are other factors with parallel importance. The lethargic management of the projects is one of the factors due to which none of the projects has been completed without cost-overrun and time-overrun. The transmission and distribution loss is over 32%, higher by 4 times than the global average (WB, 2017). Therefore, the claims are true however the problems are not limited to these.

Recommendations:

Since various study show that Nepal does not have petroleum or coal, there is no alternate of hydro as a domestic source. Based on the present situation, assumptions, and findings from the analysis, following are some of the recommendations:

- Political changes are the beauty of the democracy which might not stop, but the consensus among the political parties, in relation to the optimal use of the hydro is needed.
- Diversifying the portfolio of the resources is required thereby attracting private sector, foreign investors, and foreign aid complementing to the government resources.
- The swelling power of India and China and their mutually exclusive interests in the rivers is obvious. Nepal shall pursue balanced relation rather than sticking to one of them in the cost of another.
- Equal importance is to be placed on the project management and enhancing the governance of the sector.
- If the large projects are contested, the focus shall be shifted to small projects. The off-grid solar connections and micro-hydro projects can be the best alternatives to meet the domestic need.

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