Czech University of Life Science Prague

Faculty of Economics and Management

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Diploma Thesis

The Role of FDI in Hydropower Sector, Electricity Consumption and Economic Growth of Nepal

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DIPLOMA THESIS ASSIGNMENT

B.Sc. Kamala Nepal

Economics and Management
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Thesis title

Role of Foreign Direct Investment in Hydropower development of Nepal

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Objectives of thesis

To analyze the potential of FDI in hydropower of Nepal.

To know the current status of Hydropower production and future prospects on Nepalese economy.

To analyze the importance of FDI in Hydropower sector of Nepal

To provide suitable policy implications to attracts FDI and efficient use of it in Hydropower sectors.

To analyze the potential of power trade with India and Bangladesh

To empirically analyze the causality among the FDI in the energy sector, consumption of electricity and the economic growth of Nepal.

Methodology

In the first part of analytical framework, comparative analysis will be performed among the role in investment of China and India in hydropower sector as China and India are the highest investing countries in Nepal. Furthermore, the cost of consuming electricity and Liquified Petroleum Gas (LPG) will be analysis. Also, the pricing of electricity in Indian and Nepalese market will be analysis.

In the second part of analytical framework statistical modelling will be interpreted. For this study, the statistical tool EViews will be used and time series data for the period 1999-2018 (20 observations) are included to empirically analyze the causality among the FDI in power sector, the electricity consumption and economic growth of Nepal. The Johansen co-integration and Granger causality tests will be employed to find the causal relationship among the variable in long-run and short-run.

The proposed extent of the thesis

60-80 pages

Keywords

Nepal, foreign direct investment, least developed country, hydropower development, renewable energy, hydropower generation, power purchase agreement, power trade agreement, project development agreement, law and regulation

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Declaration

I would like to declare hereby that this thesis is my own sole work and effort, and this has not been submitted elsewhere for any award. Each source of information used in this thesis has been cited.

Date: 11.20.2020. ..…….

Kamala Nepal

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Abstraktní

Nepál má obrovský potenciál pro výrobu vodní energie a toto odvětví dostává vyšší přímé zahraniční investice než kterýkoli jiný sektor v ekonomice. V důsledku rostoucí poptávky po spotřebě energie je země v energetické krizi více než deset let. V průběhu času Nepál zvyšuje svou výrobu vodní energie prostřednictvím přímých zahraničních investic a místních fondů. V posledních letech země také zvýšila svůj dovoz z Indie a vývoz do Indie poklesl. V případě nejméně rozvinutých zemí, jako je Nepál, není samofinancování možné a PZI hrají klíčovou roli při rozvoji větších projektů. Nepál dostává přímé zahraniční investice z různých zemí světa a Čína a Indie jsou nejvíce investujícími zeměmi v Nepálu. Cílem tohoto výzkumu je zdůraznit současný stav a perspektivy energetického a energetického sektoru v Nepálu, politiku přímých zahraničních investic a empirickou analýzu oběti mezi hospodářským růstem, spotřebou energie a elektřiny a přímými zahraničními investicemi do nepálské energie a energie. sektor pro období 1999-2018. K nalezení vztahu mezi proměnnou v krátkodobém a dlouhodobém horizontu byly použity kointegrační testy a Grangerovy kauzální testy. A Grangerova kauzalita ukazuje protichůdné výsledky, že proměnné nesouvisely jak v krátkodobém, tak dlouhodobém regresním modelu nejmenších čtverců, aby bylo vidět, jak FDI, elektřina na obyvatele a spotřeba energie ovlivňují ekonomický růst země. A výsledky potvrzené proměnné jsou statisticky významné, s výjimkou spotřeby elektřiny na obyvatele.

Klíčová slova: Nepál, přímé zahraniční investice, Indie, Čína, rozvoj vodní energie, obnovitelná energie, výroba vodní energie, dohoda o obchodu s energií, dohoda o vývoji projektů, právo a regulace.

Abstract

Nepal has immense potential for hydropower generation and the sector is getting higher FDI than any other sector in the economy. Because of rising demand for energy consumption, for more than a decade the country was in an energy crisis. However, with the time Nepal is increasing its hydropower generation through the FDI and local funds. Also, the country has decreased its power import from India in recent years by improving its quality and decreasing in electricity leakage problems. In a case of a least developed country like Nepal, it's not possible to do the self-funding and thus FDI plays a key role in the development of bigger projects. Nepal receives FDI from the various countries in the world, China and India are the highest investing countries in Nepal. This research aims to highlight the current state and prospects of power and energy sector of Nepal, the policy related to FDI and empirical analysis of the casualty among the economic growth, energy and electricity consumption and FDI in power and energy sector of Nepal for the periods 1999-2018. The cointegration test and Granger causality tests were applied to find the relationship among the variable in short-run and long-run. And the Granger causality shows conflicting results that the variables didn't have any relationship in short-run, as well as long-run, multiple regression model with the usual ordinary least square method, has been examined to see how FDI, Electricity Consumption per capita and Energy Consumption affect the economic growth of the country. And the results confirmed variables are statistically significant excepts electricity consumption per capita.

Keywords: Nepal, foreign direct investment, India, China, hydropower development, renewable energy, hydropower generation, power trade agreement, project development agreement, law and regulation.

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List of Abbreviations

FDI	Foreign Direct Investment
GDP	Gross domestic product
BIT	Bilateral Investment Treaties
FITTA	Forms of Technology Transfer Agreement
OLS	Ordinary least square method
ECM	Error Correction Model
GDPGR	Gross Domestic Product Growth rate
BIPA	Bilateral Investment Promotion Agreement
ADF	Augmented Dickey Fuller test
SAARC	South Asian Association for regional Cooperation
SAFTA	South Asian Free Trade Agreement
USD	United States Dollar
LPG	Liquified Petroleum Gas
FY	Fiscal Year
VECM	Vector Error Correction Model
WTO	World Trade Organization
BIPPA	Bi-lateral Investment Protection and Promotion Agreement
VAR	Vector Auto-Regression
kWh	Kilowatt
MWh	Megawatt
GWh	Gigawatt
NEA	Nepal Electricity Authority
IPPs	Independent Power Producers
IBN	Investment Board Nepal
PPA	Power Purchase Agreement
PTA	Power Trade Agreement
HDP	Hydropower Development Policy

1. Introduction

Nepal is still a survival or deficit economy where it is not possible for the government to invest in projects that require huge investments. When bilateral aid arrived in Nepal, there was a constant tension between the interest of the donor and the country. In any case, donors have played a major role in the development of Nepalese infrastructure, industry, agriculture, the education system and the health sector. Most of the infrastructure in Nepal has been built with bilateral grants. Key industries (e.g. textiles, paper, agricultural tools) have also been supported by grants and donor investments. The key industries supported by foreign direct investment are expected to help Nepal to use its human and natural resources more effectively and efficiently. Overall, foreign direct investment aimed to make the Nepalese independent and lay the groundwork for the development of a stronger and more dynamic political system. Even though donors often had their own political motivations, those motivations were clearly outweighed by the benefits obtained in Nepal.

Over time, bilateral grants have declined and have been replaced by multilateral loans and investments. Private companies in industrialized countries have often invested their capital under these multilateral agreements. For example, Surya Nepal, Dabur Nepal and the Standard Chartered Bank are the result of foreign direct investment in Nepal. It means that the era of subsidies and social investment will be replaced by private investments which aim to make a profit and motivate the Nepalese industry to make a profit.

Based on the above information, I have decided to do further research on the role of foreign direct investment in the hydropower sector of Nepal. My main motivation to do the research on this topic is the potential of hydropower generation in Nepal as the country has the capacity of generating 43000 MW of hydropower feasibly. However, I have spent most of my childhood in 12 to 18 hours of power cuts problems on a daily basis in the hope that the country will put effort to solve the ongoing issues someday. Nepalese economy had suffered from never-ending power cuts for more than a decade and finally became free from power cuts problems by the end of 2017. To solve the power cuts problem the role of NEA was essential as it started to import power from India and continuously put effort to improve leakage problems to manage demand and supply for the electricity in the country. The hydropower is the main source of electricity in Nepal which accounted for a total of 90% of electricity generation. Additionally, almost 78 % of the population are dependent on

hydropower for electricity and the remaining population are still dependent on traditional resources. Hydropower is considered as a source of clean and renewable energy with no pollution releasing to the environment. At the present time, Nepal is doing well in the energy sector and by the end of 2023, Nepal will be independent in electricity and soon there will be storage of electricity for the export to India. The contribution of FDI in the sector has played a vital role in growth of electricity generation in the country. Thus, FDI is crucial for the LDC like Nepal.

Currently, the country relies heavily on imported gas for cooking purposes which can be replaced by electrical stoves. However, using electricity is more expensive for cooking purposes than the gas. Because of this reason it is difficult for people to substitute the cooking gas with electricity. And I want to provide some recommendations for the government that it needs to work on subsidizing the use of electricity to reduce the import of cooking gas from India. Although the consumption of electricity has increased in the country, the import of cooking gas has also increased as traditional energy sources are being replaced by LPG rather than electric stoves for the cooking purpose of rural people. Mainly the potential of hydropower development in Nepal and the need to encourage citizens to emphasize on use of electricity.

2. Objectives and Methodology

2.1 Objectives of the Thesis

The main objectives of my research are to study the status and prospects of hydropower development in Nepal. Also, to learn about the role of FDI into hydropower sectors in the past, present and future. It was emphasized on why the country is not being able to grow this sector. It was mentioned about the challenges the country is facing and how it could be solved. In recent years, the hydropower sector is progressing and how this sector will contribute to economic growth of the country in a case it will be able to attract adequate foreign investment in the sector. This research is aimed at study on following goals:

- To analyze the potential of FDI in hydropower of Nepal.
- To know the current status of hydropower production and prospects on Nepalese economy.
- To analyze the importance of FDI in Hydropower sector of Nepal
- To provide suitable policy implications to attract FDI and efficient use of it in Hydropower sectors.
- To empirically analyze the causality among the FDI in the energy sector, consumption of electricity and the economic growth of Nepal.

In order to achieve the objectives, following research questions are formulated:

- Has the FDI in the hydropower sector contributed to economic growth of Nepal?
- Is Nepal's law and policy adequate to protect foreign direct investment in Hydropower sectors?
- What are the challenges for FDI in the hydropower sector of Nepal?
- What are the prospects of hydropower generation and export in Nepal?
- What are the perspectives of the hydropower sector in sustainable development goals of Nepal?

2.2 Methodology

Methodology of this research is divided into two parts: theoretical and practical. The theoretical part is aimed to review the available literature and basic overview on the topic. Additionally, it has also specified the Nepalese economy, foreign direct investment, its legal framework and foreign investment in hydropower development. Also, the impact of foreign direct investment has been analyzed based on available data.

In terms of Nepalese economy, major indicators such as economic growth, employment, saving and investment, trade balance, remittance, and ease of doing business have been highlighted. Moreover, foreign direct in Nepal has emphasized on total foreign direct investment and its contribution to the GDP, sector-wise investment, major foreign investors, and policy for FDI in Nepal. Lastly, foreign investment in the hydropower sector highlighted the overview on hydropower development, total invested hydropower projects and its investors, licensing for the projects, potential for the power generation, hydropower development policy and challenges for hydropower projects development.

Practical part of this research includes three parts: a case study, comparative analysis and statistical analysis. For the statistical analysis data for the periods 1999-2000 are taken from the World Bank, Department of Industry Nepal and Ministry of Finance Nepal. And more details about the methods of this research as follows:

2.2.1 Case study

This part of the study mentioned a case study of the South Korean economy. It has basically focused on how South Korea became among top ten exporting countries in the world within 30 years of receiving FDI. Also, highlight that the lesson, Nepal should learn from the experience from South Korea.

2.2.2 Comparative analysis

This part of research compared the cost of consuming LPG and electricity for cooking purposes in Nepal and suggested how the government can encourage the people to be displaced in consumption of imported gas.

Also stated about the potential power export market for Nepal by comparing the installed capacity and demand of hydropower between India and Bangladesh. Last but not the least, I have also compared the domestic tariffs of Nepal and India's domestic tariffs on Electricity.

2.2.3 Statistical Analysis

The time series data for the periods 1999-2018 has been employed to do the statistical analysis among the variables such as foreign direct investment in the power sector, gross domestic product per capita (current price in USD), electricity consumption per capita and energy consumption per capita. And the data has been processed through statistical software EViews to estimate the results. Following tests was performed to estimate the result of statistical analysis:

Unit Root Test

The main purpose of unit root test is to find out whether a series follows stationary or non-stationary (unit root or not). There is a negative relationship between unit root and series. Because when a series exists unit root it is considered as non-stationary, whereas, absence of unit root in a series is known as stationary. In a case of non-stationary results in the series, such series are considered as specious and features of random walks which can cause problems in statistical inferences, economic and financial decision making. Thus, it is essential to know the nature of data before processing further steps. There are several approaches to test for unit root or not. However, most common practices are Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) test which I have followed to test for unit root or not.

Augmented Dickey-Fuller (ADF) test

An ADF test to examine stationary in time series models was introduced by Dickey and Fuller in 1979. In this test, the null hypothesis (Ho) of variables assumes that the series has unit root and cannot reject the null hypothesis, whereas, alternative hypothesis (H1) assumes that series has stationary and can reject the null hypothesis. The result of the ADF test for unit root is to identify the degree of integration in the series.

The ADF test is based on following equations:

$$\Delta Y_t = \alpha + \delta Y_{t-1} + \sum_{i=1}^{\kappa} \beta \, \Delta Y_{t-i} + \varepsilon_t \quad \text{.....equation} \qquad (1)$$

Where, Δ is the first difference operator, Y is relevant time series, t is time variable, α is constant term, δ is time trend and ε_t is an error term. The unit root in the equation can be tested in three forms; the first one is at the unit root level with only constant, second at level with trend and constant and third one is by adding the 1st or 2nd differences. The equation above (2.1) has following assumptions:

Phillip Perron Unit Root Test

To solve the serial correlation or structural breaks, the PP test has applied which will provide more robust estimates than the ADF test.

Cointegration Test

The use of non-stationary time series on the estimation and implication is not enough because the result will be specious. Nevertheless, in the case of cointegration, there is no problem of specious regression. Before the testing for existing relationships among variables for the cointegration, it should be known that the time series that are used on estimation are

integrated of the same order. The most used cointegration techniques are Engle-Granger and Johansen's cointegration. Between two techniques, Johansen's cointegration will be used rather than Engle-Granger because there are more than two variables and using Engle-Granger results in identifying only single relationships which might have many other relations.

The hypothesis for the Johansen cointegration test as follows:

Ho: no cointegrating equation.

H1: Ho is not true.

According to the theory of cointegration test, the test should be performed on the level form of the variables, not on the first difference or perform through log-transformation of the raw variables. As stated in the theory, log-transformation of raw variables will be applied in the testing for cointegration.

The Johansson cointegration test will results in two outputs, they are Trace statistics and Max statistics. And decision criteria for the test stated as:

- Rejection at the 5% level.
- Rejection of the null hypothesis if the value of the Trace and Max Statistics 5%critical value, or else fail to reject the null hypothesis.

The Vector Error Correction Model (VECM)

To estimate the VECM various statistical testing should be performed. Following are the

criteria that should be performed before estimating for the VECM:

- The series must be stationary at first difference i.e. I (1) at the same level.
- The optimal lag length should be determined through lag length criteria such as FPE, AIC, SC, or HQ for the model.
- The Johansen cointegration test should be performed on the basis of lag length criteria.
- In a case of cointegration test failing to reject the null hypothesis and statistically insignificant equation, then unrestricted VAR model should be estimated rather than VECM.
- In a case of cointegration test rejecting the null hypothesis and cointegrating equation is statistically significant VECM should be performed by reducing the number of lag lengths by 1.

- Afterwards, diagnostic tests should be performed in order to check the sensitivity of the test.

The VECM is based on following equations for the cointegrated variables:

$$\Delta Y = \beta_0 + \sum_{i=1}^{p} \beta_i \ \Delta Y_{t-1} + \sum_{j=1}^{p} \beta_j \ \Delta X_{t-j} + ECT_1 \mu_{t-1} + \varepsilon_t \ \ldots\ldots\ldots \text{equation (2)}$$

Where, Y_t and X_t represents relevant time series, Δ is the first difference operator, ECT_1 is error correction term, p is lag length and ε_t is a random error.

In case of the series are not cointegrated and are integrated of same order, granger causality test will be performed. For this testing, lag value will be decided based on vector autoregressive model. Granger causality test will be estimated based on following equation:

$$\Delta Y_t = \alpha + \sum_{i=1}^{p} \beta_{1i} \ \Delta Y_{t-i} + \sum_{j=1}^{p} \lambda_{1j} \ \Delta X_{t-j} + \varepsilon_{1t} \ldots\ldots\ldots\ldots \text{equation (3)}$$

$$\Delta X_t = \alpha + \sum_{i=1}^{p} \beta_{2i} \ \Delta X_{t-i} + \sum_{j=1}^{p} \lambda_{2j} \ \Delta X_{t-j} + \varepsilon_{2t} \ldots\ldots\ldots \text{equation (4)}$$

where, Y and X are the series variables, Δ is the first difference, ε_{1t} and ε_{2t} are random errors and uncorrelated.

Multiple Regression Analysis

The regression analysis has been applied in order to estimate the relationship between dependent and independent variables. The methods of ordinary least squares have been employed to estimate the causal relationship between variables. This analysis is based on following equation:

$Y_i = f(X_i \beta) + e_i$ Where, Y_i is function of X_i and e_i is an error term.

3. History of Political and Economy overview of Nepal

3.1 Overview of Nepalese economy

According to Osmani and Bajracharya (2007) the history of political and economic revolution of modern Nepal can be divided into four stages as follows:

I. Economy supported by dynamic development planning and dominated by the public sector and an autocratic Panchayat system with absolute monarchy (mid-1960s to 1980).
II. Introduced liberal Panchayat system and outward-oriented economic policies to encourage and promote exports for foreign buyers (1981-1990).
III. Restitution of multi-party democracy under a constitutional monarchy and economic liberalization, privatization and globalization (1991-2000).
IV. Power struggle between political parties and economic liberalization (2006 to present)

During the 18th century the kingdom of Nepal was formed when King Prithivi Narayan Shah integrated small states under his regulation. After the unification and economic integration, the Shah dynasty came to an end in power struggle with the emergence of Jung Bahadur Rana who initiated the system of hereditary prime minister in 1846. Such an inborn system of prime minister into the country had given rise to the Rana regime which continued for more than a century. During the autocratic Rana regime, Nepal was isolated from outside of the world economically and politically until 1951 when other countries such as the US, the UK and Japan were already moving towards economic growth. With the joint efforts of Shah kings and the citizens in 1951 announcing the emergence of modern Nepal which has played a vital role in the socio-economic development of Nepal. Afterwards, Nepal began the democratization and economic development process by introducing the first development plan in 1956. Also, the central bank of Nepal was established in the same year called Nepal Rastra Bank and started to print Nepalese currency in a few years of establishment. During the period, many state-owned industries as well as other banking and insurance companies were founded with the establishment of National Industrial Development Cooperation. Nepal started to implement the structural and economic reform program of the IMF and World Bank in 1985 to overcome the balance-of-payment crisis by accelerating economic growth (Shrivastav, 2008).

Maoist conflicts in Nepal between 1996-2006 had an impact on the economy as a whole, which caused the death of more than 13000 people and a huge damage to

infrastructures. The main objectives of beginning of Maoist insurgency were to eliminate the monarchy system, establish a people republic system and draft a new constitution for the country. Furthermore, their arguments were against unemployment, corruption, development failure, inequality between urban and rural life of people which led to civil war in the country in 2001. Due to all these instances, growth of Nepalese economy had stagnated. The highest measured GDP growth of the country in history was 8.6% in 1993, which declined to 3.2% in 1997. Further, it declined to 0.10% in 2001 when the situation was out of control because of increasing violence and strikes (Panta et. al. 2011) Such a state of the country led to the civil war which affected industries, businesses, development activities, tourism and hospitality sectors and many more. Also, it resulted in a decline in foreign aid and investments. The Maoist conflict ended in 2006 when the peace agreement was signed between the government of Nepal and Communist Party Maoist. With the peace agreement, economic growth of Nepal began to accelerate, and GDP growth accounted for 6.1% in 2007 (Panta et. al. 2011). Gradually every sector of the country began to perform better which contributed to enhance the overall economic growth of the country.

As the country was about to move towards development activities, a devastating earthquake hit the country in 2015, killing 9,000 people and injuring more than 22,000. In addition, more than 700,000 of homes were completely damaged and more than 300,000 homes were partially damaged. According to the reports of the Ministry of Finance (2015/16) devastating earthquakes have caused loss of 70 billion and 60 million USD, including 50 billion and 170 million USD and 1,890 million USD products. Because of the destructive earthquake in 2015, GDP growth in FY 2014/15 remained 2.32 which was 6.94% in the previous year (Ministry of Finance Nepal, 2016).

Throughout the years different types of political systems have been witnessed. Moreover, the political system is not stable because of power struggles between major political parties since 2006. Even Nepalese economy has been witnessing a gradual change with the changing political system from agricultural economy to semi-modern economy, it is still one of the least developed countries in the world.

At the present time Nepal has a system of five years government with a majority of 2/3, however Nepal totally lacks in economic revolution. For better economic development, a country requires economic transformation to continuously create new dynamic environments for interactions among market forces, innovation, industrial and commercial sectors, and stable government (Ocampo et al., 2009). Additionally, Scholars mentioned that

dynamic interaction in an economy is fundamental which entails strong government policies, active market and efficient social institution. Also, an economy can be considered as a healthy economy, if it has sustained GDP growth, low unemployment rate, stable inflation and interest rate. Even in today's globalized world, Nepal still lacks these indicators and has been slow in sustainable development procedure.

3.1.1 Economic Growth

The Nepalese economy ranked 5th among South Asian countries with 29.04 billion USD of GDP in 2018. Nepal is known as an agricultural country since long, however the contribution of the agricultural sector to GDP is gradually declining each year, whereas that of the non-agricultural sector is rising. The agricultural sector includes hunting, fishing, forestry, livestock production and cultivation of crops. The figure below shows that Nepal had an agriculture-based economy in the past with almost 69% of GDP share of agriculture in 1974/75. Over the periods of about 45 years, the share of agricultural GDP has declined to almost 24%. However, the value added by the agricultural sector to GDP is increasing in trend with 1.09 billion USD in 1975 to 7.35 billion USD in 2018. Throughout the years GDP share of non-agricultural sectors has inclined trend and already started dominating the agricultural sectors since 1980.

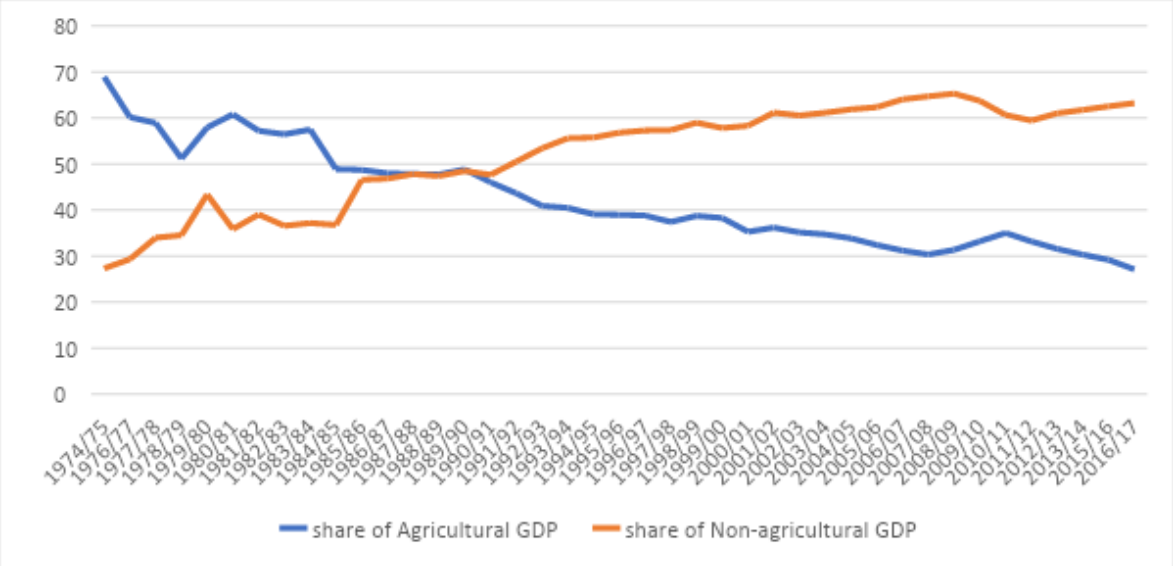


Figure 3-1 : GDP Share of Agricultural and non-agricultural sectors (% of total GDPs)

Sources: Author's Illustration (Ministry of Finance, Nepal)

The GDP growth of the Nepalese economy has fluctuated several times because of the unfavorable internal and external environment of the country. GDP of Nepal grew by 8.2% in 2017, which has decreased to 6.7% in 2018. The figure 2.2 shows that Nepal has witnessed very high growth as well as negative growth in terms of GDP from 9.7% in 1984 and -3% in 1983. Also, 8.2% in 2017 and 0.6% in 2016.

Figure 3-2: Annual GDP growth in %

Source: Author's Illustration (World Bank)

According to World Bank reports, Nepal's GDP per capita remains second lowest in the South Asian region with $1,034 in 2018, which was $911 in 2017. Further, the growth of GDP per capita was almost stagnated until 2000 with a small decline in some years. Nevertheless, the GDP per capita started to grow gradually after 2002, which represents that the living standard and wellbeing of the Nepalese people have been improving.

Figure 3-3: GDP per capita USD (Current prices)

Source: Author's Illustration (World Bank)

According to the figure 3-4, GDP per capita, Purchasing power Parity (PPP) was lowest in 1990 with $751.83 and highest in 2018 with $3,329.5. Over the period, the trend of PPP is in increasing trends however, it is very low among South Asian countries. In 2018, Nepal positioned in 7th for GDP per capita PPP with $3329.5 among South Asian countries whereas, Maldives has positioned into the first place with more than $18,945 which is almost 6 times higher than that of Nepal.

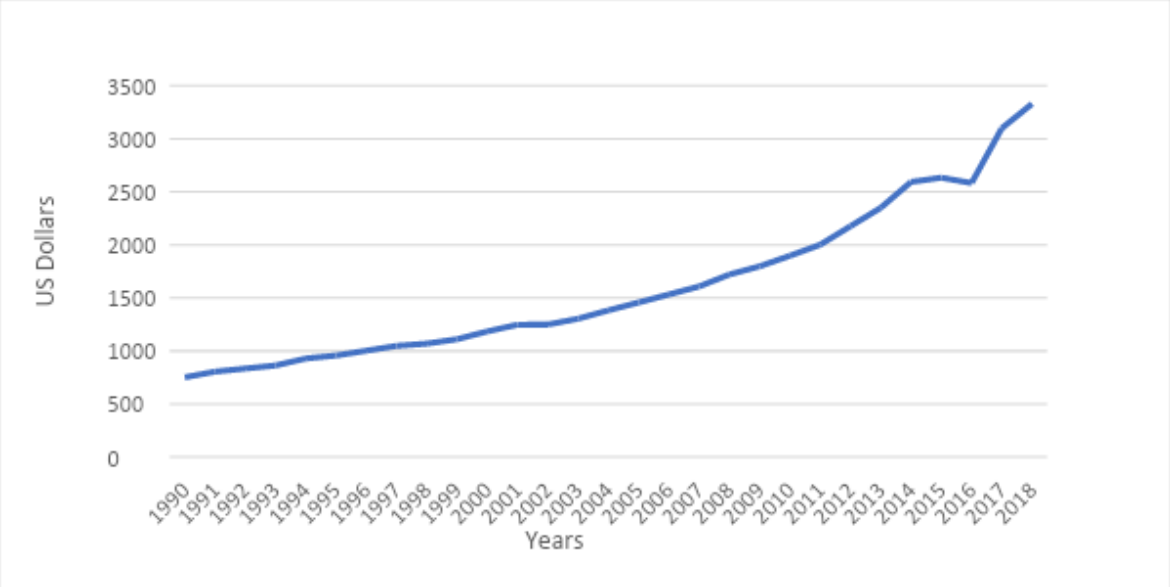


Figure 3-4: GDP per capita PPP in USD

Source: Author's Illustration (World Bank)

3.1.2 Trade Balance

Since very early period of time Nepal is heavily dependent on imports of basic consumer goods to refined petroleum, oil, gold, machinery, vehicles and so on. The main exports of Nepal are tea, coffee, textile, water, carpets, handicraft products and so on. The figure 3-5 shows the import, export and trade balance as % of GDP of Nepal. From this figure it is very clear that every year import is mounting whereas export is declining as a result the trade deficits are skyrocketing. The total import consists of more that 40% of GDP while export consists of only 2.8% of total GDP. Nepal imported more than 9.5 billion USD of products in 2017 which was 6.51 billion in 2016. However, it exported only about 804 million USD of products resulting in a negative trade balance of more than 8.5 billion USD in 2017. The major importing partners of Nepal in 2017 are China ($1.19B), India($6.05B), UAE($173M), Germany($186M), France ($154M) and so on. Similarly, exporting partners are India($432M), USA ($87.6M), Germany ($33.2M), Turkey ($54.1M), UK ($28.4M) and so on.

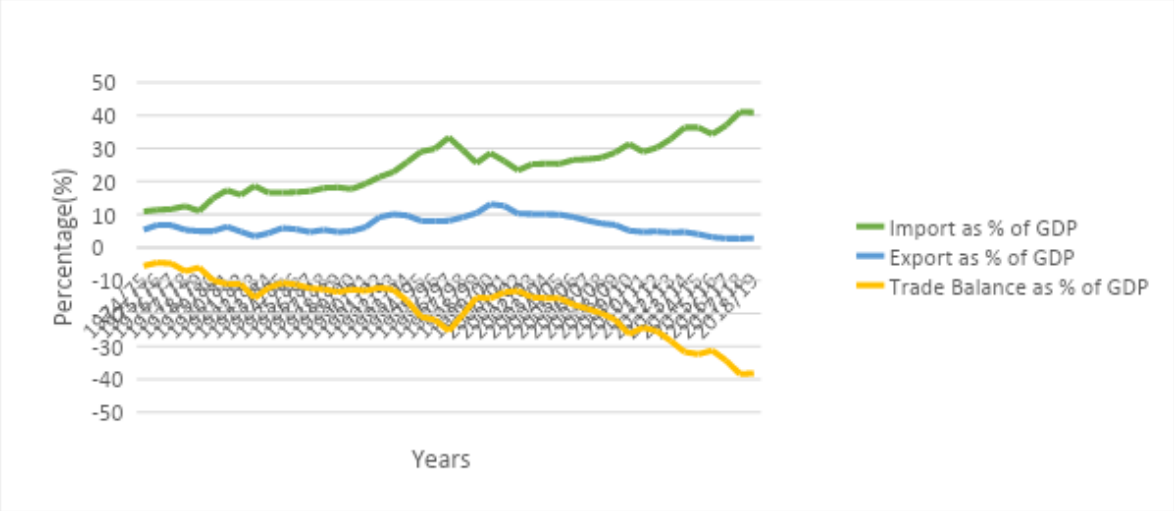


Figure 3-5: Import, Export and Trade Balance

Source: Author's Illustration (Ministry of Finance, Nepal)

There are many reasons why Nepal's trade deficits rising with its trading partners such as being a landlocked country, low export and high imports, low quality goods, higher cost of production, slow industrial growth, lack of exposure, lack of trade diversifications, inappropriate trade policy and so on (Acharya, 2019). It is very difficult for Nepal to reduce its rapidly increasing trade deficits until the country is adapting new trade policies, emphasizing in commodities structure, and quality productions, etc.

3.1.3 Employment

According to the report of the Central Bureau of Statistics of Nepal, the unemployment rate among the active population has decreased to 2.4% in 2018 from 3.2% in 2017. Table 3-6 shows that more than 70% of the active population are employed in the agricultural sector however, it has less than 28% of contribution to the total GDP in fiscal year 2016/17. Although industrial and services sectors accounted for less than 30% of total employment, it has more than 63% of contribution in total GDP of the country in fiscal year 2016/17. The figure indicates that non-agricultural sectors are more beneficial for the country's economy than agricultural sectors.

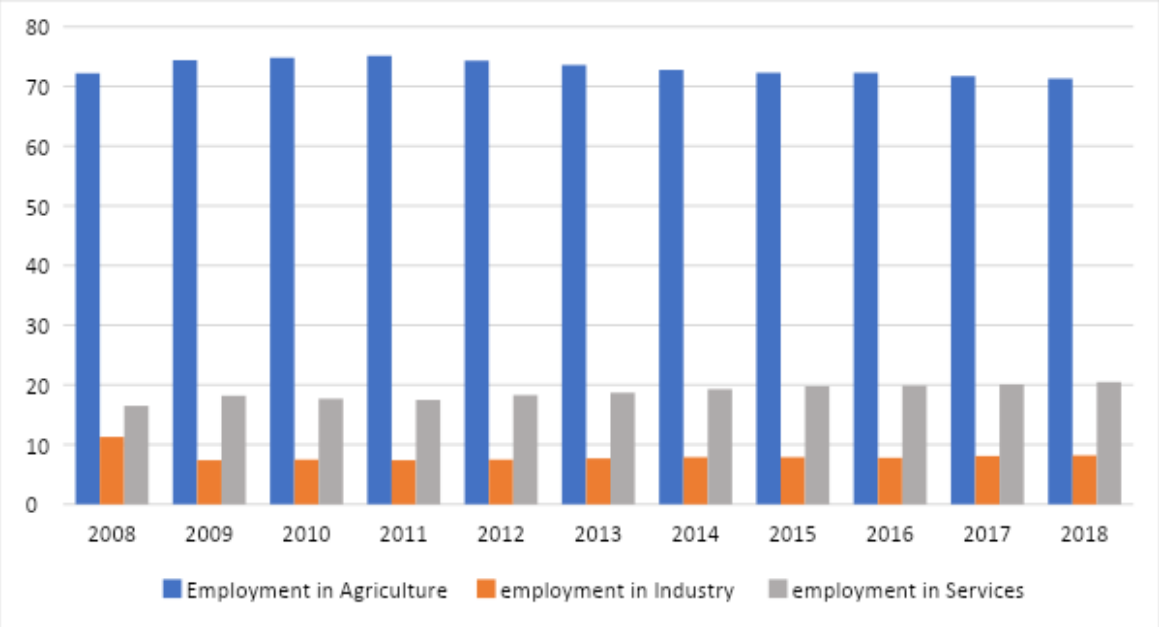


Figure 3-6: Sector-wise employment (%)

Source: Author's Illustration (WDI, World Bank)

Lack of modern agricultural infrastructure is the main cause behind the low productivity of agricultural sectors. Besides that, traditional way of farming, geographically difficult landscape, lack of proper irrigation systems, poor economic condition are the main reasons that the agricultural sector has very low contribution to the national economy.

3.1.4 Labor Migration and Remittance

These days it is very normal for Nepalese youth to migrate for employment opportunities to other countries. In recent years, remittance has become a major source of household's income for people living in rural areas of Nepal. Unfortunately, labor migration to abroad has become a major issue as it has shifted the agricultural economy to a remittance-based economy. The country is heavily reliant on remittances, which amount to as much as

25% of GDP in 2018 and the highest percentage of remittance recorded in fiscal year 2015/16 which accounted for 29.5% of GDP.

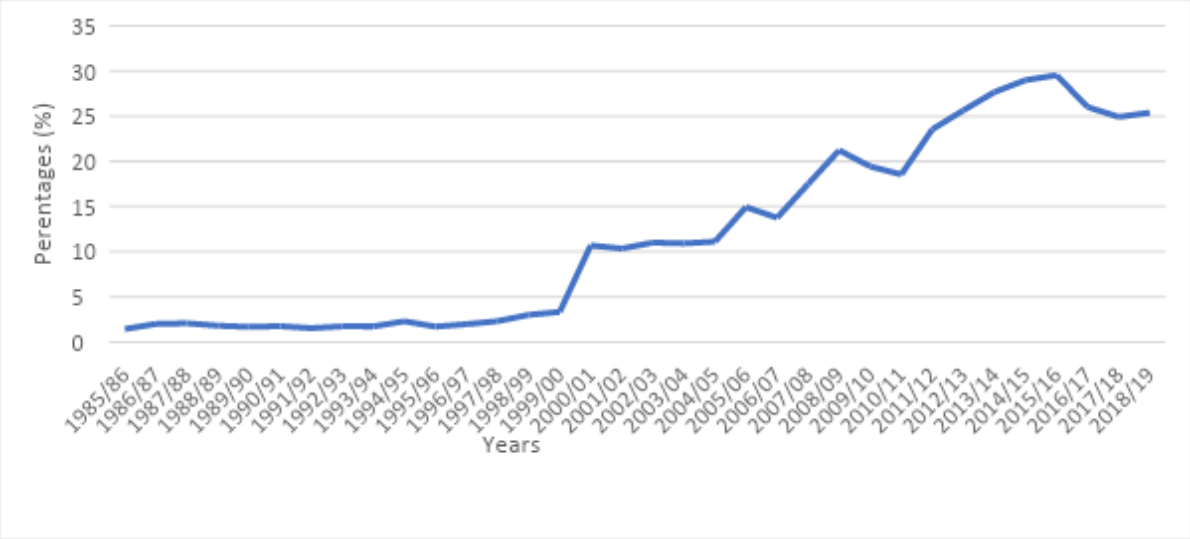


Figure 3-7: Total remittance inflow as % of total GDP

Source: Author's Illustration (Ministry of Finance, Nepal)

According to figures above until 1998, Nepal has less than 3% of remittance inflow, however afterwards the number of labor migration has increased rapidly. Ongoing armed conflict inside the country during that has displaced people from their residence to other countries and alternative means of employment are major reasons behind migration. According to Baruah & Arjal (2018), Nepal issued more than 3.5 million labor permits between 2008 to 2017 to migrant workers in Gulf countries. Furthermore, the highest amounts of remittance are received from South Korea, Australia, USA, UK, European countries and so on.

3.1.5 Gross Domestic Savings and Investment

Saving and investment are very essential macroeconomics components of an economy. The gross domestic saving is the value after reducing the final consumption from the GDP, which is expressed in percentage of GDP. It is generally accepted principles that increasing the domestic savings of the country leads to higher investment and contributes to GDP growth.

In the case of developing countries like Nepal, the gap between investment is rising because of the government's weak base in gross domestic and increase in fixed capital formation. According to the figure 3-8, in FY 2017/18, the gap between domestic saving and

investment was 37.5%, whereas it rose to 41.8%in FY 2018/19. In this way, it is clear from the figure 3-8 that the gap between investment and saving is rising negatively which become challenging for the government to fulfill the demand of increasing investment and unable to increase domestic savings to achieve higher economic growth in the country.

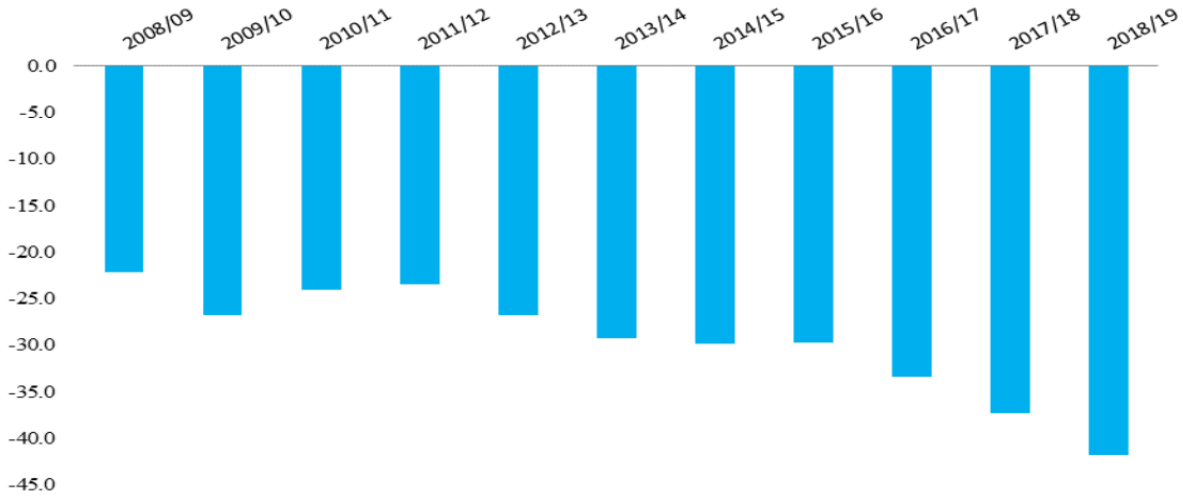


Figure 3-8:Gap between gross domestic savings and investment (as % of GDP)

Sources: Ministry of Finance Nepal, 2019

Also, the figure 3-9 shows fluctuation in the gap between gross national saving and the investment. In FY 2008/9, the gap between national saving and investment was approximately 4% of total GDP and reached to the highest of 6% in FY 2015/16. Afterwards, it's in a dramatic declining trend and reached a negative 9.9% in FY 2018/19. The main reason for the growing gap between national saving and investment negatively is that decrease in recent remittance inflows to Nepal as Nepal is a remittance-based economy. Also, the decrease in recent foreign investment to Nepal.

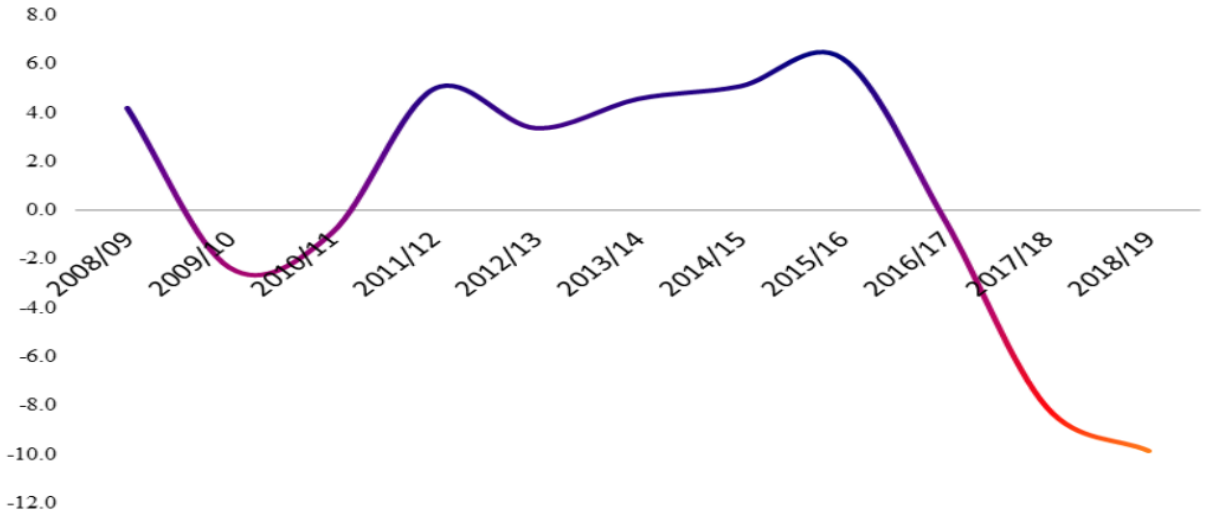


Figure 3-9 : Gap between Gross National Savings and Investment (as % of GDP)

Source: Ministry of Finance Nepal, 2019

3.1.6 Ease of doing business in Nepal

The Figure 3-10 below demonstrates the cost of doing a business report with ranking of the SAARC nations among 190 countries. In 2019, Nepal has been ranked in 110th position by scoring 59.6% among 190 countries and ranked 4th position among SAARC countries. However, Nepal was ranked in 105th position in 2018 and 3rd position in SAARC countries. Getting loans for business in Nepal is not an easy task which ranks 99th position and getting electricity for the business is costly ranking at 133rd position. As Nepal is working on improving their electricity services in terms of quality as well as cost which will help Nepal to score better in future. Even paying taxes in Nepal is expensive and dealing with construction permits is also difficult for a business.

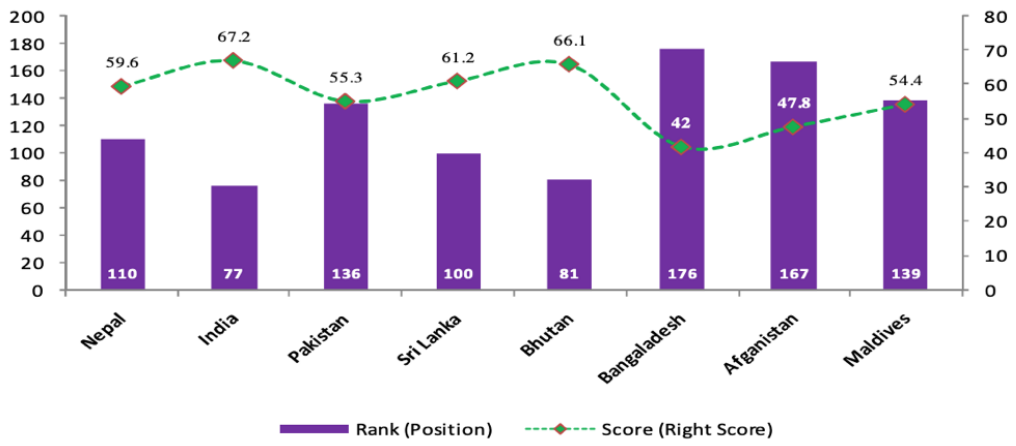


Figure 3-10:Cost of doing business in Nepal in 2018 (score in %)

Source: Ministry of Finance Nepal, 2019

Hence, Nepal is losing its position in terms of doing business reports as other countries are improving their position and scoring by facilitating in different sectors of the economy that are essential for establishing a business in a country.

3.2 Foreign Direct Investment

Foreign Direct Investment (FDI) plays an essential role in economic growth of a country. It is about the movement of capital formation which assists the potential investor to participate in the business accomplishment in other countries. Such movements allow one country to transfer technology and human capital to another country which enhances the

international trade integration, strengthens the enterprise development and creates a competitive environment into FDI receiving countries. According to Dunning (1993), there are three major common motives of the FDI in the world such as resource-seeking, market seeking and efficiency-seeking. Additionally, FDI also pursues strategic assets in the host country's economy for instance, brands, new technology and distribution channels. Mainly, emerging countries, developing countries and the countries that are in transition periods have begun to regard FDI as a source of economic development, modernization, income growth and employment (OECD, 2002). As mentioned in a report of UNCTAD (2004), various indicators of FDI has potential contribution or impact on an economy as follows:

- Technology and skills.
- Establishment of new industries and export promotions.
- Foundation of new groups as investors and built relationships with them.
- Modernization and improvement in local associated enterprises.

Table 3-1: The FDI Inflows by Region

Year	2014	2016	2017
World (USD Billions)	1324	1774	1746
Share in %			
Developed Economies	42.6	55.5	59.1
Developing Economies	53.2	42.4	37
Asia	34.8	29.5	25.3
South Asia	3.1	2.9	3.1

Sources: Author's Illustration (UNCTAD, 2017)

With rising globalization, FDI flows in the world have grown speedily particularly after the 1980s and remained significant in the recent years. According to the World Investment report published in 2017, FDI inflows in 2015 have a strong rise however, dropped in 2016. The FDI flows have slumped by $1.75 trillion which accounted for 2% of global FDI flows in 2016. The growing share of global FDI in 2016, developed economies consisted 59% in total inflows. The FDA inflow to developing economies in 2016 were distressing with a decline of 14% to $646 billion. Even the least developed country's economies remain unstable and low.

From the total FDI inflows in 2016, South Asia received only 3.1%. India is a leading country in terms of FDI inflows in South Asia followed by Bangladesh, Pakistan and Sri

Lanka. In comparison with other South Asian countries, the FDI position of Nepal is significantly low. Nepal's share of total FDI inflows in the world is only 0.01% which is very low.

3.2.1 History of Foreign Direct investment in Nepal

Nepal has always been struggling with sufficient funding sources to build better infrastructure. The economic development process in Nepal was started only after a new political regime in 1951. The first official record of FDI inflow to Nepal was recorded on 1951/52 when Nepal Commercial Corporation was formed as a joint venture with 67% of equity contribution from Indian investors (Aryal, 2009). To manage and measure the investment into the country, Nepal initiated its first five-year development plan in 1956. The country today is in its 15th development plan (2019/2020-2023/2024) which aimed to accelerate the development indicators by focusing on tourism, agriculture, roadways, hydropower, etc. (National Planning Commission, 2019).

Although Nepal was receiving FDI since 1951/52, there was not any policy and laws to regulate those FDI until 1991. During the 1980s, some proceedings were taken place to promote and encourage foreign investment and technology transfer. Also, Nepal Investment Forum was initiated in 1992, which was very successful in attracting foreign investment in Nepal (Department of Industry, 2005). The first FDI policy was initiated in 1992 with an objective to create a better environment for foreign investments. The policy also aimed at rearrangement or reform of the investment procedures to encourage more investment into the country (Aryal, 2009).The Foreign Investment and Technology Transfer Act 1992 denotes that "*the investment made by foreign investors in any industry as investment in share equity, reinvestment of the earnings derived from the investment in share equity and investment made in the form of loan facilities."* Additionally, the Act stated that the industries established with the foreign investment are also permitted to get all the facilities and incentives.

The figure 3-11 below shows that there are differences in approved FDI and actual withdrawal of investment. Until 2006/07 there was slow growth in FDI approval however, afterwards 2007/08 significant improvement has been witnessed. The end of a decade-long armed conflict and movement towards the peace process in 2008, Nepal has accelerated the FDI inflow which accounted for 23,7929 million USD in 2008/09. Devastating earthquake of 2015 has caused huge loss in the country, slacking the growth of the economy and the

country was in need of more investment to reconstruct its damaged infrastructures. As reconstruction of damaged infrastructure needed more investments in Nepal, more than 167,795 million USD was approved in 2017/18 which is the highest amount of all time.

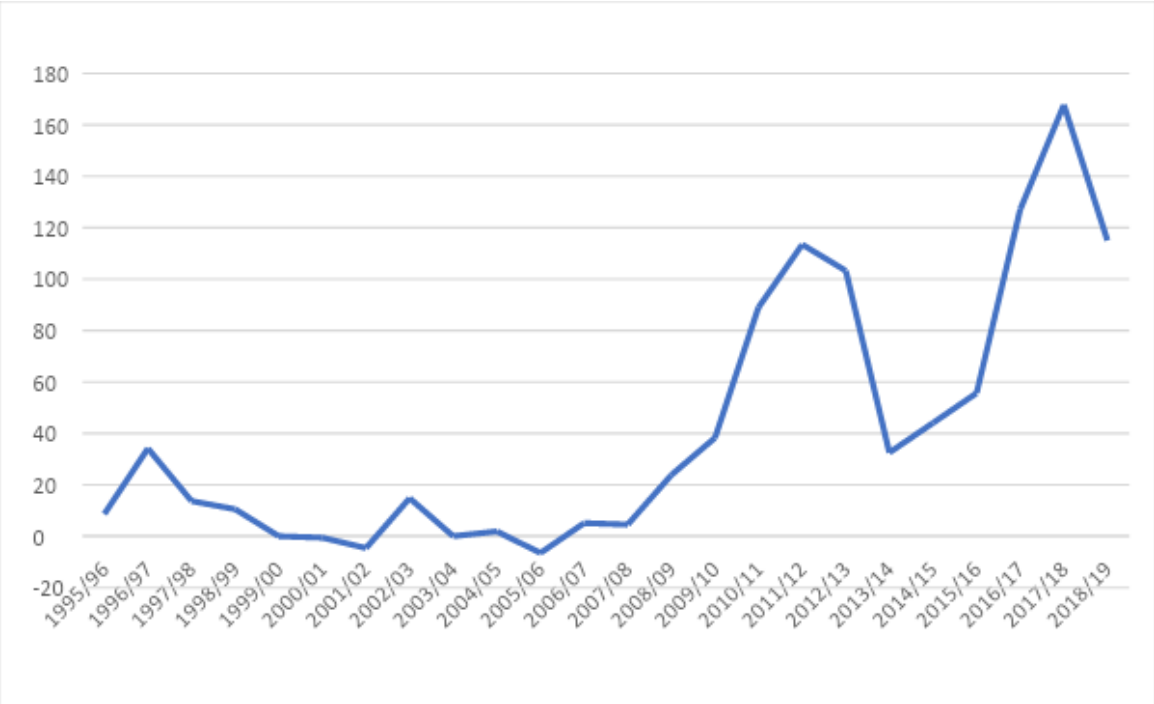


Figure 3-11: Foreign Direct Investment in Nepal, (USD in million)

Source: Ministry of Finance Nepal, 2019

Similarly, Figure 3-12 represents the trend of FDI as % of GDP in Nepal. It indicates that before 1996/97, FDI contributed to GDP almost 0.6% of total GDP and after it had dropped to negative value until 2001/02. Due to ongoing Maoist conflicts inside the country had distressed the whole economy during the time and thus there was a decrease in FDI inflows. The FDI has contributed towards the GDP significantly after the peace agreement in 2008, which accounted for more than 0.6% of total GDP. Even after the peace agreement, there was huge disagreement among political parties in the country which created insecurity among investors and caused a drop in the FDI inflow after 2012/13. Further, when the earthquake hit the country in 2015, FDI inflows started to escalate which contributed to reconstruction of infrastructures in various sectors.

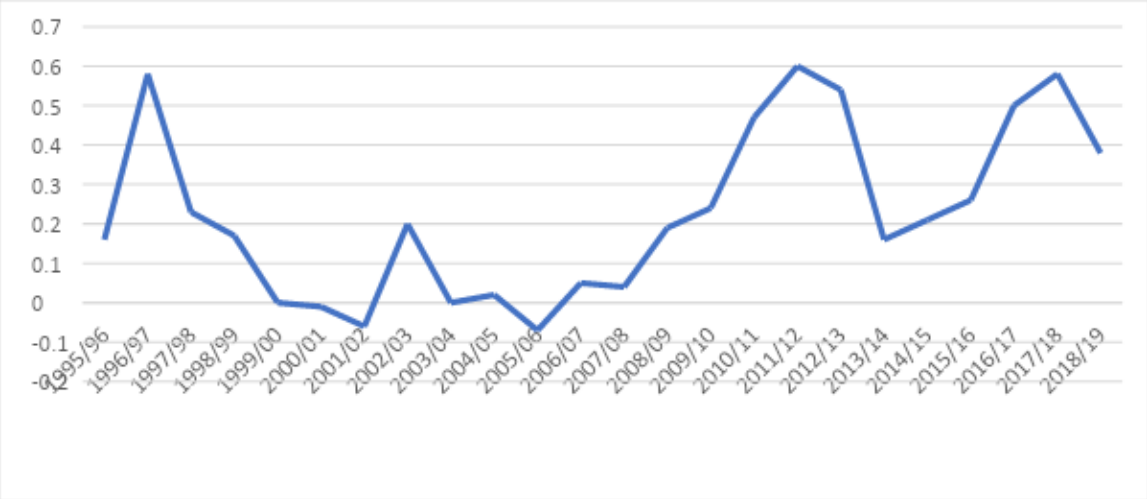


Figure 3-12: Foreign Direct Investment in Nepal (as % of GDP)

Sources: Ministry of Finance Nepal, 2019

In the case of least developed countries like Nepal, which has a huge gap between saving and investment, it's really crucial to have FDI as a means of financing into development activities. Such a circumstance within the county led to limiting the ratio of GDP and foreign aid inflow. Traditionally, FDI is considered as investment in manufacturing and services sectors from abroad however, it has also contributed to employment opportunities and economic growth of the country as a whole. Therefore, host countries are attracting more financing from developed countries to accomplish investments in large scale projects. Although Nepal is getting FDI in many sectors, due to lack of resources and requirement of huge financing in infrastructure has become an essential matter (Adhikari, 2013). Also, FDI plays an important role in transfer of technology from technologically advanced economy to poor economy. With financing, various managerial knowledge and leadership skills are being transferred by foreign investors to the host countries which can also be considered as a positive influence of FDI. Therefore, in a case of least developed countries like Nepal, FDI is considered as means of higher production, higher export, easy access to the foreign market, foreign currencies, important source of financing, etc.

3.2.2 FDI by sectors in Nepal

The major sectors of Nepal are highly dependent on foreign assistance or investment. As Nepal lacks in capital, skilled manpower, and technology to invest in large infrastructural or development projects. The table 3-2 illustrates the total amount of contribution, number of projects and percentage of FDI in different sectors of Nepal in FY 2018/19. The most attractive sector for FDI in Nepal is energy-based with 81 projects and a share of 42% of

total FDI with an amount of 1086.17 million USD. Additionally, FDI in the manufacturing and services category seems to show an almost equal contribution of 18.6% and 19% with 479.20 million USD and 482.32 million USD respectively. The highest number of projects are included in the service sector (1610) of the country followed by tourism sector (1503). Although the highest number of populations are involved in the agricultural sector, 284 projects are included and consist only 2% of total FDI. Furthermore, the tourism sector of Nepal is very important as it has contributed almost 8% to GDP of the country in 2018. In terms of FDI tourism sector is 4th attractive sector of Nepal with more than 1500 projects and share of 14% of total FDI. Also, the construction and information technology sectors are least attractive sectors for FDI with 1% and 0.4% of total share respectively.

Table 3-2: Sector-wise FDI in Nepal Up-to FY 2018/19 (USD in million)

Category	**No. of Projects**	**Total amount of FDI**	**% share of FDI**
Agriculture and forest based	284	57.99	2.0%
Construction	46	26.17	1.0%
Energy based	81	1086.17	42.0%
Information Technology	59	11.24	0.4%
Manufacturing	1167	479.20	18.6%
Mining	72	70.00	3,0%
Services	1610	482.32	19%
Tourism	1503	363.275	14.0%
Total	**4822**	**2576.37**	**100%**

Source: Own calculation (Department of Industry Nepal, 2019)

Overall, Services have the highest number of projects followed by Tourism. Number of projects under Manufacturing seems to be in the middle. Agricultural and forest based seems to have more projects than that of construction, Energy based, Information Technology and Mining combined; totally to 258 projects whereas agricultural and forest based solely accounts for 284 projects. Construction seems to reside as the least sector to receive the numbers of projects compared to other sectors of the economy.

Although Energy based seems to be the one with a high invested sector, the number of projects with high investment in this sector might be that; energy being required in all above categories, in at least one of their processes.

3.2.3 Country wise Foreign Investment in Nepal

In FY 2018/19 Nepal received a total of 2599.1720 million USD of FDI from various countries in the world. China including Taiwan is on the top with the highest numbers of projects and FDI than any of the other countries in the table below which accounted for 42% of total FDI inflows to Nepal. Similarly, India is at second position in terms of FDI inflow to Nepal with 781 projects and the amount of FDI (832.841 million USD) which covered 32% share of total FDI. The UK is the third biggest country to invest in Nepal with 5% of total FDI followed by South Korea with 4%. Moreover, South Korea invested in 354 numbers of projects but invested only 109.059 million USD, however the UK has invested 119.903 million USD in 196 numbers of projects. From this evidence, it is clear that the UK is investing in bigger projects than South Korea.

Table 3-3: Top ten countries foreign investment in Nepal FY 2018/19 (USD in million)

S. N	Country	No. of Projects	Total FDI	% shares of total FDI
1	China (including Taiwan)	1556	1091.70	42%
2	India	781	832.841	32%
3	UK	196	119.903	5%
4	South Korea	354	109.059	4%
5	USA	413	80.201	3%
6	Singapore	51	39.976	2%
7	Mauritius	11	30.395	1%
8	Japan	272	27.224	1%
9	UAE	20	26.42	1%
10	Switzerland	60	25.840	1%
11	others	1108	215.606	8%
	Total	**4822**	**2599.1720**	**100%**

Source: Department of Industry, 2019

From the table 3-3 it is clear that China and India have contributed mostly in the overall development of Nepal with the highest percentage of share in total investment in comparison with other countries. Being a neighboring country, China and India have played an essential role in determining more investment from their country. However, in the case of India, Nepal shared common traditions since ancient times and has special trading relationships. Further, the trade agreement signed between Nepal and India in 1996 was the foundation for an open trade relationship which allowed both countries to provide duty-free

access to each other's market. Being a landlocked country, it was a great opportunity for Nepal to connect with other markets to import and export products. Along with FDI from major countries, other countries also played an important role in FDI inflow to Nepal as it contributed 8% of total share with more than 1100 projects which cost at 215.606 million USD.

3.3 Acts and Policy for FDI in Nepal

The first FDI policy was initiated in 1992 with an objective to create a better environment for foreign investments. The policy also aimed at rearrangement or reform of the investment procedures to encourage more investment into the country (Aryal,2009). Along with the liberalization process in the mid-1980s, Nepal took an initiative to attract FDI to fulfill the resource gap in the formation of private capital. Foreign investment and Technology Transfer Act of 1982 was legalized for the encouragement of foreign investment in Nepal. In 1992, a new law on foreign investment and technology transfer was legislated to facilitate the liberalization process of the 1990s. Then, Nepal became a member of the World Trade Organization (WTO), the Bengal Bay initiative for BIMSTEC intersectoral technical and economic cooperation, the South Asian Free Trade Agreement (SAFTA) and the Multilateral Guarantee Agency (MIGA) investment (Investment Board of Nepal, 2019). Nepal has signed a bilateral investment protection and promotion agreement (BIPPA) with six countries (India, France, Germany, UK, Maturities and Finland) and a double taxation agreement with ten countries to gain access to neighboring and global markets. The Investment Board Act of 2010 was enacted on the basis of the Investment Board.

The Government of Nepal introduced a new foreign investment policy in 2015, replacing the 1992 policy with the aim of making the economy more dynamic and competitive to maintain the trade balance through export promotion and import management (Investment Board of Nepal, 2019). Also, by attracting foreign investment, technology, skills and knowledge in major sectors. The new policy takes into account the changing context of portfolio investment, non-Nepalese investments, special economic zones, labor relations problems and mobilization of debt instruments in national and foreign currencies. The main purpose of foreign investment policy to achieve and create sustainable economic growth, employment, attract more investments in regional and national development, fill the gap between growing demand for investment, increased domestic production and productivity.

Likewise, to establish Nepal as an attractive destination for foreign direct investment through creation of a conducive environment.

4. Literature on Foreign Direct Investment

In recent years FDI has become crucial for the infrastructure development of developing and least developed countries. And issues related to FDI are being important topics for the discussion at national and international level as it has played a vital role in economic growth of the country. Every year, many researches and investigations on FDI are being done in order to develop new theories. Mainly, the theories related to FDI were developed by J. Dunning, R. Vernon and S. Hymer, and emphasize that FDI is more important for economic development of developing countries than any other countries in the world. According to a macroeconomic viewpoint, FDI is considered as a creator of employment opportunities, high productivity, competitiveness, transfer of technology and that is the main motivation for investment (Denisia, 2010).

The main two economic theories of modernization and dependency shows the relationship between FDI and its impact on economic growth (Khatun and Ahamad, 2015). The modernization theory clarifies that FDI is essential to expand the economic growth on the basis of capital investment into the different sectors of the economy. In terms of developing or LDC, FDI is considered as a main source of technology transfer from the developed countries to promote their domestic industries. Due to the insufficient available resources, developing or LDC are lacking in development of large infrastructure, also facing problems like political and economic instability. Adams, 2009; Balasubramanyam et al., 1996, argued that FDI is not only transferring the financial investment, however it is also transferring the managerial skills, knowledge, marketing expertise and various opportunities to access the market.

On the other hand, scholars such as (O'Hearn, 1990) who supported the theory of dependency believed that FDI inflows show a negative relationship with economic growth in the long run. Further the scholars added that, after World War II the First World countries became wealthier by mining the various natural resources from the Third World countries. During the time, developing countries weren't rewarded effectively for their natural resources which led to poverty in those countries. The academics found that the main reason for capitalism is division of labor at global level. Therefore, FDI can promote existing income inequality, which can have a negative impact on the economy in the long run.

Apart from above mentioned reasons, there could also be some more reasons which show a negative relationship between FDI and economic growth. For instance, foreign investment in different sectors of an economy can reduce the production level of existing domestic firms

by creating competition in the market. Due to firm-specific advantages, foreign firms distinguish themselves from domestic firms by establishing themselves in higher productivity and creating a competitive market. And it leads to rise in cost of domestic firms and decrease in production level (Herzer, 2012). Additionally, if a case of foreign firm may not be willing to share firm-specific knowledge and skills then it may have a negative impact on domestic firms as domestic firms may lack in advanced technology and skilled workers (Herzer, 2012). Thus, FDI has positive as well as negative impact on an economy according to its various indicators. According to the definition of OECD (2002) some of the pros and cons of FDI inflows in an economy are as follows:

- **Pros**
  - FDI contributes to income growth and productivity level that leads to poverty reduction.
  - FDI inwards in an economy contributes towards their further integration in the global economy by enhancing foreign trade.
  - Standardization of products and services.
  - Transfer of technology, skills and knowledge will allow developing or least developed countries to grow their efficiency in use of resources and that can contribute to economic growth.
  - Enhancement of human capital through the shared managerial knowledge, skills and social responsibility measures.
  - Increase in employment opportunities which improve the living standard of working-class people.
- **Cons**

  - Outflows of the capital of the host country as a profit repatriation.

  - FDI inflows in a country may create competition, which increases the cost of domestic firms and can cause destruction of the domestic market or displacement of local businesses.

  -In a case of FDI inflow in industrial or some construction projects that may cause pollution, loss of natural resources and other environmental issues.

The relationship between FDI and economic growth has been significantly studied and it is still debatable subjects among scholars. Because according to the infrastructure, human capital and domestic policies to promote the FDI and trade, the empirical results across

countries are different. Some of the studies in the literature have shown a direct relationship between FDI and economic growth whereas some others have emphasized the contrary relationship. Moreover, most of the studies have focused on the overall analysis of FDI and its impact on economic growth along with various independent variables. Nevertheless, FDI in specific sectors such as power and energy and its impact on economic growth are least studied empirical literature.

Almfraji, Almsafir and Yao (2014) has examined the relationship between FDI and economic growth on Qatar's economy by using time-series data between 1990 and 2010. Scholars have used Vector Auto-Regression (VAR) and Granger causality tests which showed significant impact of FDI in economic growth of Qatar in the long-run. In the context of China, Zhao and Du (2007) assessed a unit root test, the vector error correction model (VECM), Augmented-Dickey -Fuller (ADF) test, and co-integration test and found insignificant causal relationship between FDI and economic growth for the period between 1985 and 2003. Furthermore, Belloumi (2014) studied the data from Tunisia for the period 1970-2008. The researcher applied ARDL bounds testing technique to study the relationship among economic growth, FDI, trade openness and found that there is no significant causality between economic growth and FDI. In the case of Bangladesh, Khatun and Ahamad (2015) applied Granger causality test and couldn't find causality between FDI in the energy sector and economic growth in the long-run as well as in the short-run.

Among the various economics literature, the research initiated by Kraft and Kraft (1978) found the strong relationship between energy consumption and economic growth in the United States for the period (1947-1974). On the one hand, the Neoclassical economists Berndt (1980) and Denison (1979), claimed that energy is not the substantial factor that causes economic growth based on the assumption that energy affects economic growth only in certain ways. On the other hand, scholars such as Ayers and Nair (1984) suggested a model where energy was emphasized as the main factor of production based on the Laws of Thermodynamics. Also, other scholars, such as Cleveland et al. (1984), also found significant evidence about the relationship between economic production and energy and supported their model. Furthermore, Stern (1997) also considered energy as a vital factor in production.

In a case of linkage between energy consumption and economic growth, the study carried by Ozturk and Acaravci (2010) applied the ARDL technique and Granger causality tests in Turkey period between 1968-2005 and revealed that there is a relationship among

economic growth, employment rate and energy consumption; whereas carbon emission and energy consumption did not show causality with economic growth, employment rate shown a causal relationship with economic growth. Moreover, Shahbaz, Zeshan and Afza (2012), studied the relationship between renewable and non-renewable energies and economic growth for the period 1972-2011 using the data from Pakistan. The researchers applied ARDL and Granger causality tests and found that there is a long-run causal relationship between energy consumption and economic growth.

Latief and Lafen (2019) has empirically analyzed the causality among the FDI in the power and energy sector, the energy consumption and the economic growth of Pakistan for the period 1990-2017. The Granger causality tests, and Johansen cointegration were applied to find the causal relationship among variables in short-run as well as long-run and found a positive bi-directional short-run causal relationship between economic growth and energy consumption. Also, indicate the presence of long-run causality in the equation of energy consumption. Similarly, Dhungel (2008) has empirically examined the causal relationship between per capita consumption of energy and per capita real GDP for the period between 1980 to 2004. The co-integration and vector error correction model were applied and found that there is unidirectional causality running from consumption of energy to real GDP and electricity consumption.

5. Energy Sector of Nepal

The Government of Nepal has categories its energy sectors in three major sources according to its nature such as traditional, commercial and renewable sources.

5.1 Traditional Sources

The biomass is known as traditional sources of fuel in Nepal, which includes firewood, animal waste and agricultural residue which accounted for 70.25 % of total energy consumption in FY 2017/18. Figure 5-1 shows consumption of three traditional sources, firewood is most consumed fuel throughout the years and highest consumed in FY 2017/18 which accounted for 8604 tons of oil equivalent. And second highest consumed traditional source is animal waste and the least consumed source is agricultural residue throughout the years. More than 80% of the population in Nepal are living in rural areas and involved in Agriculture and thus consumption of biomass is significant.

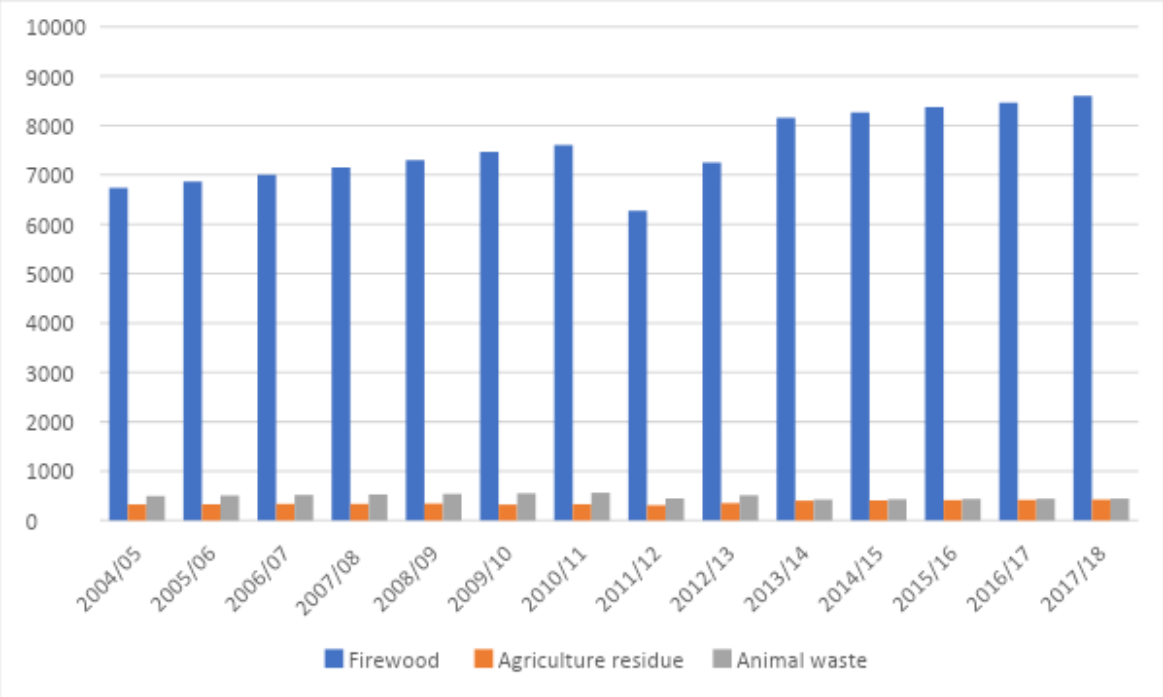


Figure 5-1: Consumption of Traditional Energy Sources in Nepal (in tons of oil equivalent)

Source: Author's Illustration (Ministry of Finance Nepal, 2019)

The lack of development in other alternative energy and overall poor economic condition are the main reasons for the severe consumption of traditional fuel sources. Additionally, continuous consumption of firewood as a main source of energy in the country is threatening the extinction of forest resources and 44000 ha of forest area is estimated to be deforested annually. Furthermore, increasing consumption of animal waste or agricultural

residue, resulting in the degradation in fertility of the agricultural land and environment pollution (Government of Nepal, n.d.).

5.2 Commercial Sources

The commercial sources of energy in Nepal includes petroleum products, coal and electricity. The petroleum products and coal are fully imported from India and least from China as Nepal doesn't have any reserves of the petroleum products. The consumption petroleum products include petrol, diesel, aviation fuel, kerosene, LPG which consisted of 2388.41 tons of oil equivalent in FY 2017/18 and highest consumed commercial energy source during the years. Similarly, coal is the second highest consumed commercial source of energy and followed by electricity consumption which consisted of 761.87 and 564.63 tons of oil equivalent in FY 2017/18. Regarding the electricity, partial consumption is imported from India which accounted for 221.99 tons in 2017/18 whereas remaining electricity is domestically produced (NEA, 2018/19). It is clear from the figure 5-2, consumption of all the commercial sources of energy are increasing in trend during the years. However, the growth in consumption of coal and electricity is very slow.

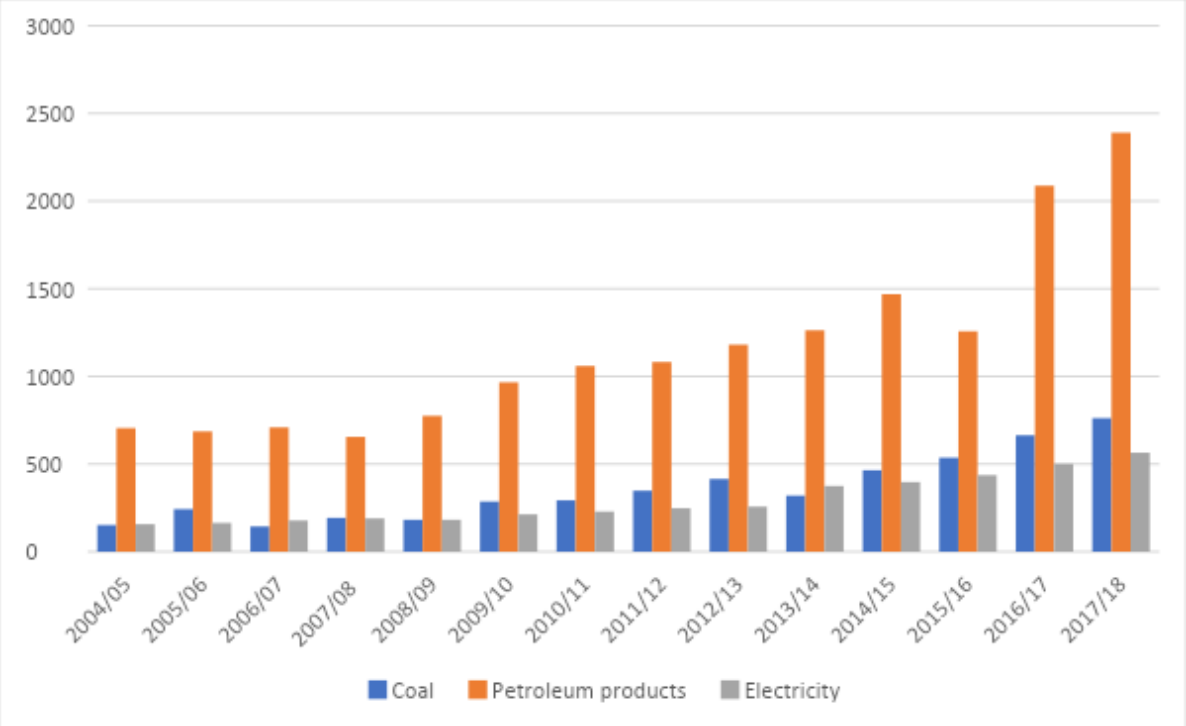


Figure 5-2 : Consumption of Commercial Sources of Energy in Nepal (in tons of oil equivalent)

Source: Author's Illustration (Ministry of Finance Nepal, 2019)

5.3 Renewable Sources

Renewable energy sources include solar-power, wind power and biogas power plants. The figure 5-3 shows a rapid increasing trend of consumption in renewable energy until FY 2013/14, however afterwards consumption has been constant. The highest consumption of renewable energy was in FY 2017/18 which accounted for 296.31 tons of oil equivalents. By mid-March FY 2018/19 36% of the population has consumed clean renewable energy as 26.5 MW of electricity have been generated form the solar, wind power and extra 3414 biogas plants have been installed (Economic Survey, 2018/19). All the renewable energy sources are domestically generated.

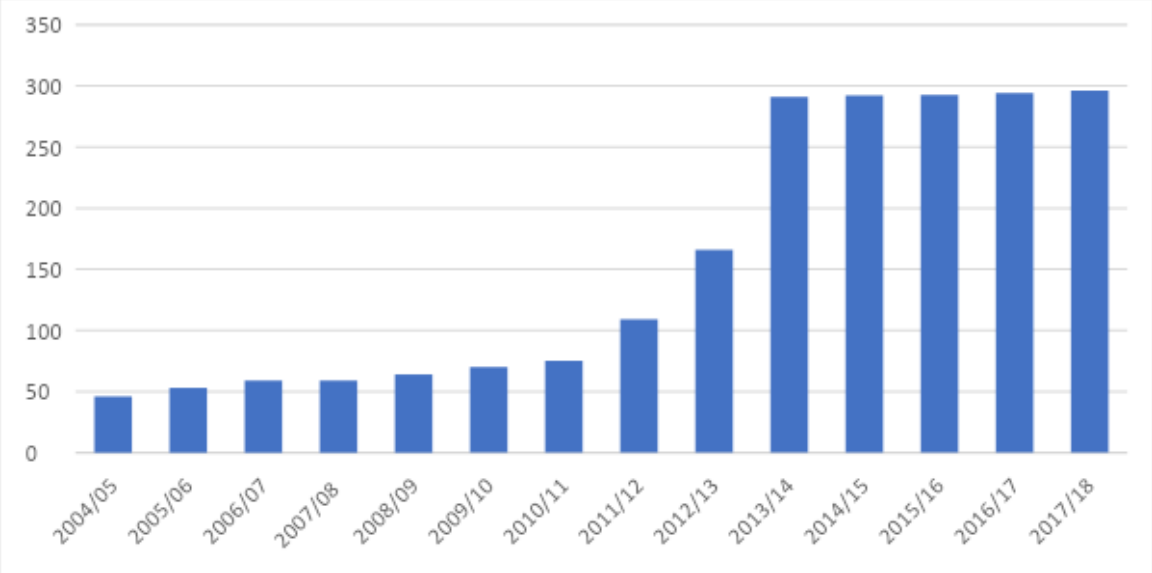


Figure 5-3: Consumption of Renewable Energy (in tons of oil equivalent)

Source: Author's Illustration (Ministry of Finance Nepal, 2019)

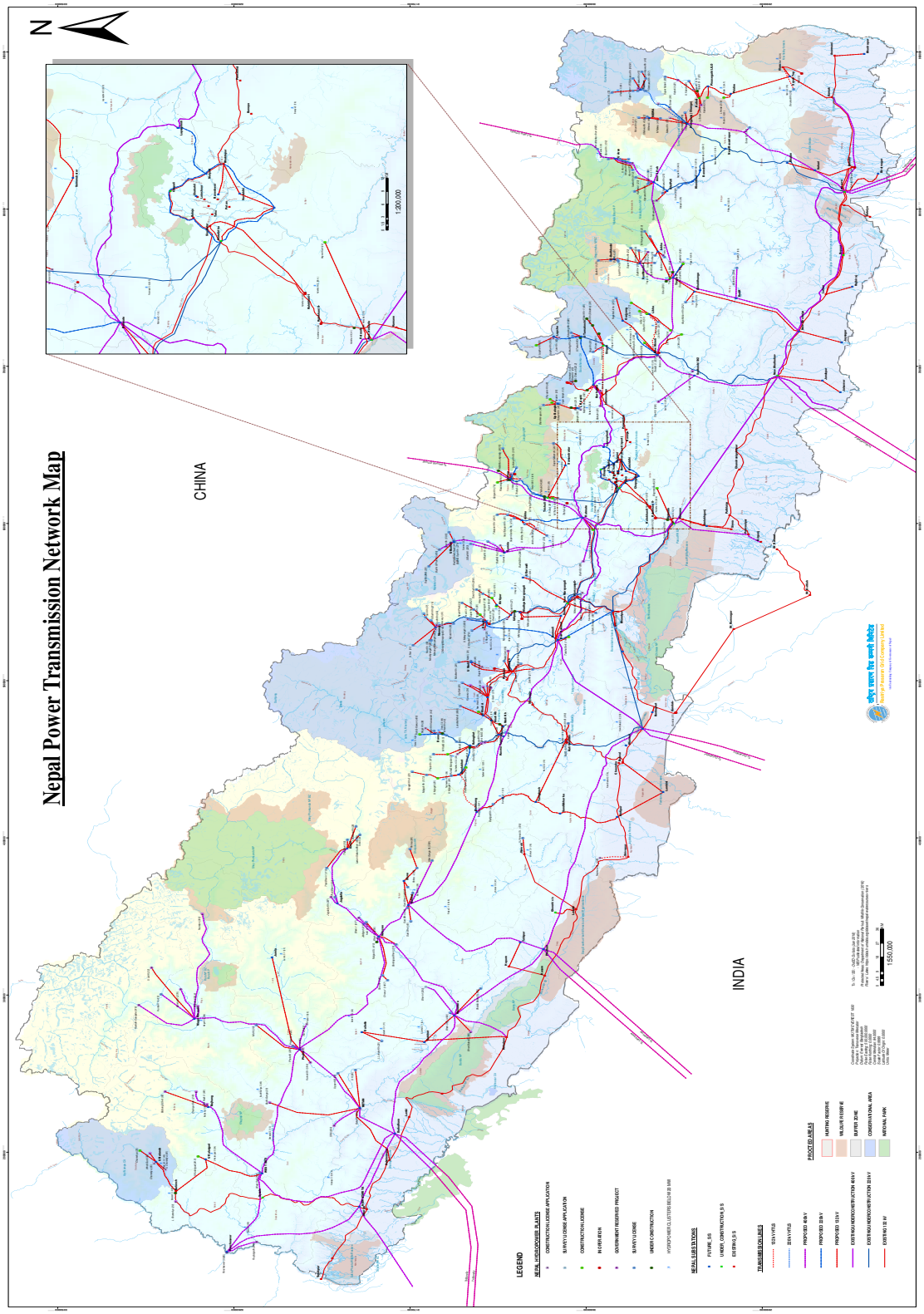
Table 5.1 Status of Alternative Energy installation in Nepal

Major programs	2007/8	2008/9	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
Electricity Generation through Small and Micro-hydro Electricity Projects (KW)	795	1193	1695	2453	3258	3366	3288	3346	1910	1245	1249
Installation of Household Solar System (Number)	34755	60502	36135	57059	35627	96495	87038	103161	56770	16084	76367
Installation of Solar Pumps (Number)	379	596	338	272	202	140	202	30	11		51
Installation of Bio-gas Plant (Number)	14884	19479	19511	17907	18979	17635	31512	30078	16706	20536	17258
Installation of Improved Water Mills (Number)	1346	1168	986	353	971	1256	341	641	673	160	203
Installation of Improved Cook Stoves (Number)	39602	53595	87154	84168	118461	120364	140662	310281	51211	60555	37787

Source: Ministry of Finance, 2019.

The table 5.1 shows the status of alternative energy installation with various modes of source. Major alternative sources of energy in Nepal are the household solar system, improved cook stove and bio-gas plant followed by small hydropower plants, improved water mills and solar mills. Among the various renewable energy sources, the highest number of improved cook stoves has been installed throughout the years followed by installation of biogas plants and household solar systems. It is also possible to see from the above table that Nepal has potential in generating power from various sources.

6. Nepal Hydropower Transmission Network



Source: Ministry of Energy, Water Resources and Irrigation Nepal, 2018.

6.1 Law for FDI in Hydropower Development of Nepal

Being a least developed country, Nepal has understood the importance of FDI for the development of infrastructure in the energy sector which required huge financing. Hence, the Government of Nepal has issued sub-legislation governing licenses, the grants of financial incentives, and provision of foreign exchange facilities for mega projects like hydropower. Even in the budget proposal of FY 2015/16 the government has endorsed the development of a master plan for a regional transmission line. Additionally, to encourage the investment in the hydropower sector the government has prioritized the importance of employing Public Private Partnerships (PPPs) to construct transmission lines on a transfer model. Furthermore, the government is focusing on multi-purpose projects aimed at achieving energy independence by the end of FY 2022/2023.

The several mega hydropower projects in Nepal which are in early stage of development and have the possibility to generate over 500 MW are being developed under the mandate of Investment Board Nepal (IBN). To tackle the shortage of electricity in the country, the IBN and other government bodies have moved forward to mega hydropower projects and various incentives schemes are being initiated to attract more FDI. In order to facilitate regional trade, Nepal has signed a Power Trade Agreement (PTA) with India and Bangladesh, paving the better way of flowing electricity as a cross-border commodity. To build the Upper Karnali Hydropower Project (900 MW), IBN has signed a Project Development Agreement (PDA) with private investor, GRM Ltd in 2014. Also, IBN has signed another PDA with an Indian government body to develop Arun III Hydropower Project (900 MW). These two mega projects are aimed to export electricity in India and Bangladesh and the cost of projects are expected to exceed 2.5 billion USD (IBN, 2019).

6.1.1 Hydropower Development Process

According to IBN, in order to get the permission for development of hydropower plant in Nepal with more than 1 MW of installed capacity required to fulfil following stages:

I. **Survey License:** The main purpose of this license is to assess the overall project site and its feasibility study for further preparation. It is also obligatory for the study of production, transmission and distribution of electricity. The validity of this license is up-to five years.

II. **Production License:** After feasibility study has been completed, Production License is needed to operate a production facility which includes feasibility study

report, partnering companies in the project, financing approach, and details of PPA. The validity of this license is maximum 50 years.

III. **Transmission License:** It is required in order to build a transmission facility. All the documents that are prepared during Production Licensing must be submitted to issue a Transmission License and this license is valid up-to 50 years.

IV. **Distribution License:** This license is crucial in order to construct and operate distribution facilities of hydropower. Also, it is certified for a maximum 50 years.

6.1.2 Nepal Hydropower Development Policy

Nepal has initiated Electricity Act and Electricity Rules in 1992 and 1993 respectively, in order to govern the survey, production, transmission and distribution of electricity. For the people who want to develop above 1 MW of hydropower must go through the Electricity Act and Rules to get the license, whereas up to 1 MW doesn't require license for the survey, production, transmission and distribution. Also, it prioritizes standardizing and efficient precautions of electricity services.

To address the growing demand for hydropower, the Hydropower Development Policy (HDP) was established in 2001. This policy incorporates issues related to electricity demand of private sectors, reasonable pricing, needed to create employment opportunities, the necessity to rural electrification, investor friendly policy to support hydropower export and so on. The main objective of the policy is to keep efficient cost of electricity by reducing cost of production, distribution of quality electricity services, expansion in use of hydropower in rural areas of the country.

Nepal's hydropower development policy states that the production and consumption of electrical power in the country is nominal. Still, the main sources of energy remain agriculture and forest resources. Despite having abundant possibility of producing hydropower as a renewable energy source, it has not been used to the extent desired. Additionally, industrial enterprises have not developed as needed due to the lack of electricity. A timely hydropower policy is therefore seen as a prerequisite for the supply of energy at a reasonable price, which plays a fundamental role in the development of rural electrification, domestic energy supply, job creation and development. industrial companies.

In 2014, South Asian Association for Regional Cooperation (SAARC) Framework on Energy Cooperation came into force which allows its related institutions in member countries to develop transmission interconnectivity within the region to allow power trade

with each other. After this framework came into force, Nepal signed PDA and PTA with India in order to build mega hydropower projects with an aim to supply power to Indian market. In 2018, Bangladesh has also signed a memorandum of understanding with Nepal and Indian GRM company to import 500 MW of power through a cross-country grid (IBN,2019).

6.1.3 Royalties for Hydropower Generation in Nepal

A hydroelectric generator pays the license fee to the Nepalese government as shown in table 6-1 and 6-2 for internal consumption as well as for export-oriented projects correspondingly after the power generation begins. However, if the excess electricity is sold to the power distribution network of the energy center set up for internal consumption, the energy fee on those powerhouses will be similar to a capacity of more than 100 MW hydropower projects. Since the establishment of hydropower development policy in 2001, the Government of Nepal has started to collect the annual royalties from the electricity generator.

Table 6-1: For Internal Consumption

Electricity Capacity		Up to 15 Years		After 15 years of commercial operations	
		Annual capacity Royalty, per kW	Energy Royalty, per kWh	Annual capacity Royalty, per kW	Energy Royalty, per kWh
1	Up to 1 MW	-	-	-	-
2	From 1 MW to 10 MW	0.88 USD	1.75%	8.85 USD	10%
3	From 10 MW to 100 MW	1.33 USD	1.85%	10.62 USD	10%
4	Above 100 MW	1.77 USD	2.00%	13.27 USD	10%
5	For captive use	13.27 USD	-	26.55 USD	-

Source: NEA, 2019

The license fees specified in export-oriented hydropower projects, will be applied to projects that are built on a commercial basis with an installed capacity of up to 1000 MW. For projects with a capacity of up to 1000 MW that have been built for noncommercial purpose, are billed with 15% of the royalties per year based on monthly power generation

capacity from the date of entry into force of production. The license fee can be negotiated for a project aimed at exporting an installed capacity of more than 1000 MW, on the basis of the taxation rates are given in table 6-1 0r 6-2.

Table 6-2: For Export-oriented Hydropower Project

Type of projects		Up to 15 years		After 15 years of commercial operations	
		Annual capacity royalty, per kW	Energy royalty, per kWh	Annual capacity royalty, per kW	Energy royalty, per kWh
1	Export-oriented run-of the-river project	3.54 USD	7.5%	16 USD	12%
2	Export-oriented storage project	4.43 USD	10%	17.70 USD	15%

Source: NEA, 2019

For hydropower projects that sell energy for internal consumption and export the remaining energy, an energy fee will be charged equal to that of the export-oriented project amount of energy exported by third parties. The fee must be paid in the same currency in which the exported electricity is sold.

The table 6-3 displays the total received amount of royalties from the capacity of hydropower plants and from the energy generation. When a project starts its commercial operation, the constructing company has to pay royalties of the hydropower project to the Department of Electricity Development as mentioned in table 6-1 and 6-2. According to the table 6-3, the highest amount of royalty was received in FY 2011/12 and the least amount was collected in FY 2010/11 which accounted for 31,343,996.74 USD and 7,299,121.357 correspondingly.

Table 6-3: Total government collected royalties from hydropower plant's (amount in USD)

Fiscal Year	**Total Received Royalties**
2009/10	10,314,518.59
2010/11	7,299,121.357
2011/12	31,343,996.74
2012/13	14,256,812.17
2013/14	10,759,432.1

2014/15	11,437,945.13
2015/16	14,775,894.08
2016/17	13,439,548.5
Total	**113,627,268.7**

Source: Department of Electricity Development, Government of Nepal (2018)

According to the Local Self Governance Rules 1999, the total collected royalties will be divided into various administrative bodies of Nepal. For instance, 50% of total received amount should be distributed to the central government, 38% of total royalties should be distributed to the regional administrative bodies and remaining 12% should be distributed to the local or district development committee. Additionally, the electricity, gas and water sector grew by 9.8% in FY 207/18 and it was 12.4% in FY 2018/19. This sector has high gross value added to the economy this is because of an increase in domestic production of the hydropower and imported electricity from India. Thus, contribution of this sector to the GDP was 1.3% in FY 2018/19 (Economic Survey, 2019).

6.2 Hydropower Development in Nepal

The first hydropower plant in Nepal was built in 1911, after 29 years of the world's first hydropower plant was built. To meet the requirement of ruling class families in the country, the Pharping Hydropower project (500 kw) was completed with British assistance (Dhungel, 2016). It is very fascinating to note that hydropower development in Nepal had such an early start, even before its establishment in China. During the time, the set-up of the hydropower plant was small by surrounding the waterfalls of the city because it was not feasible to transfer electric power over the long distance. The second hydropower (640 kw) was built in 1936 at Sundarijal, Kathmandu. Similarly, as a third hydropower plant in Nepal, Morang Hydropower company was established with the capacity of 1800 kw under the private partnership. However, later on it was completely destroyed by a landslide. After the introduction of the first development plan in the country, the development of hydropower was institutionalized and the First-Five-year Plan (1956-61) was initiated with an aim to produce 20 MW hydropower. Also, with the Second-Three-year Plan (1962-65) some progress in the hydropower sectors was achieved. However, it was not able to achieve targeted goals. Furthermore, Nepal Electricity Corporation (NEC) was founded in 1962 with proposals of proper transmission and distribution of the electricity. And the responsibility of electricity generation was allocated for the Electricity Department. The hydropower generation capacity in the country was extended after the completion of the Panauti

Hydropower plant (2400 kw) and the Trishuli Hydropower plant (24000 kw) in 1965 and 1967 respectively.

Afterwards, several hydropower projects were initiated, also the Eastern Electricity Corporation was founded in 1974 for the better cooperation in eastern part of the country. With increasing hydropower projects in the country, a Small Hydropower Development Board was started in order to manage and control the overall performance of the projects. Again in 1985, almost all the development boards, Electricity Department and Nepal Electricity Corporation were merged and resulted in establishment of Nepal Electricity Authority (NEA). Since the date NEA has been responsible for the generation, transmission and distribution of electricity in the country.

Furthermore, the policymaking body was created in 1981, and other public sector institutions collaborated with the Hydropower sector such as the Water and Energy Commission and its Secretariat in 1976. In recent years, the private sectors are also active in hydropower development. The Independent Power Producers (IPPs) has power purchase agreements with NEA to sell the electricity. And IPPs have been a new institutional innovation in the power sector of Nepal (Adhikari, 2006).

During the 1996 to 2006, the hydropower power development projects were stagnated as armed Maoist insurgency caused damage to infrastructures, violence, and that scared away the investors. By the time demand for electricity was rising every year there was a power shortage which caused power cut problems for more than 50 hours a week in the country for more than 10 years during the wintertime. And consumers were compelled to purchase expensive power backup systems to fulfil their electricity requirement. In October 2017, NEA was able to boost its power supply by optimizing power-plant operations and improving power leakage problems which resulted in solving the power cut problem. To deal with this situation in 2017, NEA imported 330 MW of power from India and more than 1000 MW being generated by the hydropower projects in the country which was enough to fulfill the national demand of 1350 MW.

6.2.1. Generation and Consumption of Hydropower in Nepal

Availability of abundant water resources has been an important aspect for economic development in Nepal. According to the report published by the Government of Nepal Water and Energy Commission Secretariat (2017) theoretically Nepal has potential of generating 83,000 MW of hydropower whereas, economically there is potential of producing more than 42000 MW of electricity. As of FY 2019/20 Nepal has installed a total capacity of 1128.71

MW (NEA, 2020). Despite having a huge potential for hydropower generation, the country has not been able to fully utilize its available resources.

The Figure 6-1 shows the total consumption, total generation million in KWh and Self-Sufficient Rate (SSR) of hydropower in Nepal. Throughout the years, total consumption and generation of hydropower were in increasing trend until FY 2017/18. The highest consumption and generation of hydropower was recorded in 2017/18 with the value of 5,523.29 million KWh and 7,057.93 million KWh respectively. However, there was a drop in total consumption and generation of hydropower in FY 2018/19 which accounted for 4061.48 Million KWh and 4993.12 Million KWh respectively. Regarding the self-sufficiency rate, it has fluctuated throughout the years. However, self-sufficiency for hydropower in the country has been increasing gradually, still the country needs to put more effort on generating hydropower to become independent in the sector.

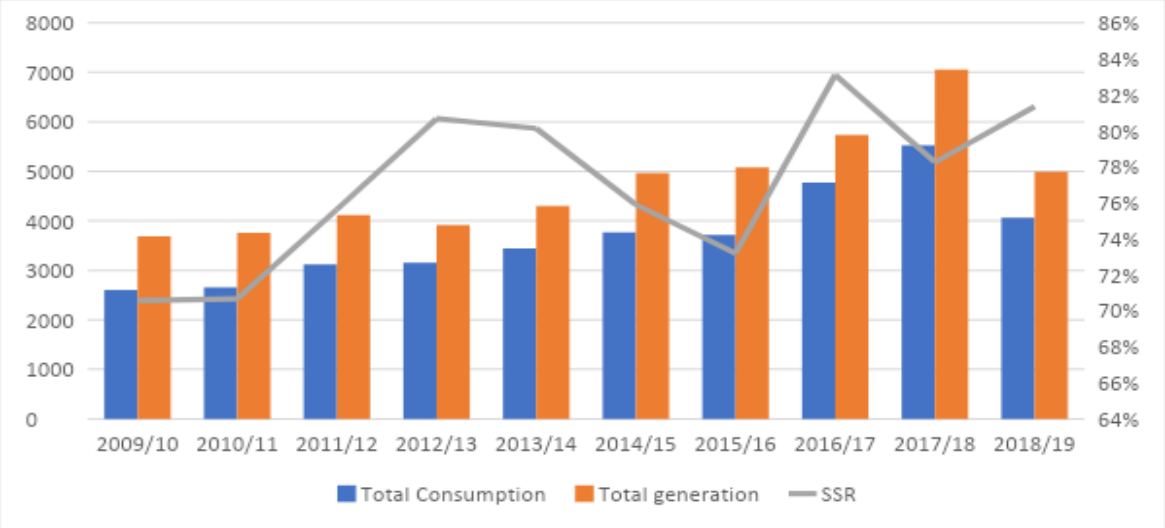


Figure 6-1: Total consumption, total generation and self-sufficiency rate (SSR) of hydropower (Million in KWh)

Source: Author's Own Illustration (Ministry of Finance Nepal, 2020)

6.2.2. Demand and Supply of Electricity

According to the reports of NEA (2019), every year consumption of electricity in Nepal increases at 7-9% and demand will be reached to 3600 MW by 2027. The evening peak demand has risen dramatically for household consumption. Since 2007, the rising demand and stagnation in building additional power generation capacities in the country has led to shortage of power supply. Therefore, from early 2009 the NEA started power cuts up

to 18 hours a day during the winter. However, by that time there has been significant progress in the sector by building hydropower generation capacities, improving leakage problem and increase in import of electricity from India which helped to tackle the shortage problem.

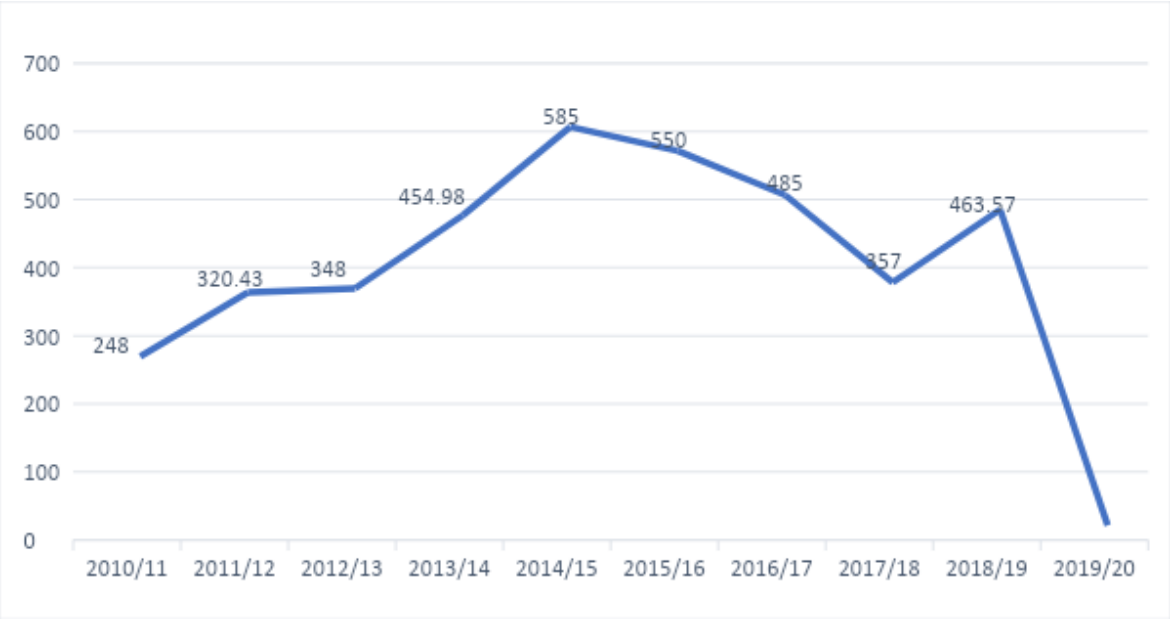


Figure 6-2: The gap between demand and supply of electricity in MW

Source: Author's Own Illustration (Ministry of Finance Nepal, 2020)

The above figure 6-1 illustrates the decreasing gap between electricity demand and supply in MW between year 2010/11 to 2019/20. From the figure 6-1, it is clear that Nepal has improved significantly by reducing the gap between demand and supply of electricity. In FY 2014/15, the difference between demand and supply of electricity has recorded the highest of all time which accounted for 585 MW of electricity. Similarly, during FY 2017/18 the difference in supply and demand of electricity was 357 MW, whereas this gap has been reached to 463.57 MW by 2018/19. Finally, dramatically decreasing the gap between demand and supply of electricity in FY 2019/20, the country was able to reach its demand for electricity. In future, hydroelectricity will grow even better than present time as many hydropower projects will be completed by the end of FY 2021/22 and will be added more than 1000 MW of hydroelectricity to the current generation capacity which is 1128.71 MW (NEA, 2020).

6.3 Current Status of Hydropower Development in Nepal

Nepal is considered as the richest country in terms of water resources and potential of hydropower ranked as the second country in the world after Brazil. According to the report

(USAID, 2018) more than 90% of the country's total electricity production capacity generated by hydropower plants, Nepal relies heavily on water resources to meet its energy needs. Because of its potential, hydropower plays a particularly important role in Nepal's economic future. According to the scientific study led by Scholar Narendra Man Shakya has revealed that Nepal has potential to generate 53,000 MW, however, because of geographical features of the country it is economically and technically feasible to generate 43,000 MW of hydropower (National Planning Commission, 1985). If this potential is exploited, it could easily meet the suppressed demand of Nepal and create a surplus that could be exported to neighboring countries in South Asia. However, the lack of access to reliable electricity from the grid is a major obstacle to economic growth and an obstacle to poverty reduction. By developing sustainable hydropower production plants, Nepal can compensate for its supply deficit during the dry season with export gains during the rainy season with high flows (Dhungel, 2016).

The 2018/19 NEA report revealed that approximately 77.8 % of Nepal's population has access to electricity, more than two thirds of which have access to networks and only in rural areas about 22.2 % of people depend on traditional sources (wood, kerosene) for lightning. Although, load shedding ended up in October 2017 which used to be 18 hours per day during the dry season. Nepal is still importing electricity from India during its peak hour to meet the growing demand and it is very difficult to expand the electricity network to 100% population with access to grid electricity.

According to the hydropower status report published by International Hydropower Association (2019), Nepal is ranked as a 5th South and Central Asian country in terms of installed capacity. In 2018, Nepal added its hydropower capacity by 71 MW and reached a total of 1016 MW. In Nepal NEA’s hydropower plants generated a total of 2,548.11 GWh of electricity in fiscal year 2018/19 which was the highest recorded electricity generation in history.

Moreover, total power purchase from IPPs in Nepal was 2,190.05 GWh and the total energy imported from India was 2,813.07 GWh in FY 2018/19. The NEA has 33.75% of contribution, IPPs has 37.25% and imports from India accounted for 29% in total available energy in the country (NEA, 2019). Additionally, Hence, investing in hydropower can help the country to solve its debilitating problem of electricity shortage and it can be best tackled by the private sector in the short and medium term, given the financial limitations of the Nepalese Electric Authority (NEA) and the Government of Nepal.

6.4 Prospects for Hydropower Development in Nepal

National reports on Sustainable Development Goal (SDG) (2015) included access to affordable, reliable and clean energy to all in SDG7, which has emphasized hydroelectricity as clean energy. Further, extreme use of fossil fuels and non-renewable energy led to an increase in carbon emission which is the cause of accelerating climate change. Thus, SDG8 and SDG9 mentioned strong infrastructural development at regional and trans-border level for economic development whereas, SDG12, SDG13 and SDG15 has supported to take action against ongoing climate change by ensuring renewable sources of energy from wind, solar and hydro. Thus, in one way another, it has also encouraged the development of hydropower infrastructure in Nepal. According to national reports on Sustainable development Goals 2016-2030 has proposed SDG7 targets for Nepal as follows:

- Accessibility of electricity to 99% of households.
- 10% reduction in use of firewood in rural households as their primary fuel for cooking.
- Generation of at least 10,000 MW of electricity.
- Use of only electricity for public transportation.
- Decrease in energy strength of GDP by 0.8% per annum.

6.5 FDI in Hydropower sector of Nepal

Nepal has good prospects for investment in hydropower, tourism, agriculture and information and technology. There is great potential in the country's hydroelectric sector with a workable production capacity of 42,000 MW. Thousands of Nepalese students travel abroad each year to study and spend billions of rupees. A large number of young people also travel abroad to work. However, the country has still not been able to use the available resources and opportunities to initiate economic activity in the country. There is a lack of capital, skilled workers and modern technology to initiate economic activities in the domestic market. There is therefore a need to bring foreign direct investment to Nepal (Dhungel, 2016).

Historically, the first Pharping hydropower plant in Nepal was built in assistance of British government in 1911. The first bilateral agreement of Nepal with India was in 1954 and 1959, Koshi and Gandak (15 MW) which was aimed to provide small irrigation and hydropower to Nepal, also for irrigation and flood control in India.

The table 6-1 shows the list of completed hydropower plants in Nepal through foreign investment. In the early phase of hydropower projects India, China and former USSR were the main investors in Nepal. The projects such as Fewa (1 MW), Trishuli, (21 MW), Devighat (14.1 MW) were built in assistance of India. Similarly, Sunkoshi (10.5 MW), Seti (1.5 MW) were funded by China. And Panauti (2.4 MW) were constructed through the support of the former USSR. Until the 1970s, grants were most commonly used in the form of investment in hydropower development of Nepal. However, after the 1970s bilateral assistance in the form of grants were replaced by the loans and multilateral investment in the sector.

Table 6-1: Completed Hydropower Plant in Nepal form Foreign Investment

S. N	Name	Installed Capacity (MW)	Funded by
1	Fewa	1	India
2	Seti	1.5	China
3	Panauti	2.4	Former USSR
4	Chatara	3.2	India
5	Sunkoshi	10.5	China
6	Modikhola	14.8	North Korea
7	Gandak	15	India
8	Devighat	14.1	India
9	Trishuli	21	india
10	Middle Marshyangdi	70	KFW
11	Kulekhani II	32	JICA
12	Kulekhani I	60	WB, JICA, Kuwait, UNDP, OEPC
13	Marsyangdi	69	IDA, KFW, KFED, SFD, ADB
14	Bhote Koshi	45	USA
15	Chameliya	30	Korea
16	Khimti	60	Norway
17	Kaligandaki A	144	ADB, JICA, WB

Source: NEA, 2018

When bilateral assistance in the form of grants were ended in 1970, Nepal depended on multilateral investment and loans for hydropower development. During the time primary

sources of loans or investment were international organizations such as the World Bank (WB), Asian Development Bank (ADB), and other organizations from Japan, Kuwait, North Korea, Germany and etc. cooperated to provide funds for hydropower projects such as Kulekhani I (60 MW), Kulekhani II (32 MW), Marsyandi (69 MW), Modikhola (14.8 MW), Kaligandaki A (144 MW), Middle Marsyangdi (70 MW), Chameliya (30 MW) and so on. The role of such larger projects has been fundamental in meeting rising demand of power in the country. The projects such as Upper Marshyangdi and Upper Trishuli 3A are under construction through the loans from China while Upper Karnali are being constructed through investment of Indian private company GMR. The larger Upper Karnali hydropower is an export-oriented project aimed at the Indian and Bangladesh market and expected to benefit Nepal in terms of revenue from taxes, royalties and so on.

Table 6-2: Hydropower Plant Under-construction from Foreign Investment

S. N	Name	Capacity (MW)	Funded by
1	Upper Marshyangdi	50	China
2	Upper Trishuli 3A	60	China
3	Arun III	900	India

Source: NEA, 2018

After the implementation of the structural and economic reform program of IMF, WB and IFC in 1985 the country overcame the balance-of-payment crisis by accelerating economic growth which has drastically changed the modality of hydropower financing in Nepal. To be eligible for loans, a country or beneficiary should implement such economic reform programs which were expected to allow the free market to have a superior role in supporting the economy of the recipient. In the form of FDI through the contribution of International Financial Institutions (IFIs), hydropower projects such as Bhotekoshi (45 MW) and Khimti (60 MW) were successfully completed by USA and Norway respectively. During the project development the US and Norway provided financial as well as technical assistance.

Table 6-3: Hydropower Plant on pipeline

S. N	Name	Capacity (MW)	Funded by
1	Upper Karnali	900	India
2	West Seti	750	China

3	Budi Gandaki	600	China

Source: NEA, 2019

At the present time, the biggest hydropower projects of the country are to be started status through private foreign investment from India and China. The Projects such as Upper Karnali (900 MW) and Arun III (900 MW) are being developed by India whereas, the Projects like West Seti (750 MW) and Budi Gandaki are being developed in investment from the Chinese company. The successful examples of FDI in hydropower are Bhotekoshi and Khimti which led to a positive future for FDI in hydropower projects.

6.6 Importance of FDI in Hydropower Sector of Nepal

Since long time hydropower experts insisted on the need of fascinating FDI inflows in Nepal for the development of the overall hydropower sector. In 2016 a conference titled "FDI in Nepal's Hydropower" was jointly organized by IFC, IPPAN and NWEDC with an aim to discuss the importance of FDI in the hydropower sector. The event also emphasized on the need for appropriate policies to attract the FDI in hydropower development as well as other sectors. During the conference, the Minister of Energy, Janardan Sharma said that "*it's high time Nepal attracted FDI to exploit its rich water resources. "We have both natural and human resources. What we do not have is enough investment. Therefore, the importance for FDI is very high for Nepal."* Also, the Minister mentioned that agreements like PTA and PDA with India will encourage the FDI into hydropower sectors of Nepal. The major downsides for hydropower promoters can be the license processing, PPA and PDA which takes a long period of time.

The table 6-4 illustrates the status of different categories of hydropower production permission and number of projects that are below and above 1 MW with total production capacity. In Nepal, currently 15 (below 1 MW) and 76 (above 1 MW) numbers of hydropower plants are operating with production permission with a total of 1,038.07 MW installed capacity. Also, a total of 203 projects including less than 1 MW (25 projects) of hydropower plants are under construction with production permits which have a total capacity of 7,780.563 MW. In case of completion of under construction projects, Nepal will be independent in electricity and will start exporting the power to its neighboring countries India and Bangladesh including China.

Table 6-4: Status of Hydropower Production Permissions in Nepal

Categories	N0. of Projects	Capacity (MW)	Total Capacity (MW)	Remarks

Currently operating with production permission	15	11.24	1,038.07	> 1MW capacity
	76	1,026.83		< 1MW capacity
Under construction with production permits	25	19.73	7,780.563	> 1MW capacity
	178	7,760.82		< 1MW capacity
Application for production permit	1	0.48	1,519.24	> 1MW capacity
	29	1,518.76		< 1MW capacity
Permits for feasibility study	17	12.88	1,8193	> 1MW capacity
	284	18,180.67		< 1MW capacity
Application for feasibility study	13	1,046.36	1046.36	> 1MW capacity
	20	1,036.88		< 1MW capacity
Total	**643**	**29,577.80**	**29,577.80**	

Source: Ministry of Energy, Water Resources and Irrigation, 2019 (Up-to mid-March 2018/19)

Furthermore, 30 projects have applied for the hydropower production permits with a total capacity of 1,519.24 MW. With the total generation capacity of 18,193 MW, numbers of 301 projects are permitted for the feasibility study and 33 projects have applied for the feasibility study with the total capacity of 1,046.36 MW. In a case of completion above all (table 6-4) possibilities, Nepal will be able generate 29,577.80 MW of electricity from the hydropower. Hence, according to the table 6-4 Nepal has huge potential for the hydropower production and export which will flourish the overall development of the country. However, the country really needs to work on policies that will attract and promote the foreign investment inflows into Nepal.

6.7 Environmental Effects of Hydropower Development in Nepal

Nepal's development of hydropower plants is generating electricity mainly from its water resources from the glacier evacuation, by expanding glacial lakes and so on. According to the report of OECD conducted by Agrawal et. al. (2003), such activities leads to following impacts on the ecosystem of Nepal:

- Possibility of Glacial Lake Outburst Flooding
- Glacial lake outburst flooding and heavy rainfall events increased the risk of sediment loading and landslides.
- Glacier evacuation caused an increase in excess variability.
- Increased risk of Glacial Lake Outburst Flooding (GLOF).
- Rising temperatures of the ecosystem will lead to increase in evaporation losses from the lakes.

Because of all the above reasons, the development of hydropower plants and transmission lines for the transfer of electricity should be properly studied and planned

accordingly to minimize the risk of environmental damage as well as to maximize the benefit of the hydropower development.

6.8 Challenges for Hydropower Development in Nepal

- **Geographical Structure**

The geography of Nepal is the main challenge in construction of mega hydropower projects, as 80% of the country's space is occupied by hilly or mountains. And the sources of hydropower are glaciers in the Himalayas and monsoon rain. The most feasible location is the hilly region where the water current serves to match with the electricity productions. The rugged terrain and topography of the country affect the construction of the power plants. The remote transportation infrastructure also creates challenges along with climate influence, erosion, tectonics and human activities. There are also excessive sediments in the river in Himalayan region which is considered a burden in the hydropower projects.

- **Insufficient Financial Sources, Advance Technology and Skills**

Shortages of financial investments and lack of modern technology and related skills are the major challenges that Nepal is facing at the moment. The high dependency on imports has caused huge trade deficits and resource gap problems in the country and created a huge negative saving and investment gap (Ministry of Finance Nepal, 2019). And thus, Nepal is lacking funding sources for hydropower development. Nepal is in the process of export-oriented mega hydropower development which requires billions of dollars of investment, advanced technology and skilled labor force to successfully complete. In order to attract such a huge foreign investment, there must be an environment of ease of doing business to convince the investors to invest in Nepal. According to ease of doing business reports, Nepal has been ranked in 110th position by scoring 59.6% among 190 countries and ranked 4th position among SAARC countries (Ministry of finance, 2019). And Nepal should emphasize on regulatory framework and well-coordinated bureaucracy to improve its position.

- **Physical Infrastructure Development**

Another major drawback for hydropower development in Nepal is insufficient infrastructure development. To reduce the cost of constructing hydropower development, the government should prioritize on constructing proper road infrastructure, telecommunication, etc. at first which will ease transportation of equipment for the construction. For instance, most of the potential hydropower projects exist in rural areas of

Nepal and investors are facing extra costs for the construction because of delay in transfer of raw material, destruction of equipment, accidents etc. (Gaire, 2014).

The figure 6-2 is the rating of the World Bank in terms of trade and transport quality in Nepal for periods 2008-2018 which was very low. In 2008, the rating was 1.77 out of five and reached 2.7 in 2016 which was highest of all time. Thus, it is clear from the figure 6.2 that Nepal is lacking maintenance in its roadways.

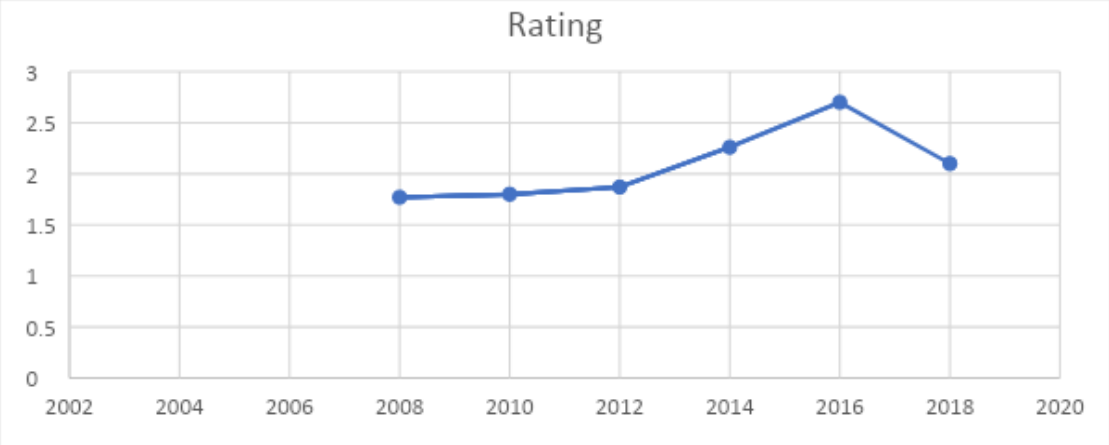


Figure 6-3: Logistics Performance Index: Quality of Trade and Transport-related Infrastructure in Nepal (1= low and 5= high)

Source: World Bank, 2019

According to the annual report of the Ministry of Physical Infrastructure and Transportation, a total of 42% of road was black topped, 24% was graveled and 34% was earthen until 2017. There is lack of regular maintenance for black topped roads, whereas graveled roads are in poor condition and earthen roads are only accessible during the fair-weather periods. Because of the heavy rainfall and landslide during the monsoon, roads are being damaged (Bhagat, 2017). Thus, it is a main challenge for hydropower development as Nepal doesn't have any other means of transportation.

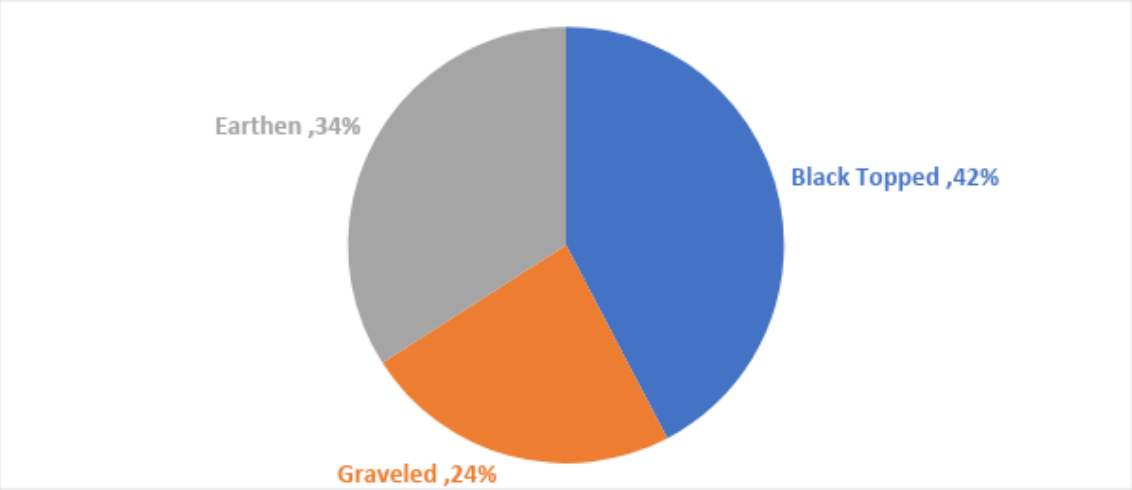


Figure 6-4: Categories of road constructed roads in Nepal (in % shares)

Source: Ministry of Physical Infrastructure and Transportation, 2018

- **Exporting market**

This is also one of the challenges in the context of Nepal. Because Nepal has the possibility of generating 83,000 MW of hydropower, technically approximately 42,000 MW of energy can be generated and the highest demand of the energy in Nepal is projected for maximum 7,000 MW that means the country will have surplus which can be exported abroad. Investors are always looking for profit in their investment which can be generated through sale of electricity. On the one hand, Nepal has the possibility to export its power to India, China and Bangladesh where their domestic production is not adequate to meet their demand. On the other hand, the cost of generating electricity is quite higher in Nepal than in those countries. Thus, it is the biggest challenge for Nepal to reduce its cost of production.

- **Effectiveness in Implementation of policy**

Another important factor that has affected the hydropower development in Nepal is the effective implication of policy and timely reform of the policy otherwise it will discourage the investors. The effective policy should address the following issues: timely payment of subsidies and incentives, double tax avoidance, power purchase agreement, addressing social and environmental issues, timely process of licensing, and so on (Dhungel, 2015). Thus, addressing such issues will create an investor-friendly environment in the country.

- **Other Challenges**

Nepal's hydropower generation is mainly based on the run of rivers which causes excess of the waters in monsoon which causes damage to hydropower plants and landslides in the territory. Whereas, decreased in the flow of water in the winter season causes less production of the electricity. Lack of proper transmission line, unstable and poor-quality electricity

production, inappropriate estimation of environmental effects, problems in incentives distribution to the local people and so on (Bhatta, 2017).

7 Impact of FDI in South Korean Economy: A Lesson to be Learned by Nepal

Until the 1960s, the South Korean economy was listed as underdeveloped as the country was in conflict between 1950 to 1953. However, over the time South Korea has boosted their economy towards an advanced level after joining the OECD in 1996 and organizing the G20 summit in 2010. The development of the South Korean economy in short span can be considered as a role model for emerging economies in the world to achieve success despite a scarcity of resources, a limited domestic market and so on. From the early phase of economic development, the South Korean government emphasized on production of basic material such as cement, fertilizer, etc. in order to substitute the import. Also, labor-intensive industries like textiles, plywood were promoted in order to enlarge its export. During the period, to support export industries in the economy, several procedures were initiated for instance, lower interest rate policy, tax exemptions, tax reimbursements. In 1966, Foreign Capital Inducement Act was introduced, and branches of international banks could operate in the country with an aim to encourage foreign capital inflow (Koojaroenprasit, 2012).

To encourage the domestic saving investment in the economy during the 1970s, the South Korean government raised the interest rate and foreign loans. Also, supported the exports by providing direct subsidies, imposed taxes and restricted on import quota. Additionally, the South Korean Government made huge investments in industries like steel, machinery, ship building, chemical, electronics, etc. and implemented export oriented foreign trade after the industrialization in the 1980s which attracted the huge amount of FDI inflow in the country (Nicolas, et al. 2007). As a result, after the 1980s South Korean economy achieved double digit growth as the host country played a vital role in making overflowing FDI competitive which increases the productivity of domestic resources. In fact, FDI encourages capital formation and human capital formation.

At present, South Korea is listed as a developed OECD member country with the highest standard of living and per capita income of 16,567.175 USD in 2018 which used to be the poorest country in the world during the 1960s with 100 USD per capita income. According to the UNCTAD World Investment Report, in 2018 South Korea was placed at 19th among the recipients of FDI in the world which accounted for 14.5 USD billion. And its economy is considered as highly developed in the world with annual GDP of 1720.49 billion USD in 2018 (World Bank, 2019). In this way, it can be said that FDI has performed

an enormous role in industrial development of the South Korean economy. In less than a half century South Korea has transferred from a least developed country to an advanced economy and it could be very interesting to explore the role of FDI in its growth of economy.

Apart from the availability of natural resources in the country, political environment and economic policies have also played an important role to influence the FDI inflow in the countries. According to the theoretical perspectives of FDI, FDI doesn't only bring the funding however it also brings technology, skills and knowledge that are necessary for the economic growth of developing countries (OECD, 2002). By understanding these viewpoints, policy makers in South Korea adopted the interventionist approach during the 1960s and 1970s. Mainly, South Korea focused on technology transfer requirements to boost and encourage the domestic industries. As a result, FDI were directed towards the export-oriented manufacturing industries which also supported in substitution of imported products (Nicolas, et al. 2007). Additionally, liberalization of FDI policies or acts such as Free Export Zone Establishment Act (1970), Foreign Capital Inducement Act (1983), founding of the Korean and Investment Promotion Corporation (1995), New Foreign Investment Promotion Act (1998), Foreign investment Zones (1999), Free Trade Zones and Free Economic Zones (2003), Invest Korea Act (2003), revision of Foreign Investment Promotion Act (2010) were essential in growth of South Korean economy in terms of upgrading technologically and to restructuring the industries towards higher value and more sophisticated production (Nicolas, et al. 2007).

The figure 7-1 shows the history of sector-wise energy consumption in South Korea. Throughout the years consumption of energy in all sectors of South Korea has increased significantly. The high energy consumption growth was in sectors of industrial and residential whereas transport and public sectors had the least growth rate. However, after 1990, the energy consumption rate in the industrial sector is significant. Even though South Korea energy consumption is mostly dependent on imports of coal and crude oil from other countries, it is among the top exporter of petroleum products with 3 major refinery crude oil out of 10 largest refineries in the world (US Energy Information Administration, 2018).

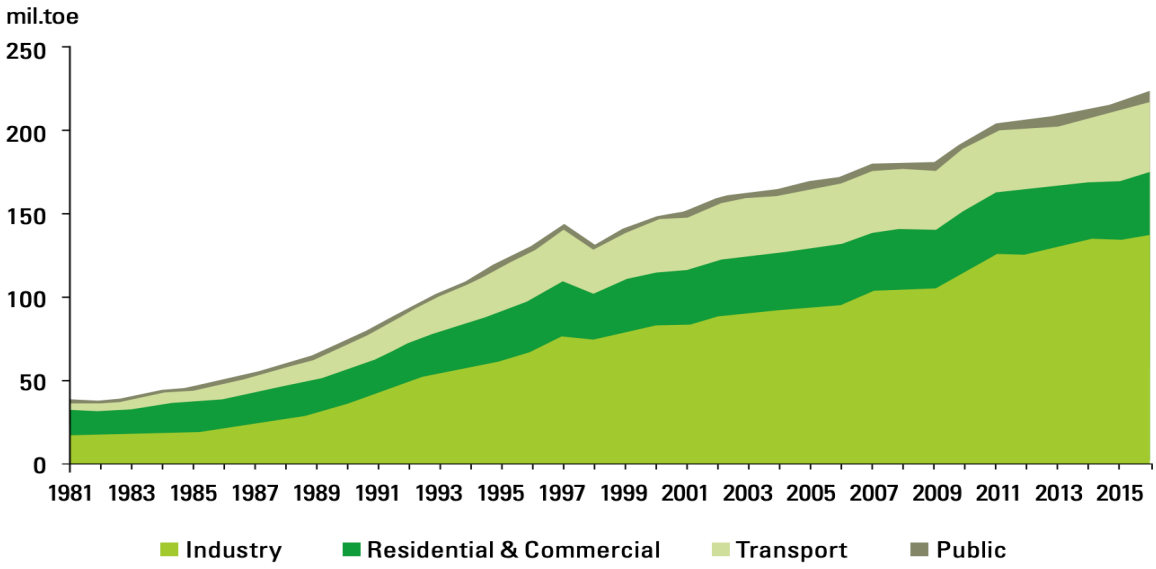


Figure 7-1: Sector-wise Consumption of Energy in South Korea (million in tones)

Source: Korea Energy Economics Institute (Park,2017)

Hence, consumption of energy in South Korea is increasing in trends which contributes to revenue generation of the country.

The figure 7.2 displays that there is a growth in consumption of domestic and industrial sector of energy in Nepal throughout the years. The growth of consumption of energy in the Industrial sector is very slow, also the commercial sectors. Consumption of energy in the industrial sector during the FY 2015/16 has decreased because of damage to industry by the earthquake in 2015. The Figure indicates that the government should bring the incentives plan and policies to encourage the increase in consumption of energy mainly in industrial and commercial sectors, also in domestic consumption to replace other imported energy sources.

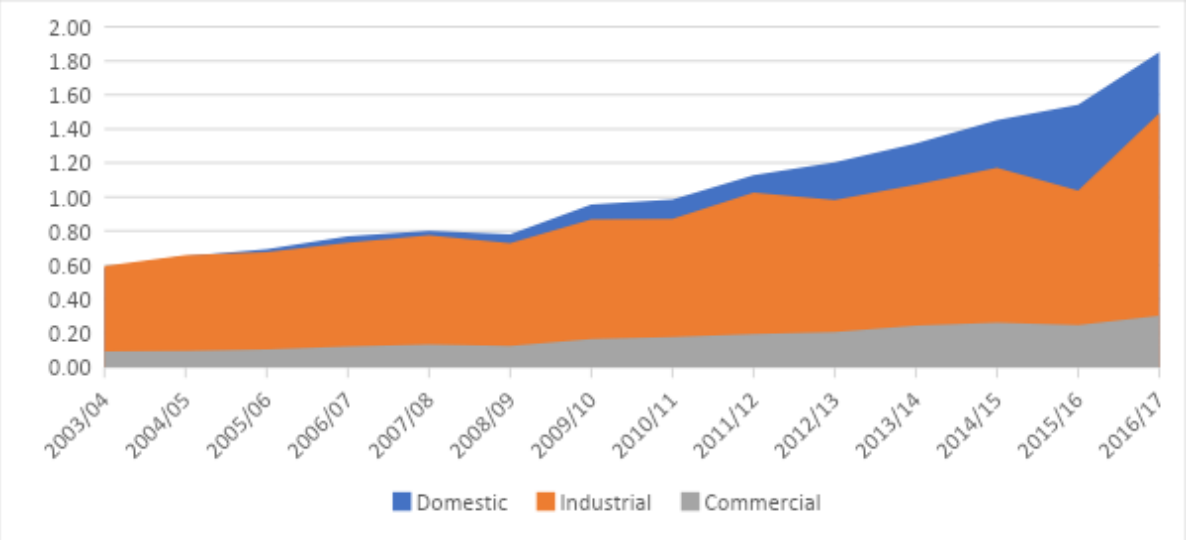


Figure 7-2: Sector-wise Consumption of Energy in Nepal (in millions KWh)

Source: Nepal Electricity Authority (2019)

Therefore, Nepal should promote its industrial sector to increase its energy consumption in future to utilize its produced electricity in the country, which could be contributed for the investment in hydropower development as well.

Consequently, I would like to state that, after the country's (South Korea) most of the infrastructure was destroyed by the war, it was not easy for South Korea to move forward. With the fact that 70% of the country's land is captured by hilly or mountain areas, three sides of the country are surrounded by ocean and North Korea in the north which seems geographically isolated. Even in such circumstances, having least natural resources and tackling the shortages of basic needs of people in the country, South Korea has aggressively promoted the export-oriented industrialization and substituted imported products by relying of foreign aid and investments. By realizing the importance of foreign investment in infrastructure development of the country various measures such as policies or acts were initiated to protect the foreign capital. As a result, the country was very successful in attracting the largest amounts of foreign investment and able to set an example of sharp economic growth by surprising the world. After decades of FDI inflows in the country, South Korea came into the top 10 list of exporting countries in the world and now South Korea is known as the FDI source countries rather recipient country.

Therefore, there are some similarities in the case of the South Korean and Nepalese economy. Nepal is an inland country with its 80% of the land in hilly or mountain areas. Nepal has the highest Himalayan mountain range which is the greatest tourists' attraction in the world as well as one of the greatest sources of hydropower. In a case, the government is

able to create more employment opportunities in the country through the investment in infrastructural development, Nepal has a large population of youth workforce which can actively participate in such developmental activities to grow its economy. That can also contribute to eliminating the unemployment problems and will reduce the youth migration abroad for employment opportunities. Additionally, FDI in export-oriented hydropower projects in Nepal such as West-Seti, Upper Trishuli, Arun III, Upper Karnali, etc. may set a steppingstone for the future growth of the economy. Through the successful completion of such projects, Nepal may attract more foreign investments in other sectors in future.

Nepal can also learn from the experience of South Korea in terms of promoting export-oriented industrialization and liberalization of FDI policy to attract more foreign investment. It's high time that Nepal really should focus on implementing the policy effectively and initiate the programs that encourage the increase in export of the country to balance the trade as well as to eliminate the negative gap between saving and investment. By doing this, Nepal will be able to increase saving to invest in its industrial development and become financial independent. Nepal has immense potential in generating hydropower which can be achieved through the investments. Furthermore, Electricity is essential for fulfilling basic human needs as well as for infrastructure development. Such development includes transportation, telecommunications, technology, tourism, etc. which will contribute to economic growth of Nepal.

8 Comparative Analysis

8.1 The role of India and China's investment in hydropower sector of Nepal

Despite having the largest hydropower resources in the world, Nepal lacks adequate access to the electricity. However, the progress that has seen in recent years is noticeable in the sector. Currently, Nepal has achieved its domestic demand of electricity by importing from India. The foreign financing has seen positive growth in the sector as the country has signed its several mega hydropower projects with India and China which are export-oriented projects. In this way, there is a possibility that in a case of successful completion of ongoing mega projects, FDI will lead the financing in hydropower. Due to the increasing negative gap between saving and investment of the country, it is not possible for the government to invest in mega hydropower projects which will fulfill the mutual goals of electrification, industrial support or cross border power trade. Hence, the role of foreign investment for the further development of the hydropower sector is substantial.

The neighboring countries of Nepal (India and China) have played a crucial role in the overall development of the country. For Nepal, overall investment of China and India are placed at 1st and 2nd respectively, also in the case of investment in the hydropower sector these countries are at top. The table 8-1 and 8-2 represent the total investment of China and India in hydropower projects of Nepal. Mentioned projects in the tables are in different stages such as completed projects, under construction, and projects to be started. In terms of investment of China, the total installed capacity of the projects is 1,472 MW, whereas the total installed capacity by India's investments are 1,854.3 MW. From table 8-1, the projects such as Seti, Sunkoshi, Upper Marsyangdi, are already completed projects and Upper Trishuli is soon to be completed. However, the mega projects such as West Seti and Budi Gandaki are to be started in future. The total investment of China in the hydropower projects is 4,411.7 million USD, with the highest investment in Budi Gandaki (2500 million USD) and West Seti (1600 million USD).

Table 8-1: China's Investment in Hydropower of Nepal Up-to FY 2018/19 (completed projects, under construction and to be started projects) (Million in USD)

S. N	Projects name	Capacity (MW)	Cost (Millions in USD)	Cost per MW (Millions in USD)	Commissioned date
1	Seti	1.5	0.34	0.23	1985
2	Sunkoshi	10.5	3.12	0.30	1972
3	Upper Marsyangdi	50	188.24	3.76	2016
4	Upper Trishuli 3A	60	120	2.00	2019
5	West Seti	750	1600	2.13	Soon to be started
6	Budi Gandaki	1200	2500	2.08	Soon to be started
	Total	**1472**	**4411.7**		

Source: Own Calculation, (NEA, IBN)

According to table 8.2, projects such as Fewa, Chatara, Gandak, Devighat, Trshuli are completed projects whereas the Arun III and Upper Karnali projects are under construction. The total investment made by India in the sector is 2583.35 million USD, where the highest budget projects are Upper Karnali and Arun III with the estimated cost of 1500 million USD and 1040 million USD.

Table 8-2: India's Investment in Hydropower of Nepal Up-to FY 2018/19 (completed projects, under construction projects).

S. N	Project Name	Capacity (MW)	Cost (Million in USD)	Cost per MW (Million in USD)	Commissioned date
1	Fewa	1	0.18	0.18	1969
2	Chatara	3.2	2.13	0.67	1996
3	Gandak	15	4.25	0.28	1979
4	Devighat	14.1	29.33	2.08	1984
5	Trishuli	21	7.46	0.36	Soon be started
6	Upper Karnali	900	1500	1.67	2022
7	Arun III	900	1040	1.16	2018
	Total	1854.3	2583.35		

Source: Own calculation, (NEA, IBN)

Looking at the investment of both countries in the hydropower sector, India and China are very important sources of finance for Nepal. Both countries seemed important to Nepal, however Nepal shared an open border with India and cross border power trade as Nepal was unable to meet its demand in dry season, the country imports electricity from India and exports electricity to India in monsoon. Nepal has already signed a PTA with India and Bangladesh as the projects that are being built by Indian companies are export-oriented projects. After the completion of Upper Karnali project, Bangladesh will also purchase its 500 MW of electricity and transmission line will be connected through India. Even in other export and import of goods and services Nepal is more dependent in India. Because, Nepal

has set a fixed exchange rate system with India which makes businesses easier to do the cross-country transactions. Hence, India seemed more important to Nepal than China.

8.2 Cost of consuming electric stoves and Gas for cooking purpose in Nepal

According to the Economic Survey report of the Government of Nepal (2018), the country is highly dependent on imported fossil fuels from Indian and China such as coal, petroleum products including LPG which constitute 16.68% of the total sources of energy, while electricity constitutes only 3.32%. Furthermore, renewable energy sources such as solar, wind, biogas, improved cook stove, etc. constitute 3.03%. However, the country's dependency on traditional sources, such as biomass and animal waste, agricultural waste, is a massive 76.9%.

The figure 8-1 displays the total consumed energy for cooking purposes in Nepal. In 2015, the highest consumed sources of energy for cooking was 151. 6 million Gigajoule (Gj) followed by animal waste and vegetables waste; 22 and 17.5 million Gj respectively. The consumption of LPG gas placed at fourth with 5.8 million and biogas at fifth with 5.8 million Gj. And electricity was consumed by 3.9 million Gj only and the least consumed source was kerosene.

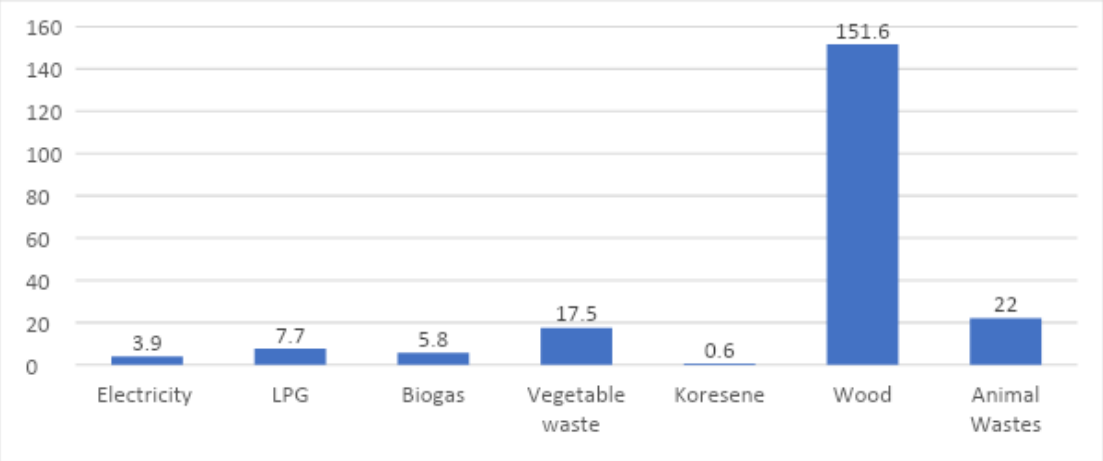


Figure 8-1: Consumption of energy for cooking in Nepal, 2015 (million Gigajoule)

Source: Ministry of Energy, Nepal

To drastically displace traditional sources of energy and imported fossil fuel with hydropower, the government should make electricity easily accessible to rural areas of the country as well because the highest number of traditional sources are being used in rural

areas of Nepal. And the government should provide subsidies to encourage in more consumption electricity in Nepal.

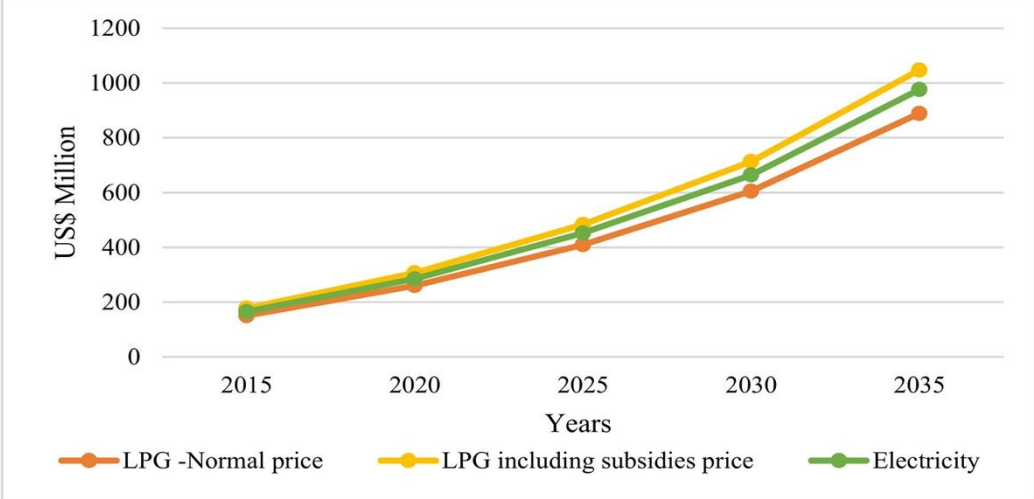


Figure 8-2: Forecast of yearly spending of government on LPG and Electricity in Nepal

Source: Nepal Oil Corporation, Water and Energy Commission Secretariat, 2017

The figure 8-2 shows, upward trend of total spending of the government on LPG and electricity in millions of USD. Furthermore, in 2015, 27.2 million USD of subsidies was spent for LPG which will reach 158.3 million USD in 2035. Similarly, the average LPG price in 2015 was projected for 165 million USD which will cost 1046.8 million USD in 2035. With this fact, governments need to provide huge subsidies in future, however if the government will be able to replace the consumption of LPG through electricity or biogas it could save millions of subsidies yearly.

In Nepal the regular gas cylinder comes with 14.2 kg of gas which provides 181.9 KWh of power which costs only about 13.44 USD per cylinder whereas the consumption of the same electricity cost almost 18 USD. Considering the cost of energy, the electricity is quite higher than LPG. So, it is very important for the government to reform their tariffs to increase domestic consumption of electricity which will contribute to the reduction in growing demand for the LPG. Also, the government should promote awareness programs specifically in rural areas of Nepal to eliminate the use of traditional fuel sources which will contribute to the good health of the people in villages as well as deforestation will be eliminated.

8.3 Prospects for exporting Hydropower to neighboring countries: Indian and Bangladesh

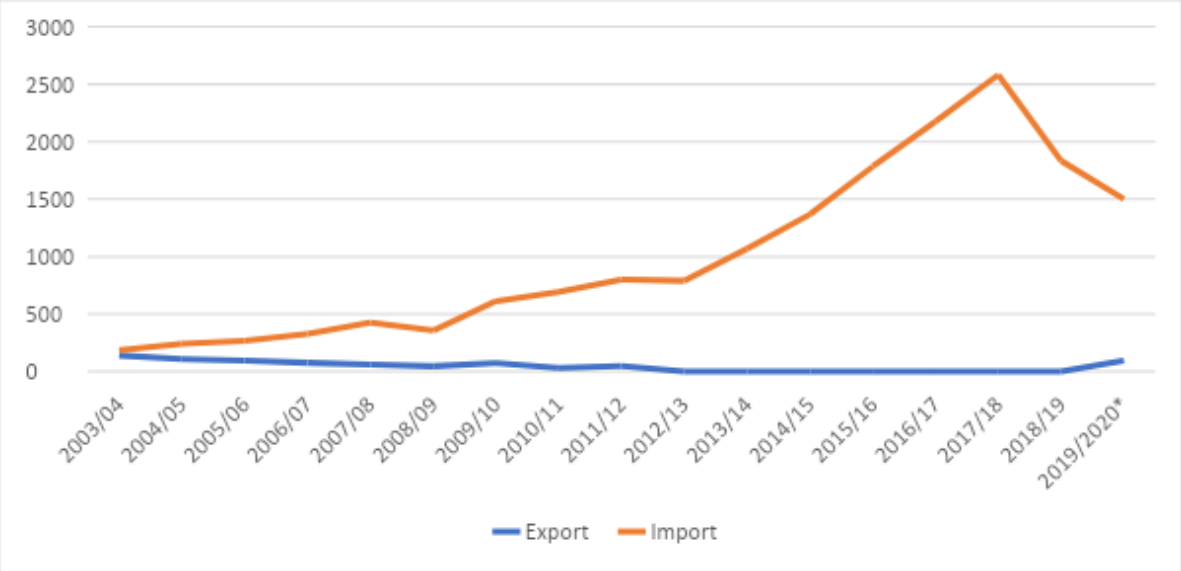
Bangladesh is facing an energy crisis in rural areas of the country with the increasing population. To improve the basic livelihoods of urban and rural population, the country should focus on accelerating development through investment in the country. Bangladesh remained the least producer of the hydropower among South Asian countries with the total installed capacity of 230 MW. Whereas, India has enormous potential of the hydropower generation with the commercially feasible capacity of 84,044 MW and has already harnessed more than 50% of its feasibility.

Table 8-3: Hydropower generation Capacity of India and Bangladesh

	Hydropower Capacity (MW)	
Country	Commercially feasible	Installed
India	84044	45400
Bangladesh	755	230

Source: Bangladesh Power Development Board, Central Electricity Authority India, 2018

The table 8-3 represents that Bangladesh could be a more potential market for Nepal to export its power. Bangladesh is one of most populated countries in the world with 160 millions of population. Increasing rapid urbanization in the country by stable economic growth has created increased demand for energy. Among the total population of the Bangladesh, 79% of people are suffering from the power-cut problems whereas 60% of them are facing low voltage supply (Islam and Khan, 2017). Currently the country is importing electricity from India and Bhutan, also has shown interest in importing electricity from Nepal through the transmission line of India. However, India has shared an open border with Nepal and has closely connected with highly populated areas such as Uttarakhand, Uttaranchal, Bihar, etc. where the energy is insufficient and that can be solved through mutual trade and cooperation in future.



**until March 2020*

Figure 8-3: Export and import of Electricity of Nepal with India (in million KWh)

Source: Author's Illustration (Ministry of Finance, Nepal, 2020)

Figure 8-3 illustrates that the trade balance of electricity is in deficit throughout the years. The increase in demand of energy in the country led to an increase in import of electricity from India. Nepal's electricity production depends on run-off rivers due to this, there is higher production of electricity in monsoon season. The power exchange deal with India permits Nepal to export electricity during high production and import from India during the dry season. Thus, Nepal is unable to import its electricity to India however, by the end of 2023, Nepal will be independent to fulfill its rising demand of electricity in the country (NEA, 2020).

8.4 Tariff of electricity in domestic market and Indian Market

Nepal's electricity tariff is considered as the second highest in South Asia after the tariff rates of Pakistan, which is a major challenge for Nepal at the present context. Because the country already signed a PTA to its neighboring country Indian and Bangladesh to export its power, it also has plans to expand its power trade in the northern border with China in future. With this fact, if the tariff rates of Nepal are higher than the exporting country's then the trading partner will not be ready to import the power at a higher cost than their domestic production. In such case, either Nepal should reduce its tariff rates than actual production cost otherwise there will be no meaning to just producing the electricity. The table 8-4

represents the tariff rates of electricity for the consumption of domestic, industrial, agricultural and commercial sectors in Nepal and India. Based on the cost of power generations, rates of tariff are also different between countries. Specifically, Nepal's domestic tariffs are higher than in India and thus its rate is higher for the exporting market as well. For the domestic consumption of electricity, tariff rates in Nepal accounted for 5.6 cents UDS for up-to 20 KWh, 10.3 cents USD for the range between 21 and 250 KWh whereas 13.9 cents USD for above 250 KWh. However, in India tariffs rates for domestic consumers are lower than Nepal's, which accounted for 5.5 cents USD for up-to 200 KWh, 8.8 cents USD for the consumption between 2001 to 400 KWh and 10.4 cents USD for the above 400KWh. The higher rates of tariffs on electricity consumption in Nepal has led to an increase in import of LPG by four times in the last 10 years which accounted 2.5% of total import of Nepal. (Nepal Oil Corporation, 2018). Hence, Nepalese are unable to enjoy the benefits that are created from electrification.

Table 8-4: Consumer Tariff Rates in Nepal and India (USD in cents per KWh)

Annual tariff	**Nepal**	**India**
Domestic Consumer tariff	up-to 20 KWh = 5.6 21 to 250 = 10.3 above 250 = 13.9	0-200 KWh = 5.5 201 to 400 = 8.8 above 400 = 10.4
Industrial tariff	9.3	11.3
Agricultural tariff	5	3.5
Commercial tariff	10.8	-

Sources: Ministry of Energy Nepal, Ministry of Power India

Furthermore, in a case of consumption for the agricultural sector, India has only 3.5 cents USD/KWh, while Nepal has 5 cents USD/KWh. However, tariffs for the industrial sector in Nepal are slightly lower than India's tariff rates.

From the above explanation it is clear that Nepal should reform its tariff rates to encourage the consumption of electricity for the domestic market as well as the exporting market. Because of the geographical structure of Nepal and lack of proper infrastructural development, it is really difficult to transport its required equipment on time and thus it causes extra time and investment in the projects. When cheaper electricity is already available in their market no one would buy expensive power from the other market. Thus,

to remain competitive in the power-trade market Nepal should bring modern technology which could reduce the unit cost of electricity generation.

9 Statistical Analysis

9.1 Data Collection

The annual time series data for Nepal from 199 to 2018 (20 years), which are publicly available in online databases has been employed in this diploma thesis. The data on electricity per capita and energy per capita are taken from The World Bank, whereas data of FDI on power and energy are taken from The Department of Industry, Nepal. Also, the data of real GDP has been taken from the Ministry of finance to calculate GDP per capita. Statistical Software "EViews" has been used to analyze the chosen data.

Table 9-1: Explanation of Variables

GDPPC	Gross Domestic Product Per Capita (Current price in USD)
FDIPs	Foreign Direct Investment in Power sector (Million in USD)
ENPC	Energy Per Capita (in USD)
EPC	Electricity Consumption Per Capita (in USD)

Source: Author's Selection

9.2 Descriptive Statistics

Table 9-2: Descriptive statistics

Variables	Units	Mean	Median	Minimum	Maximum	Standard Deviation	C.V.
GDPPC	**USD**	522.005	474.00	215.00	1034.00	257.6093	0.4935
FDIPS	**USD in million**	63.95171	22.9614	0.000	515.5002	131.6243	2.05818
EPC	**USD**	106.2370	92.2850	55.00	207.00	42.50924	0.40014
ENPC	**USD**	390.60	358.50	320.00	658.00	81.66324	0.2091

Source: Author's Calculation from EViews

The table 9-2 highlights the Descriptive Statistics of the selected variables under study. The results indicate that FDI in the power sector has the highest Coefficient of Variation indicating the largest C.V. which indicates highest variability and hence it is the

most inconsistent variable whereas, Energy Per Capita has the least Coefficient of Variation indicating that it is the most consistent variable.

9.3 Unit Root Test

After the ADF and PP test there will be likely to have three scenarios i.e. series are integrated for order zero. That is, stationary in level which requires no differencing. Another scenario is that series are integrated in order 1. Meaning that, stationary after first difference. And lastly, series are integrated of different orders which means having the combination of both series e.g. I (0) and I (1).

I. Augmented Dickey Fuller

H_0: The variable has a Unit Root (That means that the Data Series is Non-Stationary) vs.

H_1: The variable does not have a Unit Root (That means that the Data Series is Stationary)

Table 9-3: Augmented Dickey Fuller Unit Root Test

Variables	Constant		Constant & Trend		Order of Cointegration
	At Level	At 1st Difference	At Level	At 1st Difference	
LNGDPPC	-0.027333 (0.9445)	-3.816429 (0.0109)	-1.823059 (0.6532)	-3.701118 (0.0491)	I (1)
LNFDIPS	-1.821612 (0.3594)	-6.032274 (0.0001)	-3.118690 (0.1302)	-4.098061 (0.0253)	I (1)
LNEPC	0.950136 (0.9939)	-4.086258 (0.0063)	-1.516925 (0.7868)	-4.309216 (0.0163)	I (1)
LNENPC	1.600698 (0.9987)	-2.743442 (0.04866)	-0.453696 (0.9741)	-2.935940 (0.04661)	I (1)

Note: The figures in the parenthesis are the p-values of the corresponding coefficients
Source: Author's Calculation from EViews

II. Phillip Perron Unit Root Test

To solve the serial correlation or structural breaks, the PP test has applied which will provide more robust estimates than the ADF test. This test has following hypothesis:

H0: The variable has a Unit Root (That means that the Data Series is Non-Stationary) vs.

H1: The variable does not have a Unit Root (That means that the Data Series is Stationary)

Table 9-4: Phillip Perron Unit Root Test

Variables	Constant		Constant & Trend		Order of Cointegration
	At Level	At 1st Difference	At Level	At 1st Difference	

LNGDPPC	-0.037203 (0.9434)	-3.801769 (0.0112)	-1.917568 (0.6063)	-3.701738 (0.0490)	I(1)
LNFDIPS	-1.695996 (0.4172)	-7.222969 (0.0001)	-3.118690 (0.1302)	-7.250359 (0.0000)	I(1)
LNEPC	1.955055 (0.9996)	-4.061923 (0.0066)	-1.437980 (0.8147)	-4.818985 (0.0063)	I(1)
LNENPC	0.308795 (0.9762)	-4.835565 (0.0014)	-1.548930 (0.7746)	-5.520681 (0.0017)	I(1)

Note: The figures in the parenthesis are the p-values of the corresponding coefficients
Source: Author's Calculation from EViews

The results of both the above Unit Root Tests indicate that the test statistic values for all the variables are found to be non-stationary at level but stationary at 1st Difference since their p-values are less than 0.05 at 1st Difference. The p-values less than 0.05 indicate the rejection of the Null Hypothesis, concluding that there is no unit root for the variables at 1st Difference and hence they are Stationary at First Difference. This indicates that all the variables have order of Co integration as I (1). Hence, it is possible to apply VECM (Vector Error Correction Model) after checking for Cointegration. Estimation of VECM involves three steps:

Step-1: Optimum Lag Selection

Step-2: Checking for Cointegration using Johansen's Cointegration Test

Step-3: Estimating VECM

9.4 Optimum Lag Selection

Different criteria for the selection of optimum lag can be used as shown in Table-4 below. The most widely used are AIC (Akaike Information Criterion) and SIC (Schwarz Information Criteria). The lower values of these criteria are preferable since these criteria indicate the loss of information by taking lags.

Table 9-5: Optimal Lag Selection

VAR Lag Order Selection Criteria
Endogenous variables: LNGDPPC LNFDIPS LNEPC LNENPC
Exogenous variables: C
Date: 03/31/20 Time: 18:27
Sample: 1999 2018
Included observations: 18

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-7.053870	NA	4.02e-05	1.228208	1.426068	1.255490
1	50.58997	83.26332*	4.17e-07*	-3.398885*	-2.409583*	-3.262474*
2	65.22471	14.63474	6.78e-07	-3.247190	-1.466446	-3.001649

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: Author's Calculation from EViews

The results shown in the above table indicate that optimum lag value selected uniformly by all the criteria is 1 as indicated by '*' in the table against the values of the respective criterion. Thus Lag 1 can be used for model estimation.

9.5 Co-integration Test

The cointegration tests examine non-stationary time series processes which have variances and means fluctuate over the time. The non-stationary time series data can be converted into stationary through transformation or differencing. In a case of a series is stationary itself then it is signifies as I(0), however, when a non-stationary series becomes stationary after a single differencing then it is known as integrated in order one which signifies as I(1) and if it becomes stationary after two set of differencing then it is known as integrated in two order and signifies as I(2).

Table 9-6: Johansen's Cointegration Test

No. of Co-integrating Equations	EigenValue	Trace Test			Max. EigenValue Test		
		λ_{max}	5% Critical Value	P-value	λ_{max}	5% Critical Value	P-value
None	0.805956	47.02489	47.85613	0.0597	29.51406	27.58434	0.0279*
At Most 1	0.502208	17.51084	29.79707	0.6023	12.55631	21.13162	0.4938

Source: Author's Calculation from EViews

The above results indicate that p-value for Trace Statistic is 0.0597 greater than 0.05 but near to 0.05, while that for Maximum Eigen Value Statistic is 0.0279 which is less than 0.05 indicating that it is significant. Trace test says no cointegration but Rank Test (Eigenvalue Test) indicates 1 co-integrating equation. Therefore, there must be at least 1 co-integration model.

9.6 Granger Causality Test (VECM)

Further, the results of Granger Causality Test (VECM) are shown in table 8-7 below:

Table 9-7: Granger Causality Test (VECM)

Pairwise Granger Causality Tests
Date: 03/31/20 Time: 20:02
Sample: 1999 2018
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
LNFDIPS does not Granger Cause LNGDPPC	19	1.46350	0.2439
LNGDPPC does not Granger Cause LNFDIPS		7.93369	0.0124
LNEPC does not Granger Cause LNGDPPC	19	0.47546	0.5004
LNGDPPC does not Granger Cause LNEPC		1.34289	0.2635
LNENPC does not Granger Cause LNGDPPC	19	2.36864	0.1433
LNGDPPC does not Granger Cause LNENPC		2.81796	0.1126
LNEPC does not Granger Cause LNFDIPS	19	3.16897	0.0940
LNFDIPS does not Granger Cause LNEPC		0.14823	0.7053
LNENPC does not Granger Cause LNFDIPS	19	0.01869	0.8930
LNFDIPS does not Granger Cause LNENPC		0.04583	0.8332
LNENPC does not Granger Cause LNEPC	19	5.17015	0.0371
LNEPC does not Granger Cause LNENPC		3.91903	0.0652

Source: Author's Calculation from EViews

The above results indicate that only one p-value is significant indicating LNGDPPC Granger Causes LNFDIPS. This implies a unidirectional relationship between GDP and FDI in the power sector. All the other pairs of variables do not have Granger Causality.

Table 9-8: Granger Causality Under VECM Framework

VEC Granger Causality/Block Exogeneity Wald Tests
Date: 03/31/20 Time: 19:49
Sample: 1999 2018
Included observations: 18

Dependent variable: D(LNGDPPC)

Excluded	Chi-sq	df	Prob.
D(LNFDIPS)	0.249102	1	0.6177
D(LNEPC)	0.678466	1	0.4101
D(LNENPC)	3.338521	1	0.0677
All	5.116032	3	0.1635

Dependent variable: D(LNFDIPS)

Excluded	Chi-sq	df	Prob.
D(LNGDPPC)	0.655418	1	0.4182
D(LNEPC)	0.011742	1	0.9137
D(LNENPC)	2.860429	1	0.0908
All	3.494693	3	0.3215

Dependent variable: D(LNEPC)

Excluded	Chi-sq	df	Prob.
D(LNGDPPC)	1.501517	1	0.2204
D(LNFDIPS)	4.850124	1	0.0276
D(LNENPC)	0.422923	1	0.5155
All	7.723897	3	0.0521

Dependent variable: D(LNENPC)

Excluded	Chi-sq	df	Prob.
D(LNGDPPC)	0.203355	1	0.6520
D(LNFDIPS)	1.141612	1	0.2853
D(LNEPC)	0.128089	1	0.7204
All	1.234692	3	0.7447

Source: Author's Calculation from EViews

Examining the p-values of the variables in the above table indicate that there is only one significant p-value for the model where D(LNEPC) is the dependent Variable with D(LNFDIPS) excluded. Thus, there is no evidence of short run or Long Run Granger Causality amongst the variables. Further, the coefficients of the estimated co-integration

model were tested for their significance using Wald test. The estimated co-integrated (VECM) model with Lag1 is shown in Table 9-9 below:

Table 9-9: Estimated Co-integrated VECM Model

Dependent Variable: D(LNGDPPC)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 03/31/20 Time: 19:02
Sample (adjusted): 2001 2018
Included observations: 18 after adjustments
D(LNGDPPC) = C(1)*(LNGDPPC(-1) - 0.0267599916528*LNFDIPS(-1) - 1.86941976339*LNEPC(-1) + 2.74060348831*LNENPC(-1) - 13.74943035) + C(2)*D(LNGDPPC(-1)) + C(3)*D(LNFDIPS(-1)) + C(4) *D(LNEPC(-1)) + C(5)*D(LNENPC(-1)) + C(6)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.247213	0.173233	-1.427052	0.1791
C(2)	0.400688	0.330593	1.212027	0.2488
C(3)	0.006010	0.012042	0.499101	0.6267
C(4)	0.301007	0.365437	0.823690	0.4262
C(5)	0.587680	0.321635	1.827162	0.0926
C(6)	0.013280	0.047328	0.280607	0.7838

R-squared	0.343580	Mean dependent var	0.083506
Adjusted R-squared	0.070071	S.D. dependent var	0.070598
S.E. of regression	0.068079	Akaike info criterion	-2.275082
Sum squared resid	0.055618	Schwarz criterion	-1.978292
Log likelihood	26.47574	Hannan-Quinn criter.	-2.234159
F-statistic	1.256193	Durbin-Watson stat	2.112963
Prob(F-statistic)	0.343535		

Source: Author's Calculation from EViews

Here, C (1) is the long run coefficient and C (2) to C (6) are short run coefficients. C (1) is called Speed of Adjustment for Long Run which must be significant and negative. Here it is negative but not significant. Thus, there is very weak long run causality from the independent variables. Thus, the independent variables do not have a significant impact on the Dependent variable in the long run indicating very weak long run causality.

For examining Short Run Causality, the coefficients C(2) to C(6) were tested for their significance using Wald Test, the results of which indicated that all the coefficients were found to be insignificant since their p-values of Chi-square test statistic for each variable were found to be greater than 0.05. This indicates non-existence of shorn run association between the variables of this estimated model.

9.7 Variance Decomposition Test

Variance Decomposition Test was also carried out in order to examine the short run and long run behavior of the variables as regards their self-explanatory power, the results of which are shown in Table 9-10 below:

Table 9-10: Variance Decomposition Test

Variance Decomposition of LNFDIPS:

Period	S.E.	LNFDIPS	LNGDPPC	LNEPC	LNENPC
1	1.669289	100.0000	0.000000	0.000000	0.000000
2	1.927772	98.39820	0.560515	0.694956	0.346332
3	2.463840	79.43316	1.416219	8.789430	10.36119
4	2.933431	71.14428	2.798438	13.34240	12.71488
5	3.357867	66.76619	3.082373	15.56436	14.58708
6	3.711477	64.20682	3.370759	16.87492	15.54750
7	4.055157	61.99739	3.554742	17.99713	16.45074
8	4.366668	60.50630	3.725376	18.78086	16.98747
9	4.660565	59.34437	3.831822	19.37974	17.44406
10	4.934734	58.45562	3.925254	19.84186	17.77726

Variance Decomposition of LNGDPPC:

Period	S.E.	LNFDIPS	LNGDPPC	LNEPC	LNENPC
1	0.068079	0.391443	99.60856	0.000000	0.000000
2	0.110902	3.064403	94.42276	1.999454	0.513386
3	0.134272	2.169281	93.43034	1.372546	3.027836
4	0.155189	1.770715	84.49636	4.535308	9.197621
5	0.171420	1.629611	80.69654	6.041857	11.63199
6	0.187487	1.534991	77.80672	6.980980	13.67731
7	0.201750	1.433971	75.81291	7.694102	15.05902
8	0.215461	1.372304	73.99951	8.356038	16.27215
9	0.228126	1.322147	72.69230	8.841601	17.14396
10	0.240252	1.283552	71.59987	9.238393	17.87818

Variance Decomposition of LNEPC:

Period	S.E.	LNFDIPS	LNGDPPC	LNEPC	LNENPC
1	0.034874	3.716066	4.728559	91.55537	0.000000
2	0.107661	2.819412	1.474311	64.86754	30.83874
3	0.160267	1.328168	4.542055	65.96144	28.16833
4	0.220112	1.136965	5.193764	64.82770	28.84157
5	0.263051	1.030452	5.896497	64.97614	28.09691
6	0.302472	1.009006	6.024952	64.76972	28.19632
7	0.336559	0.968300	6.231422	64.75902	28.04125
8	0.368422	0.954510	6.319932	64.68828	28.03728
9	0.397316	0.939293	6.413221	64.67130	27.97618
10	0.424483	0.930808	6.466735	64.64025	27.96221

Variance Decomposition of LNENPC:

Period	S.E.	LNFDIPS	LNGDPPC	LNEPC	LNENPC
1	0.142848	3.361033	0.161127	58.13278	38.34506
2	0.180506	2.610509	0.674749	63.13188	33.58286
3	0.202049	2.090953	0.628794	63.38936	33.89089
4	0.225367	1.686181	0.505411	63.74609	34.06232
5	0.248748	1.384593	0.426074	64.15585	34.03348
6	0.269241	1.183365	0.369418	64.48330	33.96392
7	0.288198	1.033568	0.324978	64.67749	33.96397
8	0.306055	0.916890	0.291359	64.83811	33.95364
9	0.323006	0.823719	0.264634	64.96556	33.94608
10	0.339064	0.748016	0.242884	65.07211	33.93699

Cholesky Ordering: LNFDIPS LNGDPPC LNEPC LNENPC

Source: Author's Calculation from EViews

The above table indicates the proportion of variance of the dependent variable decomposed and explained by each of the independent variables in short run as well as long run. The above results do not indicate any significant in long run as well as short run

association between the study variables. Hence in order to examine how FDI, Electricity Consumption per capita and Energy Consumption affect the economic growth of the country, I have estimated Multiple Regression Model with usual Ordinary Least Square Method.

9.8 Multiple Regression Model

Table 9-11: Multiple Regression Model

Dependent Variable: LNGDPPC
Method: Least Squares
Date: 03/31/20 Time: 14:33
Sample: 1999 2018
Included observations: 20

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.454357	0.966152	2.540342	0.0218
LNFDIPS	0.041609	0.016212	2.566551	0.0207
LNEPC	1.232562	0.140396	8.779194	0.0000
LNENPC	-0.348274	0.214879	-1.620795	0.1246

R-squared	0.969074	Mean dependent var	6.132701
Adjusted R-squared	0.963276	S.D. dependent var	0.523727
S.E. of regression	0.100365	Akaike info criterion	-1.583155
Sum squared resid	0.161169	Schwarz criterion	-1.384009
Log likelihood	19.83155	Hannan-Quinn criter.	-1.544280
F-statistic	167.1234	Durbin-Watson stat	1.591159
Prob(F-statistic)	0.000000		

Source: Author's Calculation from EViews

The table 9-11 results indicate the coefficients of all the variables except LNENPC are significant as they have their p-values less than 0.05. Per Capita Electricity Consumption is the highest contributing variable (with coefficient 1.23) amongst the independent variables, with positive significant effect on Per Capita GDP, whereas FDI has the lowest contribution (only 4.16%) to Per Capita GDP with a positive significant effect. Energy consumption has a negative but insignificant effect on GDP. The value of R-square is around 96% which indicates that the estimated model is fairly good. The p-value of F-Statistic is also less than 0.05 indicating the significance of R-square. Thus, the estimated model is powerful as it helps explain 96% of the total variation in GDP as explained jointly by FDI, Electricity Consumption and Energy Consumption.

10 Discussion and Recommendation

The main purpose of this research is to know about the status of FDI in different sectors of Nepal. This research has mainly emphasized the power and energy sector, as this sector is the highest FDI receiving in the country. To analyze the Hydropower sector in Nepal, overall economic situation and various laws related to hydropower development process has been discussed. And overall economic condition of the country reveals that the country is lacking its national savings for the investment in power sectors of Nepal.

For comparative analysis and statistical analysis, it was necessary to study others literature and case study to provide basis and recommendation to this research. From the literature review it is found out that the cost and benefits related to FDI varies according to the country's economic conditions, policy, geographical features and so on. Also, the history of FDI in Nepal suggests, over the time the forms of grants and loans are being invested as a form of FDI in different sectors. In the context of Nepal, the trend of FDI shows that when the country is in harmony, the rate of FDI has increased whereas, if the country is in conflicts then the FDI inflows to the country has decreased. Thus, it is really necessary for the country to have harmony in an economy to attract more FDI.

Additionally, in the total FDI and FDI in hydropower development of Nepal, China and India are the two biggest investors and it is really a positive sign for Nepal that both neighboring countries are interested to make investment in Nepal. There are several reforms of the policy and cooperation was carried out such as the legislation of the Technology Transfer Acts (1980), became the WTO members, BIMSTEC, SAFTA, MIGA, BIPPA and so on. In terms of attracting the FDI in the country Nepal is doing better than before however it is not adequate. The regulatory framework and policy related to FDI of the country has been reviewed to know about its role and effectiveness in the country. Even the several changes are made to increase the FDI inflow, the study carried out on inflow of FDI and results achieved from the investment on the basis of policy analysis, problem analysis, comparative growth analysis and potential analysis found that the major challenges for the FDI in Nepal is because of political instability, poor implementation of existing policy, (Hasan and Kim, 2014). Additionally, Dhungel and Rijal (2012) mentioned that policy constraint is also one of the main challenges for Investment in the Hydropower sector of Nepal which creates confusion for domestic as well as foreign investors. For instance, Hydropower development

policy suggests a production license only for 35 years whereas Electricity Act proposes for 50 years. And such inconstancy among policies should be avoided.

Similarly, the overall sector-wise FDI of the economy has been discussed and known that the most attractive sectors for the FDI is the power and energy sector which accounted for 42% of overall investment. Before discussing the hydropower development in Nepal, the overall energy sectors have been discussed because it is very important to know the overall sectors before entering into the specific. The status of energy sectors indicates that almost 70% of the population are still dependent on consumption of traditional sources of energy, whereas second highest consumed energy are commercial sources. And least consumed sources are renewable energy resources. From the increasing trend in consumption of renewable energy, it is predictable that Nepal has the possibility to increase in production of clean energy such as biogas, solar system as Nepal's more than 70% population are still dependent on traditional fuel sources and more than 80% of population are living in rural areas. And those populations are mainly involved in the agricultural sector, which makes it easy for Nepal to produce biogas through the marine of cattle and organic waste. The government initiation for the installation of biogas plants in rural areas is considerable as more than 3000,000 units of installation was finished until 2015 and a devastating earthquake in 2015 has interrupted the programs afterwards (Ministry of Energy, 2018).

After the general overview on the energy sector, the specific sector, hydropower development in Nepal has been highlighted. The enormous potential of hydropower development in Nepal consisted of 83,000 MW and technically there is possibility of generating 42,000 MW of power. Because of this fact, development of hydropower in the country is often regarded as the prospects for uplifting the economic condition. Due to a decade of Maoist conflict in the country has impacted the hydropower development negatively and stagnated the growth in the sectors. During the periods, many infrastructures of the hydropower plants were destroyed, and investors were threatened which caused fear among the investors. Moreover, after the peace agreement in 2006 the sectors started to grow slowly due to the political instability in the country. With the growing demands for electricity in the county, the problems of load shedding started, and a decade long problem was solved by the end of year 2017.

The hydropower development in the country is facing several challenges such as geographical structure as Nepal's 80% of area is covered by hilly and mountain regions. And other challenges are lack of infrastructural development, insufficient financial investment,

lack of modern technology, environment related issues, social challenges and exporting market (Dhungel and Rijal, 2012). To tackle the geographical difficulties and environmental issues there should be a proper field of study and planning accordingly. Because the source of hydropower generation in Nepal are run-off rivers and glacial lakes. And construction of hydropower plants causes landslides and floods in the nearby areas which can cause damage to hydropower as well as destruction of the nearby natural resources. Furthermore, problems related to society such as incentives should be paid timely and should emphasize on providing opportunities to the local people. Whereas challenges related to infrastructural development and inadequate technology can be brought through the FDI for the better development of hydropower.

From the study of South Korea Nepal should learn to initiate environment friendly FDI policy through the providing the incentives to the investors, by securing the investment in Nepal. Also, over the years South Korea has increased its consumption of energy in the industrial sector by promoting industrial development in the country which benefits the economy from industry as well as revenue from the energy use (Park, 2017). For the overall development of the country Nepal should follow the pathway that was followed by South Korea.

Currently, the trends in the gap between consumption and production of electricity is declining, and the country will be independent for its power consumption by the end of 2023. As the country is politically stable at present time, the potential of hydropower in the country is attracting more foreign investment. However, lacking in effective implementation of the policy in the sector is problematic.

The cost comparison between consumption of LPG and electricity indicates that consumption of LPG is 20-30% cheaper than electricity, which discourages people to increase in the consumption of electricity. According to the Economic Survey report of Nepal (2018), the imports of LGP in the country has increased by four times in the last 10 years and represents 2.5% of total imports of the country. Such, scenario in the country will create troubles in the future to increase the consumption of electricity. Also, Dhungel (2008) suggested that Nepal can plan for the exchange program of electricity with petroleum products and coal to its neighboring countries which will have a positive impact on its overall economic growth. Thus, Nepal should plan for the industrial development in the country which will increase the consumption of energy as well as reduce the import in the country as Nepal has huge trade deficits.

The statistical analysis of this research, the causal relationship between FDI in the power sector and energy and electricity consumption and economic growth has been empirically analyzed for the period 1990-2018. The ADF and PP unit root test was employed to check the stationary of each variable. And the results of these tests highlighted that all the models of variables are non-stationary at level whereas stationary at I (1) order of integration. Afterwards, Johansson cointegration test and granger causality test to find the causality among variables in long-run and short-run. Also, the variance decomposition test has been applied to get more consistent results.

Furthermore, the power sector is getting higher FDI than any other sectors however, the country is still importing electricity in the dry season to meet its demand. The empirical study shows conflicting results that there are not any short-run or long-run relationships among variables. However, it shows a long-run unidirectional relationship between GPD and FDI, meaning that economic growth is a single factor which attracts more FDI into the country. Because, when a country's policies are effectively implemented, and economic growth is stable then it will encourage more FDI into the country. In the context of Nepal, the country is still among the least developed or low-income status and has to be highly dependent on foreign grants or loans to fulfil its basic needs. And thus, the problems of resource gap are vital which lacks the country to achieve its goals, even the opportunities and financing are enough.

As the Granger causality didn't show any indication that the variables have any relationship in short-run as well as long-run, multiple regression model with usual ordinary least square method has been examined to see how FDI, Electricity Consumption per capita and Energy Consumption affect the economic growth of the country. And the results confirmed variables are statistically significant except for electricity consumption per capita. This is because the electricity consumption per capita is among the lowest and has seen least growth during the periods. Furthermore, the results indicate the corresponding coefficient estimation is significant and it implies that those parameters are having some effect on the economic growth of the country.

Similarly, a previous study done by Dhungel (2008), on the causal relationship between energy consumption and economic growth in Nepal, found that there is unidirectional causality among variables. Scholar also suggested that per capita energy consumption is the encouraging factor for enhancing the economic growth in Nepal and the Government of Nepal should make an effective effort to encourage investment in energy generation.

However, Scholars such as Latief and Lafen (2019) have empirically analyzed the causality among the FDI in the power and energy sector, the energy consumption and the economic growth of Pakistan for the period 1990-2017. The Granger causality tests, and Johansen cointegration were applied to find the causal relationship among variables in short-run as well as long-run and found that GDP and energy consumption do not have causal relationship with FDI in long-run as well as short-run. Rather, there was a positive bi-directional or cyclic short-run causal relationship between economic growth and energy consumption. Meaning that economic growth in Pakistan causes an increase in energy consumption and vice versa. Also, Scholars mentioned that such bi-directional relationship between GDP and energy consumption is very essential for the rapidly developing countries like Pakistan where economic growth helps to accelerate the energy consumption.

11 Conclusion

This study highlighted the history, present status and potential of hydropower development in Nepal. From the total sector-wise FDI reveals that the power sector in Nepal has higher investment than any other sectors. Moreover, the neighboring countries of Nepal, China and India have played a vital role in terms of providing FDI as these countries placed at 1st and 2nd place respectively. Also, China and India invested the most in the hydropower sector of Nepal. Similarly, from October 2017, Nepal became free of load-shedding by ending more than a decade of problems. And it shows that Nepal's power sector is progressing. The trends in the gap between consumption and production of electricity is declining, and the country will be independent for its power consumption by the end of 2023. As the country is politically stable at present time, the potential of hydropower in the country is attracting more foreign investment. However, lacking in effective implementation of the policy in the sector is problematic.

In terms of attracting FDI in the country, Nepal can also learn from the experience of South Korea by promoting export-oriented industrialization and liberalization of FDI policy to attract more foreign investment. It's high time that Nepal really should focus on implementing the policy effectively and initiate the programs that encourage the increase in export of the country to balance the trade as well as to eliminate the negative gap between saving and investment.

For the cooking purpose, still more than 70% of population are dependent on traditional fuels sources such as firewood, animal waste, vegetable waste, whereas 7.7% of population are consuming imported LGP and only about 3.3% of population consumed electricity for the cooking. The cost comparison between consumption of LPG and electricity indicates that consumption of LPG is 20-30% cheaper than electricity, which discourages people from increasing the consumption of electricity. According to the Economic Survey report of Nepal (2018), the imports of LGP in the country has increased by four times in the last 10 years and represents 2.5% of total imports of the country. Such, scenario in the country will create troubles in the future to increase the consumption of electricity. The Nepal Electricity Authority already requested the public to increase their domestic consumption of electricity,

however there is lack of cooperation between the oil corporation and electricity authority. At the end this situation will harm the overall economy, because limiting imports in LPG will save the country from monetary losses as well as increase in consumption of electricity will contribute to the GDP. Also, the government should reform the tariff for electricity and should initiate awareness programs to replace the use of traditional fuels.

Also, the comparison of tariff in domestic market and Indian market shows that, rate of tariff is quite higher in Nepal than in India. In this context, it will be difficult for Nepal to export its power to India. Because no one would be willing to buy the expensive products when the cheaper products are already available in their market. The geographical structure of the country, lack of modern technology and lack of infrastructural development are the main reasons that the cost of hydropower in Nepal is higher and this problem can be solved in a case Nepal will focus on well infrastructural development and bring modern technologies through FDI. Additionally, the comparison of potential markets for the power trade with India and Bangladesh indicates that Bangladesh could be more important in the future than India because Bangladesh is facing an energy crisis with growing consumption and India is already doing a great job in terms of expanding the energy sector. However, southern border areas of Nepal could be potential markets as this part of India has higher population density and higher demand for energy.

The statistical analysis of this research, the causal relationship between FDI in the power sector and energy and electricity consumption and economic growth has been empirically analyzed for the period 1990-2018. ADF and PP unit root test was employed to check the stationary of each variable. And the results of these tests highlighted that all the models of variables are non-stationary at level whereas stationary at I (1) order of integration. Afterwards, Johansson cointegration test and granger causality test to find the causality among variables in long-run and short-run. Also, the variance decomposition test has been applied to get more consistent results.

Furthermore, the power sector is getting higher FDI than any other sector, the country is still importing electricity in the dry season to meet its demand. The empirical study shows conflicting results that there are no short-run or long-run relationships among variables. However, it shows a long-run unidirectional relationship between GDP and FDI, meaning that economic growth is a single factor which attracts more FDI into the country. Because, when a country's policies are effectively implemented, and economic growth is stable then it will encourage more FDI into the country. In the context of Nepal, the country is still

among the least developed or low-income status and has to be highly dependent on foreign grants or loans to fulfil its basic needs. And thus, the problems of resource gap are vital which lacks the country to achieve its goals, even the opportunities and financing are adequate.

As the Granger causality did to show any indication that the variables have any relationship in short-run as well as long-run, multiple regression model with usual ordinary least square method has been examined to see how FDI, Electricity Consumption per capita and Energy Consumption affect the economic growth of the country. And the results confirmed variables are statistically significant except for electricity consumption per capita. This is because the electricity consumption per capita is among the lowest and has seen least growth during the periods.

At the end I would like to mention that there are several factors which have affected the effectiveness of FDI in Nepal despite having potential growth and political stability. One of the main factors is policy initiation that supports the foreign investors and its effective implementation to secure the foreign investment.

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13 Appendix

Years	GDP per capita	FDI in power sector	Electri city per capita	Energy per capita	GDP growth rate
1999	215	0.26	55	327	4.4
2000	230	0.00	59	339	6.2
2001	247	0.26	65	344	0.12
2002	244.7	0.00	67.5	343	4
2003	252.4	0.23	70.5	347	4.6
2004	286	0.00	74.43	348	3.5
2005	316	0.35	77.07	355	3.4
2006	347	0.00	83.82	350	3.4
2007	391	38.49	87.63	353	6.1
2008	470	28.74	83.48	362	4.5
2009	478	63.68	96.94	369	4.8
2010	592	16.98	102.54	378	3.4
2011	699	37.00	115.82	391	4.8
2012	698	31.32	120.9	375	4.1
2013	716	113.91	136.64	417	6
2014	743	515.50	146.47	435	3.3
2015	793	17.18	148	320	0.6
2016	777	30.95	150	465	8.2
2017	911	347.34	177	536	6.7
2018	1034	36.85	207	658	7.1

Status of Power Generation and its Consumption (In Million KW Hour)

Fiscal Year	Domestic	Industrial	commercial	Others	Total Consumption	Export	Loss	Total generation
2009/10	1109,29	1008,37	193,12	292,57	2603,35	74,48	1011,44	3689,27
2010/11	1143,18	1012,87	204,92	294,92	2655,89	31,1	1071,38	3758,37
2011/12	1311,07	1192,06	227,06	384,5	3114,69	50	953,71	4118,4
2012/13	1397,46	1141,07	237,91	379,56	3156	0	756	3912
2013/14	1526,84	1246,7	285,16	383,56	3442,26	0	853,83	4296,09
2014/15	1688,5	1362,61	302,57	415,78	3769,46	3,17	1194,04	4966,67
2015/16	1792,95	1205,69	286,48	430,7	3715,82	3,15	1358,21	5077,18
2016/17	2150,21	1735,05	352,37	530,18	4767,81	2,69	966,5	5737
2017/18	2403,63	2074,16	407,59	637,91	5523,29	2,83	1531,81	7057,93
2018/19	1731,34	1553,9	301,5	474,74	4061,48	1,84	929,8	4993,12