



## ECONOMIC ACTIVITIES ASSOCIATED WITH EXTRACTION OF RIVERBED MATERIALS IN THE TINAU RIVER, NEPAL

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### Abstract

A study was conducted during 2012 to 2013 in the selected reach of Tinau River, Nepal. The main objective of the study was to quantify employment and income generation from extraction of construction materials from the river. A 10 km stretch of the river was selected for the study. Sample survey with semi-structured questionnaire and field observation were the main tools used during field investigation. Extraction of riverbed materials from the banks, beds and floodplain areas of the river has provided many kinds of job opportunities for the people living in the vicinity of the river. It has also generated adequate amount of revenues. The collected revenue has been invested for many kinds of social and infrastructures development for years. Though extraction of riverbed materials is beneficial for income and employment generation, it has also negative environmental impacts in and around the river. Furthermore, the study concluded that riverbed extraction should be continued with special monitoring and evaluation in the areas where there is still room for extraction.

**Key words:** Extraction, Crusher plants, Economic activities, Tinau River

### 1. INTRODUCTION

Rivers are our life lines, which have been used for various purposes. Rivers and river banks reflect the cultural heritage and economic prosperity of the people living there. They also reflect people's respect for nature, environment, and their understanding of the ecological processes (Baidya, 2003). There are thousands of such rivers throughout the world. Among them, the top ten large rivers are the Sepik, the Mississippi, the Volga, the Zambezi, the Mekong, the Ganges, the Danube, the Yangtze, the Nile and the Amazon (Touropia, 2013). These rivers are

not only the genesis of human civilizations but also the means of transportation, resource generation and promotion of tourism development. Such rivers maintain the ecological balance as well (Dahal et al., 2012a, 2012b). But such rivers are being disturbed by several factors. One of them is unregulated extraction of riverbed materials from the beds, banks and floodplains, which invites numerous effects on aquatic environment.

Rivers provide physical and biological resources to sustain life, but they are being impulsively used by humans to meet their needs. Besides many such anthropogenic activities, urbanization is considered as the pivotal one (Roach et al., 2008). Urbanization decreases the mean catchment area of perennial rivers (Roy et al., 2005). It results into diversion of rivers for various purposes like irrigation, water supply, and generation of hydro-electricity. The diversion of river water for such purposes breaks the river continuum, which ultimately disturbs the ecology of the river downstream (Vorosmarty and Sahagian, 2000; Allan et al., 2006).

Tinau River is one of the potential rivers of Nepal, which carries lots of sand and gravels. As the river enters into the Terai Region of Nepal, it deposits the material. These materials are being used by the local administrative bodies such as village development committee (VDC), municipality and district development committee (DDC). These local administrative bodies are generating millions of Nepalese Currency for years. However, the extraction of riverbed materials is not going on in a scientific way (Dahal, 2014). Thus, the ecology of the river is degrading.

Aquatic ecology of Tinau River has been altered due to human activities, such as excavation and extraction of construction materials, for the last decade. Tinau River has been facing both external and internal degradation for years. External degradation is increasing with the pace of increasing population of this region, whereas the internal devastation is caused by geo-environmental degradation of Tinau River basin (BTM, 2001). The external degradation includes impacts on water quality, non-treated and non-regulated foul water discharge into the river, dumping of garbage in the river floodplain areas, encroachment of floodplain areas as well as uncontrolled extraction of riverbed materials (ERMC, 2011; DWIDP, 2011).

In Nepal, local self governance act and local self governance regulations provided the right to extract the natural resources for the income generation within their political boundaries (LSGA, 1999; LSGR, 2000). Since then massive extraction of construction materials started without considering environmental consequences.

## 2. MATERIALS AND METHODS

The study was conducted during the period of 2012-2013, in the Tinau River from Paschim Amawa VDC to Bethari (Gonaha VDC). Around 10 km stretch of Tinau River was selected for this study (Fig. 1). The study was based on field survey. Semi-structured questionnaire was prepared for field investigation. Labors in the extraction activities, industrialists and the businessmen of the study area were taken for sample survey. In every port of entries (Naka) of the extraction zone 48 labors were selected randomly for interview. Similarly, businessmen and industrialists were also selected for the interview. Besides, some age-old persons from the study area were questioned. Total of 90 persons were selected for interview. Out of 90, 48 were from labors, 10 from businessmen, 17 from industrialists and 15 from age old inhabitants. The focused group discussion (FGD), seminar and interaction were held for appropriate data collection for this study. By the end of sampling, it was cross checked for the

validation of collected data. The data was processed using software Excel. Pie chart, Bar Chart and Tables were used for presenting primary and secondary data.

The length of Tinau River is 95 km, and total catchment area is 1081 km<sup>2</sup> (Dahal, 2014). There are many tributaries of Tinau River but the major are: JhumsaKhola, SisneKhola, BhaiskattaKhola and DobhanKhola (Dahal, 2012a; Kharel, 2002). However, the study was conducted only in a small stretch (10 km.) of the river. The river originates from the Palpa district (Mountainous region) and flows through the plain area (Terai) of Rupandehi district. The study covers only some parts of the Terai region of Rupandehi district (where there is sufficient riverbed materials deposited).

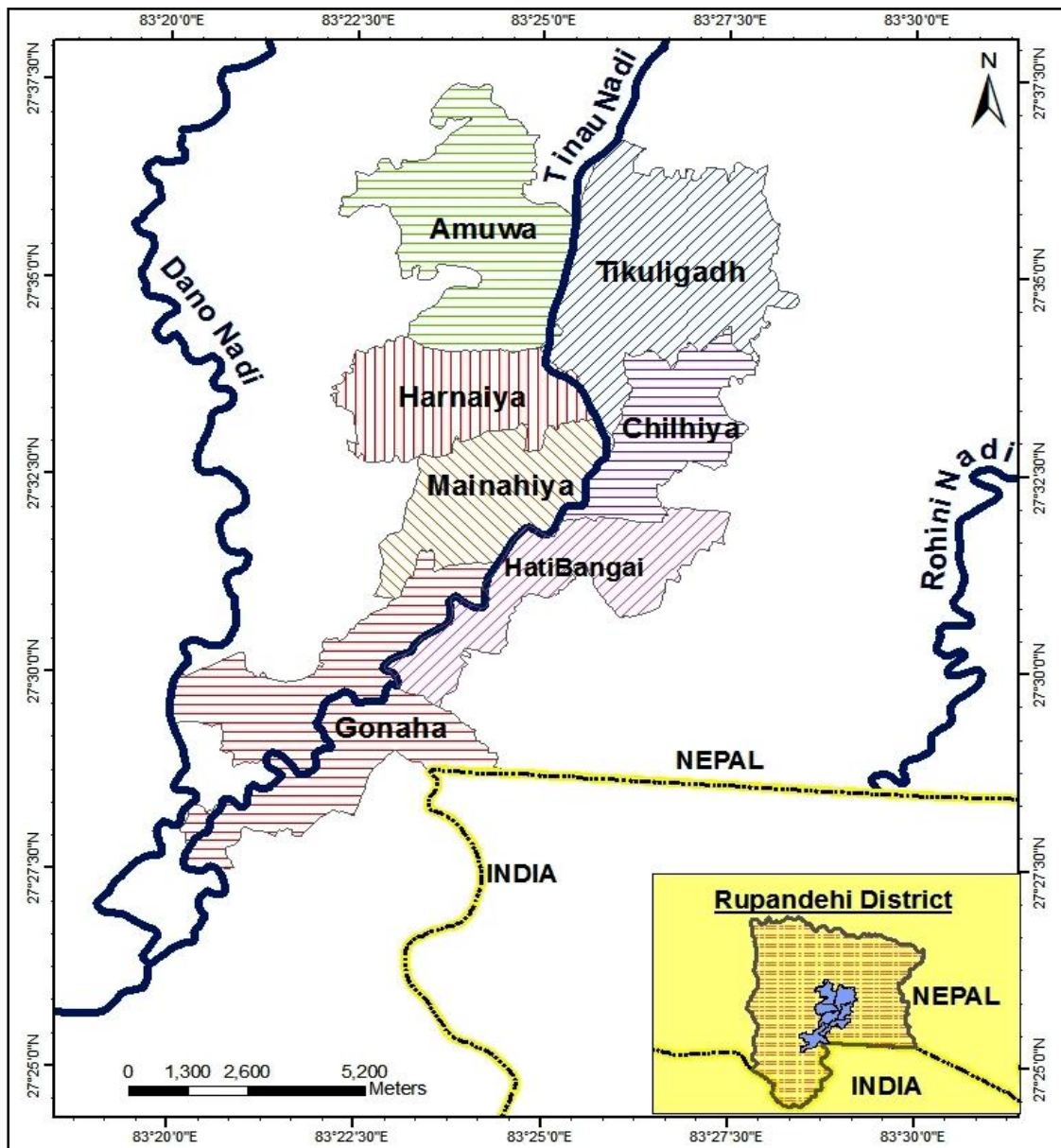


Figure.1: Map showing study area (Source: DOI, 2013)

### 3. RESULTS AND DISCUSSION

#### 3.1 RESULTS

There are 17 ports of entries (NAKAs) along the bank of Tinau River. But there were only 10 NAKAs running during the period of 2012. The main existing NAKAs and their status are presented in table (Table 1). These NAKAs are open for extraction of riverbed materials as the environmental impact assessment (EIA) report of DDC.

**Table 1: Details of NAKAS**

Name of Rivers	Name of VDCs	Open Ports (Naka)	Total Extracted Quantity,cft.
Tinau	Tikuligadha	Baghdhuranaka	755400.00
		Jeetpurnaka	736400.00
	Chilhiya	Kawanaka	0.00
		Sonaret	0.00
	Hati Bangai	Mahuwari	564400.00
		Bairihawa	569700.00
	Mainahiya	Kutta	171000.00
		Bargadawa	58600.00
	Harnaiya	Bhaisakhadar	433500.00
	Pa. Amuwa	Kanari	685255.00
<b>Grand Total, Cubic Feet</b>			<b>3,974,255.00</b>

**Source: Field survey, 2012**

The extraction of riverbed materials has generated self employment. There are some new businesses such as hotels and grocers emerged due to riverbed extraction along the bank of Tinau River. These businesses have provided employments for adequate number of people. The details of employment generated from the hotels and grocers (KiranaPasal) are presented in table 2.

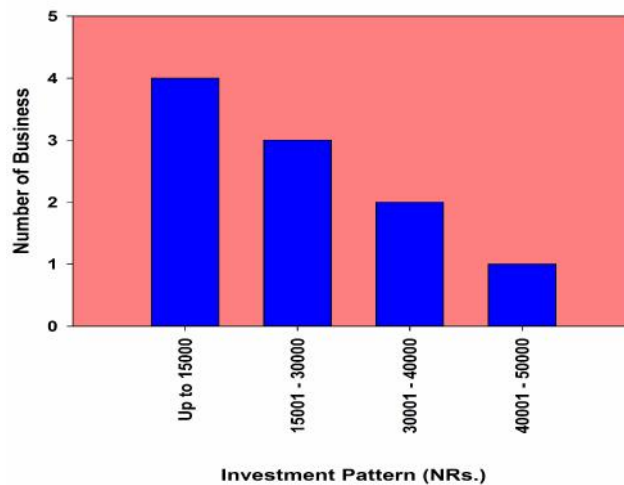
**Table 2: Employment generated from the hotels and grocers (KiranaPasal)**

S. N	Name of "NAKA "	Type of Business		Estab-lish-ment.	Business pattern Seasonal / Yearly	No. of human resources engaged	Investment (NRs.)
		Hote l (H)	Grocers (G)				
1	PashimAmuwa, Bardahawa	H	-	2008	Seasonal	2	23000.00
2	PashimAmuwa, KanariChowk	-	G	2012	Yearly	5	40000.00

3	PashimAmuwa, Kanari	H	-	2009	Seasonal	3	30000.00
4	Shankarnagar, Dingernagar	-	G	2010	Seasonal	2	15000.00
5	Shankarnagar, Yogikuti	H	-	2011	Seasonal	4	50000.00
6	Aanandavan, Pauni	H	-	2005	Seasonal	3	12000.00
7	Aanandavan, Gorkatta	H	-	2008	Yearly	4	40000.00
8	Motipur, Sauraha	-	G	2010	Seasonal	2	12000.00
9	Bhaisakhadar, Harnaiya	-	G	2007	Seasonal	4	22000.00
10	Kutta, Mainahiya	H	-	2003	Seasonal	2	12000.00

**Source: Field survey, 2012**

The deficit of construction materials has directly created a negative impact on new emerged businesses along the bank of Tinau River. During survey, five hotels and three grocers were found to be in danger. These businesses were in loss and about to be closed. However, one hotel and one grocer have only minor effect and can run in the extreme condition too. The investment pattern of business along the selected stretch on bank of the River is presented in Fig. 2.



**Figure.2: Investment pattern of business in the bank of Tinau River**

There are altogether 17 crusher plants along the banks of Tinau River. But all plants are not in good economic condition. During survey the owners of the crusher plants reported that they had major effects on income generation due to shortage of construction materials and ban on the extraction activities from the Tinau River basin. As a result, some plants run seasonally and only a few run all weather. The details of crusher plants are presented in table 3.

The crusher plants have earned millions of Nepali Currency from the finished and unfinished materials. These industries not only had earned huge amount of money but also provided the job opportunities for hundreds of people (Table 3). Similarly, industries had stopped people from going to the foreign countries such as Malaysia, Qatar, Dubai, South Korea, etc. for job opportunities to some extent. Thus, these industries would be much more beneficial for us if we give them to sustain and work under controlled mechanism.

**Table 3: Income/loss, investment and employment generation from crusher plants**

S.N	Name of Industries	Type of Business (Seasonal/Yearly)	Employment generation	Yearly Income/Loss (NRs.) '000	
				Income	Loss
1	Irbin Crusher Udhyog	Seasonal	22		500
2	Super concrete Udhyog	Yearly	24	3000	-
3	Pathak RodaDhungaUdhyog	Seasonal	12	1500	-
4	KalikaRodaUdhyog	Seasonal	10		400
5	Tinau RodaDhungaPrasodhan	Seasonal	50	1000	-
6	ShristhiRodaUdhyog	Seasonal	10	500	-
7	Muktinath Concrete Udhyog	Seasonal	35	4000	-
8	KasyamNamunaRodaU dhyog	Seasonal	30	2500	-
9	Siddheshworikamanarod aUdhyog	Seasonal	50	2000	-
10	Tilottama Concrete Udhyog	Seasonal	25	500	-
11	Pasupati Stone Crusher	Seasonal	15	-	400
12	ChamundaRodaDhunga Industries	Seasonal	18	-	300
13	Shrestha RodaUdhyog	Seasonal	20	600	-



14	New ShristhiNamunaRodaUdhyog	Seasonal	17	700	-
15	Kamana Stone	Seasonal	19	-	700
16	Juntara Concrete Udhyog	Seasonal	10	1500	-
17	Buddha Concrete Udhyog	Seasonal	14	-	500

**Source: Field survey, 2012**

Although some opportunities had been generated by the Tinau River, the rate of employment generation was decreasing day by day due to shortage of construction materials in the river.

After the ban on extraction of construction materials, some industrialists reported that they were in loss from the industry. The effects of shortage of materials could directly be seen on the employment and income generation. There was large number of labors engaged in the extraction activities. However, their job was not secured. The engaged labors were of two types; married and unmarried. During survey it was found that the majority of labors were married (83%) and minority (17%) was unmarried. The income generation by labors from the involvement in the extraction of construction materials is presented in table 4. During survey, age old people of that locality were questioned whether the extraction activities were bad or good. The people answered differently. Eighty percent (80%) of the respondents (age-old people) reported that it was beneficial. Twenty percent (20%) of the respondents reported that the extraction activities should be banned as it degraded the river valley environment. However, hundreds of labors were engaged in the extraction activities. The details of labors, their daily income and working hours are presented in table 4.

**Table 4: Engaged labor and their details of works**

S.N.	Age	Daily Income (NRs.)	Working Hours (Per Day)	Working Month (Per Year)
1	28	700	6	6
2	28	500	6	5
3	30	1000	8	5
4	22	600	6	5
5	22	600	6	5
6	21	600	6	6
7	22	600	6	6
8	28	600	6	8
9	45	500	6	8
10	34	500	4	6

11	27	500	4	8
12	18	500	4	8
13	19	500	4	8
14	36	500	4	8
15	19	500	4	8
16	25	500	4	8
17	18	600	4	8
18	18	600	4	8
19	16	600	4	6
20	38	600	4	8
21	17	600	4	8
22	27	600	4	6
23	32	600	4	8
24	30	500	4	8
25	25	700	6	8
26	36	500	6	8
27	39	500	8	8
28	32	600	8	7
29	34	700	8	6
30	41	700	8	8
31	17	500	8	8
32	35	600	8	6
33	40	800	8	7
34	55	500	8	8
35	52	400	8	6
36	40	300	8	5
37	40	350	6	5
38	25	500	8	5
39	15	300	6	8
40	52	600	6	6
41	40	500	8	6
42	41	500	6	7
43	44	250	6	7
44	55	350	5	7
45	56	400	8	8
46	27	700	5	7
47	19	700	8	8
48	16	600	8	7

Source: Field survey, 2012



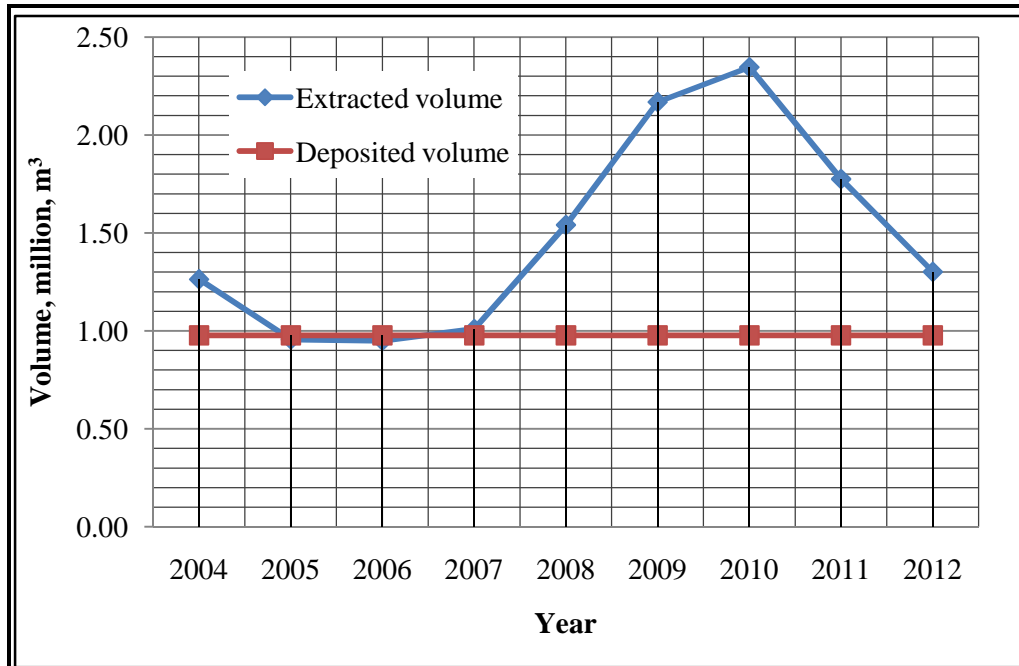
### 3.2 DISCUSSION

The natural resources like sand, gravel and boulders are the good sources of income and revenue generation. Many districts of the Terai (15 districts) and some of mid-hills like Makawanpur, Kavre, Udayapur, Bhaktapur, Kathmandu, Dhading, Kaski and Nuwakot are also the potential districts for riverbed materials (**UNDP, 2011**)

Tinau River is also one of the most important rivers in the western development region. There are altogether 17 ports of entries but the eight numbers of ports of entries have already been stopped due to lack of raw materials in the river. Though the riverbed materials are more profitable raw materials for crusher industries, the extracted volume was more than the deposited volume(**Dahal,2014, Fig. 3**). Thus, there is deficit of raw materials.

Sand, gravel, stones (SG&S), and other mined natural resources are the foundations of both the ancient and the modern world. The great structures and wonders of the world would not have been possible without these resources. However, the reckless use of these resources has also led to serious human and property consequences in many countries. Nepal, a mountainous country, has an abundance of SG&S resources which, if utilized judiciously, could help to shape Nepal's development and affluence. However, a balanced outlook on Nepal's SG&S sub-sector seems to be lacking. There are two extreme outlooks – one that tries to accumulate wealth at the cost of the environment, and the other which opts to keep the resources intact and untouched. In this situation, it is imperative for the country to seek a prudent outlook on the sub-sector so that the undesirable extremes of “quick-and-dirty extraction” and “non-extraction” are substituted by “environmentally regulated extraction,” for which to become feasible, the sub-sector must be observed and studied thoroughly. This realization has led to the production of this report. Crusher plants are the backbone of income generation of these districts. On average 137 million Nepalese Rupees (NRs.) is generating by DDC from crusher plants (**Dhital, 2014**). This amount is distributed to the affected VDCs and Municipalities for their social development. This is adequate amount of money for minimum development of local bodies. However, after the stoppage of extraction of raw materials from the river basin, local bodies have got economic losses.

Though there are direct benefits from the extraction of riverbed materials, in the long run it changes the bed and width of the river and also hampers the structures built across the river and on the banks (**Guragain, 2012; Dahal et al., 2013b**). Similarly, excessive extraction of riverbed materials from the bed, banks and floodplain areas lowers the ground water table of shallow aquifers and affects the livelihood of the fishers (**Dahal et al., 2012a, 2012c; Dahal, 2014**).



**Figure. 3: Extracted and deposited volume of riverbed materials**

**(Source: Dahal, 2014)**

Riverbed extraction in Tinau River basin is associated with many direct and indirect businesses. Direct businesses are hotels and grocers. Indirect businesses are the employment generation in the extraction work, hotels, industries and grocers. Hundreds of labors (married, unmarried, under aged, over aged) are engaged in the work and thousands of rupees they have earned. Furthermore, such activities have stopped searching foreign employment. However, in these days, there are fewer materials and not all factories are working to provide adequate jobs for the locals. During survey at site, many old people living at that locality reported that the extraction of construction materials is beneficial and easy earning source. However, the Supreme Court has decided to extract the materials in certain points, where DDC has permitted (DDC, 2011). Some people and experts of this sector feel it as an un-necessary decision. The matter is very controversial and it needs further scientific proofs and investigations.

As the river has incised, there is a need of construction of bed bar throughout the length of Tinau River for stoppage of further degradation (PEP, 2009; Dahal and Guragain, 2013). Some social and environmental activists are claiming that crusher industrialists have created the danger in Tinau River but, there is no sufficient evidence to support this statement (Dahal et al., 2013a). However, the proper management and regular monitoring of river is lacking. Similarly, people are not analyzing the economic return from the riverbed materials; they are talking about the degradation of environment. Of course, there is a degradation of river environment but the cost could be internalized in the project (Kondolf, 1993). However, this matter has not been considered while awarding contract of riverbed extraction.

The Constitution Assembly (CA) Committee has also mandated the DDCs to carry out Initial Environmental Examinations (IEEs) or Environmental Impact Assessments (EIAs), of the source rivers and the preparation of environment management plans based on the IEE/EIA findings before domestic tax farming contracts or export permits can be issued (Dahal, 2014). Most

districts engaged in river bed materials contracts for domestic sales or export has prepared their IEE/EIAs. The study found that the district IEE/EIA reports followed standard environmental guidelines but differed in content and in their degree of comprehensiveness. In general, the IEE studies that were outsourced to private consultants were more thorough than those carried out by the DDC's own technical staff (**Dhital, 2014**).

Though the riverbed materials are very much useful raw materials for industrialists, there is no analysis on the negative impacts or negative externalities. Furthermore, it affects negatively the base of the infrastructures and damages (**Kondolf, 1997, 1998; Dahal, 2014; Dahal et al., 2012c; Dahal and Guragain, 2013**). Anyway, it is beneficial and base of the infrastructures to be built newly. However, it raises the external cost too.

The total revenue from the riverbed materials in the fiscal year (2009/10) was 1 billion, whereas the repair and maintenance cost of the road was 11 billion (**UNDP, 2011**). However, extraction of riverbed materials is the major source of livelihood for the poor people in Nepal as well in the countries having low income (**Khanal, 2001**).

Riverbed materials are the backbone of construction industries and have been using in many ways in the world. In some countries government also is failure to stop the illegal extraction of sand and gravels (**Dahal, 2014**).

In the case of Tinau River, there is a fractured institution and along the basin there is no implementation of integrated water management. The legal framework is also not working efficiently and effectively (**Gyawali and Dixit, 1999**). Thus, the river basin itself needs to develop in an integrated approach. There are over 6000 river and rivulets in Nepal. Tinau River is one of them. Many rivers are potential for riverbed materials and they can generate millions of Nepalese Currency (NRs/Rs.) if we develop them in a scientific way. During last year, the studied VDCs collected about 4 million cubic feet of riverbed materials from the Tinau River and the revenue they collected was Rs. 11.92 million (Nepalese currency). Similarly, total labors engaged were 1.9 million man days (MD) during the year 2012 to 2013 (**Dhital, 2014**). However, the planning and proper implementation is lacking (**Dahal, 2014**). Furthermore, it needs a detailed technical report for monitoring during excavation and extraction of construction materials (**WECS, 1987**).

#### 4. CONCLUSIONS

Extraction of riverbed materials creates employment, generates revenues and makes social development of local administrative bodies such as VDCs, Municipalities and DDCs. Local administrative bodies collected 137 million of Nepalese Rupees during last 5 years. Similarly, dozens of labors have got employment and some new businesses such as hotel and small scale grocers have emerged along the bank of Tinau River. Since the materials are in decreasing trend in the river, government has stopped some ports of entries and income generation is also decreasing. As a result, crusher industries are also in crisis. Some of the crusher plants have already stopped due to lack of raw materials. Local bodies have done many social, educational and infrastructure development with the income generated from the riverbed materials. However, there is deficit of riverbed materials as the extraction rate is greater than the deposition rate.

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