

December, 2014

*A study report on*

**NATIONAL SKILLED HUMAN RESOURCE PROJECTION  
IN  
HEALTH AND ENGINEERING PROFESSION**



Final Draft

Council for Technical Education and Vocational Training  
Research and Information Division  
Sanothimi, Bhaktapur

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## Acknowledgement

Human resource development related to the education, training and utilization of human potentialities are for social and economic progress, while human resource projection quantifies tentative requirement of future need of human resources. The human resource projections are based on economic trends and context transformation, not only within the country but also beyond its horizons. Research and information division at CTEVT has taken a small step to address the projection of national needs in the sector of engineering and health.

It gives us immense pleasure in placing on record our sincere gratitude and deep appreciation to all those who have directly or indirectly contributed towards this research study on National Skilled Human Resource Projection in Health and Engineering Professions. It's our privilege to have CTEVT management team who encouraged and supported us to this genuine initiative. We express our gratitude to Dr. Gopal Khanal, Vice-Chairperson, CTEVT and Dr. Ramhari Lamichhane, Member Secretary, CTEVT for providing us this opportunity to pursue research work in the field of Human Resource Development. Our appreciations are also extended to Mr. Rajendra Karki, former Director, Research and Information Division who have initiated this research work.

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Saurav Ram Joshi  
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## Executive Summary

Availability of skilled human resource is one of the main prerequisites for the economic development of any country. Comparative study of the status of various countries reveals that higher the level of education and skill of the citizen, higher the level of development of the country and vice versa. This fact is even more justifiable in the case of technical human resources. Furthermore, present situation of Nepal has epitomized this facts since lack of skilled human resource is felt as a major bottleneck both to enhance the industrial development as well as modernize the agriculture sector. On the one hand, economic development of Nepal is being adversely affected by the lack of skilled human resources in various sectors and regions. On the other hand, the mismatch between demand and supply of HR not only misuse the scare resources of the country but also creates serious repercussion due to educational unemployment. This study therefore is an attempt to quantify the actual need of middle level technical human resources and thereby helps to adjust the supply system accordingly.

The analytical approach adopted in this study is quantitative and based on the secondary data and information however, some qualitative information collected from primary sources was also considered which played vital role in the analysis. Because of the different nature of available data and information, separate methodologies were applied in health and engineering sectors. Need based approach was adopted to project the required human resources in health sector however, trends analysis and future plan were the main basis of projection in engineering sector.

Demand of HR in engineering trade was directly proportional to the infrastructure development activities in the country. Although, such infrastructure development activities in the last decade was not in the volume to generate significant numbers of employment opportunities in the country, current Three Years Plan 2069/70-2071/72 as well as the approach paper for graduation to developing country have proposed to invest huge amount of budget in various development interventions like transportation, hydroelectricity projects, irrigation, water supply among others which is likely to generate large numbers of employment opportunities for Technical Human Resources in engineering sectors. The sectoral growth rate of GDP, and employment elasticity of output growth were considered to quantify the requirements of HR in the future. The derived coefficient of employment elasticity of output growth is 0.71 and projected growth rate of construction, electricity, gas and water and manufacturing sub-sectors are 5.5, 8.2 and 4.7 percent respectively are the main basis to project the tentative requirements. Based on these two facts demand of engineering professionals is speculated to increase by 3% to 5% annually in various professions of engineering sectors. Besides, needs of emerging professions in engineering sectors are also discussed in the report.

In the health sectors, both demand-based approach and need-based approach was discussed however, projection was mainly based on need-based approach. The factors like HRH-population

ratio, human development index and targeted growth rate of population for the coming decade are the main factors considered for the projection. The desired density of HRH and the number of population provides enough ground to quantify the future requirements. Human development index which is the best measure of development level of the country is regressed with the HRH density to establish a relationship between them, since required density of HRH is found closely associated with the development level of the country. The established relationship then used to project the tentative requirements of HRH. In some categories where such density was not available, the existing ratio of various categories of HR in Health Service of Government of Nepal is taken as the clue to project the required number. The number of population in the coming decade was projected based on the annual growth rate ranges from 1.35 to 1.20 as mentioned in the approach paper of graduation to developing country. The tentative number of HR requirements in various categories of health trade up to 2023 was projected and presented in annex II. This requirements ranges from 5% to 25%.

The demand of HR or employment of graduates is not irrespective with quality. The additional quality augments additional employability in them. Attention should therefore be paid to enhance the quality of such programs. Excluding some trades which are not presently running such as radiographer, family planning assistant, etc, significant need of HR was not observed in the rest of the trades. However, demand was seems gradually expanding.

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## **ACRONYMS AND ABBREVIATION**

HRH	Human Resource in Health
CTEVT	Council for Technical Education and Vocational Training
TSLC	Technical School Leaving Certificate
NLSS	Nepal Living Standard Survey
GDP	Gross Domestic Product
CBS	Central Bureau of Statistics
WEF	World Economic Forum
JCT	Junior Computer Technician
DoLIDAR	Department of Local Infrastructure and Agricultural Road
TYP	Three Year Plan
GON	Government of Nepal
HR	Human Resource
TVET	Technical and Vocational Education and Training
WHO	World Health Organization
AAHW/AHW	Assistant Ayurvedic Health Worker/Ayurvedic Health Worker
MoHP	Ministry of Health and Population
ANM	Auxiliary Nurse Midwifery
MDG	Millennium Development Goal
HDI	Human Development Index
UNDP	United Nation's Development Program
LDC	Least Developed Countries
CMA	Community Medical Assistant
HA	Health Assistant

## **PART I**

# **INTRODUCTION**

### **1.1 Background**

Council for Technical Education and Vocational Training (CTEVT) has been mandated for producing basic to higher level technical human resources as per the need of the country. Presently, the graduates of CTEVT run diploma and TSLC program are absorbed not only in national labour market but also in global labour market. In this regard, demand of both domestic and global labour markets has been remaining the matter of our profound concern.

Analysis of labour market needs considers two different approaches. On the one hand, micro approach considers the need of individual employer, and uses it for macro level projection. On the other hand macro approach considers the absorption capacity of labour market as a proxy of employers' need. In both approaches, comparison of demand and supply is essential. It is theoretically accepted that, linkage should be established between the delivery capacity of training institutes and absorption capacity of labour market to achieve the desired outcome from the TVET program.

Poverty and unemployment are the main challenges for Nepalese economy. On the one hand, every one in four Nepalese are living below poverty line (CBS, 2011) and per capita GDP is also lowest among the South Asian Region. On the other hand, massive underutilization of labour force can be observed in Nepalese economy. Although, the officially calculated unemployment rate is not that serious (1.8% as per NLSS, 2010/011), the unemployment rate can be counted as almost 30% if the underutilization rate of labour force is considered. Moreover, it is reported that more than 450,000 labour forces enters annually in to the labour market (MoF, 2011), however majorities of them are not gainfully employed due to lack of sufficient education and training. Large numbers of labour market entrants, therefore have no choice than migrating to foreign employment and involving in 3D (dirty, difficult and dangerous) jobs.

Lack of skilled human resources is conceived as a main responsible factor for slow process of industrialization (1.6%) and decreasing contribution of manufacturing sector in GDP. The contribution of manufacturing sector in GDP has declined by 2.8 percentage point in the last decade (MoF, 2012). In informal discussion, the professionals in related field as well as in the media report, it is explored that large numbers of industries in Tarai region are employing Indian technicians because of unavailability of particular type of skills in Nepalese Workforce. It is also reported that the construction industries in Nepal is suffering from severe crisis of skilled workforce.

Employment creation and income generation are two major way-outs to address both poverty and unemployment. For this to achieve, employment oriented vocational training activities can be instrumental. In this regard, CTEVT has the responsibility both to increase the access of training program to benefit needy communities as well as to supply skilled workforce as per the country's

requirements. Due attention should therefore be paid on demand on the labour market while adjusting the supply side of training delivery. Presently, large numbers of TTPs (technical training providers) under governmental and non- governmental sectors are carrying out training programs. CTEVT has further responsibility to assure the quality of these training programs as well as coordinate such organizations to eliminate the duplication and redundancies.

## **1.2 Problem statement**

Most of the previously carried out studies had pointed out a clear mismatch between the skills in actual need and skills of available workers. On the one hand, each and every sectors of Nepalese Economy are found suffering from severe crisis of skilled human resources. On the other hand, some previously carried out tracer studies have revealed the low employment status of graduates of TVET programs. The discrepancy between these two facts clearly depicts prevalence of structural unemployment (mismatch between available skills and actual needs of skills) with in the country which underscores the need of detail labour market assessment thereby future projection of human resource is possible.

## **1.3 Objectives of the Study**

The overall objectives of the study is to analyze demand of technical human resources both in formal and informal sectors of Nepalese economy and speculate the potential needs of such technical human resources. The specific objectives of the study are to

- identify the gaps between the available human resources and actual need of employers;
- find out the measures to bridge such gaps, and
- make projection of demand of middle level technical human resources in engineering and health sectors in the coming years and decades.

## **1.4 Methodology**

The scope of this study is limited to health and engineering sector. Although, the specific approaches for analysis are different, the general approach of analysis for both of these sectors is mainly quantitative and based on secondary sources.

In engineering sector, projection was carried out based on the GDP growth rate anticipated for future as well as the coefficient of employment elasticity of output growth. Beside this, past trends of relevant and reliable data and information were also collected and taken into consideration while making the projection. Sufficient literatures were also reviewed to obtain the empirical evidence regarding the coefficient of employment elasticity of output growth. This study not only considered quantitative data and information, some qualitative data was also obtained by interviewing key-informants using semi-structured interview checklists as per the requirements.

In order to analyze the human resource requirement in the construction sector, five years house construction trend of selected municipalities as well as number and activities of private

construction companies from the sampled districts were also gathered. These districts were selected purposively.

Unlike the engineering sector, projection in health sector mainly based on the desired density of health professionals as defined by WHO in respect to the corresponding population. In this regard, the desired density of health professionals was linked with the development level of the country and speculate the need accordingly. Besides, health policy of Government of Nepal and prepared health development plan for different time interval were also taken as a reference through out the whole process.

After collecting the relevant data, it was entered and analyzed using statistical program named SPSS (Statistical Package for Social Science). The findings of the analysis are presented differently for health and engineering sectors. Different methodologies were used to project the tentative requirements in each profession as per the availability of data and accuracy of applied model.

Qualitative information was also collected during field visit. Districts from all geographical and development regions were purposively selected for this purpose. These selected districts are Sunsari, Morang, Dhankuta, Siraha, Dhanusha, Mahottari, Parsa, Lamjung, Gorkha, Tanahun, Kaski, Rupendehi, Banke and Bardiya. The field visit program mainly focused on collection of information regarding local level construction activities and other activities that can create employment opportunities for graduates of corresponding TVET programs.

### **1.5 Limitations**

Quantitative approach is widely considered as an appropriate technique to analyze the future demand of HR despite some of its limitations. Availability of time series data of concerned variables for longer period of time is the floor condition to develop a better projection model under this approach. This is one of the limitations of this study. Sufficient cross-sectional data of concerned variables can also compensate time series data to some extent however, sufficient budget was lacked for this purpose. This study could also not benefited from adequate and appropriate references because of unavailability of report that was matched either with objective or context of this study.

Presently, the employment market for TVET graduates is not limited within the country. Large numbers are migrated for foreign employment in various countries, however the projection of human resource based on global economic trends is beyond the scope of this study and only based on the domestic economy.

## **PART II**

### **ENGINEERING TRADE**

#### **2.1 Background**

Infrastructure development is both the determinant and indicator of the national development. Its importance is even more pronounced in case of developing countries like Nepal where infrastructure development is lagging far behind not only in quantity but also in quality. Moreover, it is unevenly distributed with deprivations in rural and remote locations. According to Global Competitiveness Report 2013, the score of Nepal on availabilities of scientists and engineers is only 3.5 which ranked Nepal at 108<sup>th</sup> position out of 134 countries surveyed. The score on quality of overall infrastructure is 1.9 and the corresponding position secured by Nepal is almost the lowest (130<sup>th</sup> out of 134) among the countries surveyed (WEF, 2013).

These data indicate the lower status of Nepal with regards to the infrastructure development. The quality of infrastructure is somewhat associated with human resource quality. To be more specific, it is related with numbers and quality of technicians in engineering profession.

Engineering profession is specialized under some major trades such as Civil Engineering, Electrical Engineering, Electronics Engineering, Mechanical Engineering, Computer Engineering, Refrigeration and Air Conditioning Engineering and Architecture Engineering. In each profession there are various levels of workers ranging from supervisor to professional engineers. Out of them Council for Technical Education and Vocational Training (CTEVT) is presently managing the TSLC courses with duration ranging between 15 months and 29 months, three years' diploma level program as a long term program and short term courses of vocational training of duration ranging between one week to a year. To make a projection on future requirements of technical human resources, this study has focus on the middle level technicians i.e. TSLC and Diploma level in the earlier mentioned seven sectors or trades.

#### **2.2 Current Supply Situation**

Due to lack of proper study regarding the needs of labour market or follow-up study of the graduates, we are not in position to mention whether the quantity of supply of these graduates is following or exceeding the labour market demand. The flow of students at the time of enrollment is therefore used as a proxy of labour market status on saturation level of the corresponding professionals. Obviously, notable numbers of technical institutes are operating diploma and TSLC programs in the country both under constituents and affiliated institutions. In some trades institutions are hardly getting enough students to fulfill their enrollment capacity whereas some trades are overflowed and have to select students from large number of applicants' pools. The flow of students towards these programs gives some insights about the labour market's demand. The programs which are running under capacity can be considered as the excess-supplied programs and opposite may be true in case of under-supplied programs.

Table 2.1 A: Enrollment rate in TSLC Programs

SN	Name of Program	Number of Institutes	Mean Enrollment out of 40	Enrollment (% of Total Capacity)
<b>TSLC Program</b>				
1	Civil Sub-overseer	15	29.20	65
2	Electrical Sub-overseer	6	25.83	73
3	Mechanical Sub-overseer	1	40	100
4	Basic Surveying	8	31.63	79
5	Junior Computer Technician (JCT)	3	22.67	57

Source: CTEVT, Controller of Examination, 2013.

Table 2.1 B: Flow of Students in Diploma Level Program

SN	Name of Program	Number	Enrollment Capacity	Total Applicants	Flow of Students (100% is Equal to Capacity)
1	Diploma in Civil Engineering (Total)	32	1536	3589	233.60 % of Enrollment Capacity
2	Diploma in Civil Engineering (Affiliated)	27	1296	2221	171.37 % of Enrollment Capacity
3	Diploma in Architect Engineering	2 (4)	96	13	13.54 of Enrollment Capacity
4	Diploma in Electrical Engineering (All)	11	528	731	138.45 of Enrollment Capacity
	Diploma in Electrical Engineering (Affiliated)	9	432	371	85.88 of Enrollment Capacity
4	Diploma in Mechanical Engineering(all)	3	144	364	252.78 of Enrollment Capacity
	Diploma in Mechanical Engineering(all)	1	48	32	66.67 of Enrollment Capacity
5	Diploma in Computer Engineering	17	816	414	50.74 of Enrollment Capacity
6	Diploma in Electronics Engineering	7	336	119	35.42 of Enrollment Capacity

Source: CTEVT, Controller of Examination, 2013

Table 2.1(A) gives detail information regarding the enrollment rate of some engineering related programs in TSLC level. This information will provides us some ground to determine whether the corresponding program is undersupplied or excess supplied. Figures in the table suggests that

almost all the trades are running under capacity, where the maximum enrollment capacity of all programs is 40. The two trades, Civil Sub-overseer and Basic Surveying, which are related to civil engineering profession have the relatively higher enrollment than remaining trades. Among these trades, JCT is running occupying only 57% of its enrollment capacity. Mechanical Sub-overseer is running in full capacity since it is offered by only one institute.

Table 2.1 B details the flow of students in diploma level program at the time of entrance examination. In the figure, we analyzed all the programs running under both types of (affiliated and constituent) institutes. If we considered in totality, flow of students is far greater than the available capacity of institutions. In contrast, if only affiliated technical schools are considered, flow of students are found far below than the available capacity of the institutions. Both quality and cost of the program may be the major responsible factors for this situation, however it also depends on the location of the institute. These observations suggest that most of the engineering professionals graduated from CTEVT are oversupplied in labour market except Civil-overseer which can be considered as undersupplied.

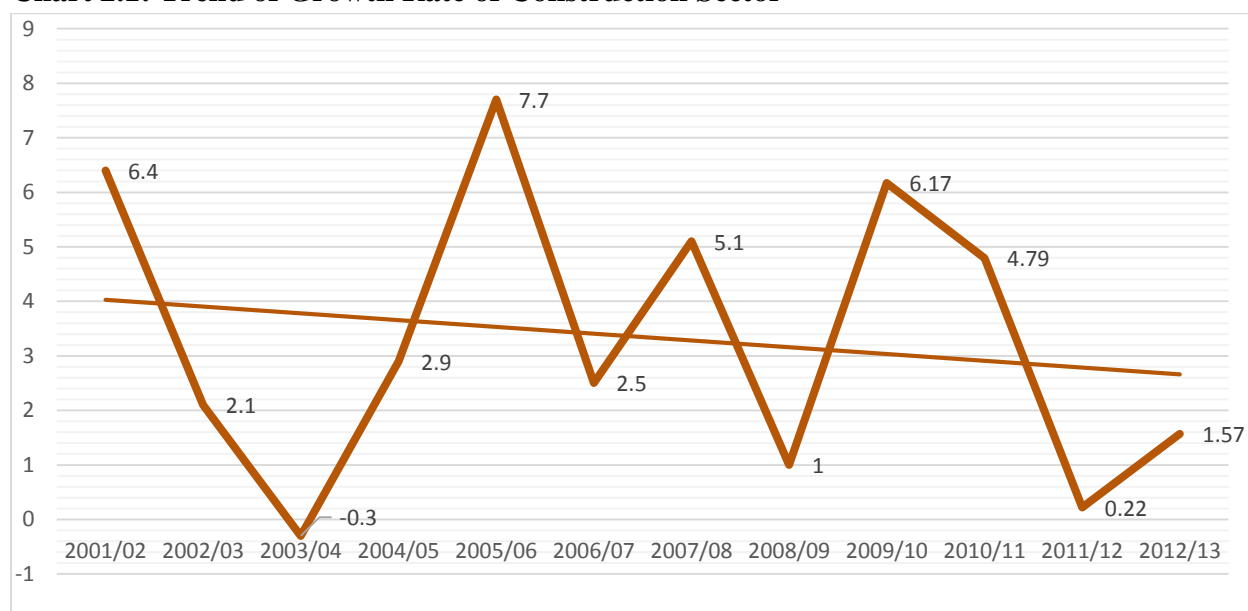
### **2.3 Demand Analysis**

Under this topic, general discussion is made regarding the demand and employment potentialities for Engineering Human Resources. The future plan of the concerned sectors of the government and past trends provides some grounds to speculate the demand of such HR in future. The following paragraphs explore some analysis regarding the trade and program wise demand of human resources in engineering sectors.

#### **2.3.1 Civil and Architecture**

The need of different levels of technicians in Civil Engineering profession depends upon the growth rate of construction sector in the country. However, this growth rate is further the function of both public and private investments, level of technology, type and quality of developed infrastructures among others. Since level of technology and type and quality of infrastructures are fixed in a short term, the demands of such technicians are more explained by the amount of investments in infrastructures development. But in the long term, none of the factors remains constants and all are responsible for the growth of the construction sector.

The growth rate of construction sector of the country has not been encouraging in the last decade. The trend in Chart 1 reveals the fluctuations of growth in the sector. During the last decade, the construction sector witnessed 3.6% growth (See Chart 1.1). However, the current Three Years Plan 2013/14-15/16 has targeted to achieve 5.5 % growth rate of the sector. In order to achieve this growth rate, huge amount of budget has been planned to invest in several areas including some mega projects of national pride, investment in hydroelectricity projects, covering all districts headquarters with road networks and expand the irrigated land by 1,76,275 hectares. Similarly, conducive environment for private investment can be expected with ending of the the current transition phase.

**Chart 2.1: Trend of Growth Rate of Construction Sector**

Source: Economic Survey, 2012/13

Under the assumption that presently available human resources are satisfying the present needs, growth rate of human resource should be compatible with the growth rate of construction sector to satisfy the demand of human resources needed for the targeted growth rate of 5.5%. However, this is only the part of the story, the growth rate of economy not only depends upon the growth rate of labour but also capital and technology. It is therefore the employment needs is not always equal to the actual growth rate of the concerned sectors. It depends upon the employment elasticity of output (a measure of relationship between employment and economic growth)<sup>1</sup>. If a country is using capital intensive technologies, the skilled human resources are required in greater proportion than in labour intensive sectors. But lower proportion of such human resources are used in opposite situation. The desired combination of skilled and unskilled human resources is therefore depends upon the use and expansion of type of technology in the country.

Infrastructure development sector largely requires technical human resources in engineering trades. Presently, large amount of money is invested by both the public and private sectors. Infrastructure development under public sector is carried out in the areas like transportation, hydroelectricity, urban development and public buildings. The current Three Years Plan 2013/14-15/16 presents some insights of government policy to develop these sectors, which are referred in the following paragraphs.

<sup>1</sup>Employment elasticity of output is the relationship between employment and output which tells the percentage change in employment due to one percent change in output. In this regard, Pini (1997) estimated that the employment elasticities in Germany and Japan rose between the period 1979-95 compared to 1960-79 while it declined in France and Sweden and showed little change in Italy, UK and US. He also detected negative employment elasticities in Italy and Sweden for the period 1990-95. Similarly, Pianta, Evangelista and Perani (1996) discovered evidence suggesting that restructuring of major economic sectors reduce the relationship between these factors.



### **2.3.1.1 Transportation**

Among the infrastructure development activities under public sector, transportation is the main intervention where large amount of investment is proposed. As per the TYP 2013/14-15/16, GoN has aimed to expand road transportation by 3000 km and upgrade the status of 2100 km existing roads. Similarly, 310 new bridges are targeted to construct during the plan-period. According to Er. Phupendra Bahadur Basnet, then Director General, DoLIDAR, construction of each 10 km of new road requires one civil engineer. In general, one civil engineer should be assisted by 2-3 sub engineers (Overseer) and 4-5 sub-overseers<sup>2</sup>. On the basis of this reasoning, almost 1000 overseers and 2000 sub-overseers are required in transportation sector. However, due to the wide use of modern technological innovation in the engineering sector and availability of overseer could adversely affect the demand of sub-overseer and therefore could gradually replace the overseers<sup>3</sup>. The existing road upgrading activities and bridge construction will also require additional numbers of such human resources.

### **2.3.1.2 Hydroelectricity**

Hydroelectricity is another major investment sector which requires large number of engineering technicians in various categories like Electrical, Civil, and Architecture among others. Government has aimed to start 584 MWs of hydroelectric-projects and complete projects with 668 MW of capacity which are under construction. Similarly, construction of 400 km of transmission lines, expansion of electricity facilities to 3000 new villages and increasing the share of population that have accessed to electricity facility from 67.32% to 87% are the expected outcome as per the current three years plan. All these activities also require large numbers of engineers, overseers and other skilled human resources. However, it is difficult to quantify and categorize the requirements. If all the planned activities start in the planned period, the absorption capacity of skilled human resources of hydroelectric sector may be double of the present capacity.

### **2.3.1.3 Urban development and local Infrastructure**

Under the urban development activities, physical infrastructure for 16 municipalities are aimed to be developed which benefits 1.2 million population. In addition to this, 10 new cities is aimed to be developed to make enough residences for 1 million population. These infrastructure development activities will require substantial numbers of engineering professionals ranging from civil engineers to field supervisors.

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<sup>2</sup> The organization structure of DoLIDAR includes 158 engineers and 300 sub- engineers which is almost in 1:2 ratio. Moreover, in the minimum requirement published by GoN for contractors' agency mentioned that A level contractors agencies must require 2 engineer and 4 overseer, this is also in 1:2 ratio.

<sup>3</sup> At the beginning years, the Civil Sub-overseer programs were run under full capacity, however after launching diploma level program, enrollment in Sub-overseer programs has dramatically declined. The average enrollment in Civil Sub-overseer program are 29.9, 28.6, 24.9, and 29.6 respectively for the year 2067, 2068, 2069 and 2070.

Similarly, during the plan period, 3250 kilometer long agricultural road is targeted for construction. Likewise large numbers of suspension bridge construction will be initiated and irrigation facility will be available in additional, 35000 hectors of land. Through these interventions, a total of 250,00,000 labour-day employment will be generated. Informal discussion with the technicians working in concerned sector opined that the required proportion of engineer, overseer, sub-overseer and construction labours is 1:2:5:200. As per this assumption, altogether, 329 engineers, 659 overseers, 1646 sub-overseers will be employed in these activities. Because of the employment friendly policy of DoLIDAR, it adopts labour intensive technologies. Thus labours and supervisors are required in greater numbers than other high skilled staffs (DoDIDAR, 2010).

Table 2.2: Absorption Capacity of Contractor Agencies

SN	Class	Number	Min. Requirement	Required Consumption	Degree of Activeness	Net Consumption	Remarks
1	Class A	194	4	776	100%	776	
2	Class B	325	2	650	70%	455	
3	Class C	1265	2	2530	40%	1012	
4	Class D	12000	1	12000	5%-10%	840	
<b>5</b>	<b>Total</b>	<b>13784</b>		<b>15956</b>	<b>3442</b>	<b>3083</b>	

Source: Federation of Contractors' Association of Nepal, 2013

Notes: 1) Minimum requirement is based on Construction Business Regulation 2056, Annex 10-13`

2) Degree of Activeness is based on field survey of 10 districts

Almost all the construction works under public sector are carried out through the private contractor agencies. These contractors are classified as A, B, C and D categories. The first three categories are centrally registered under the Minister of Construction and Physical Planning where as the contractor agencies under 'D' category should registered and renewed themselves in DDC secretariat of each district. The information regarding number and activeness of these contractor agencies were collected from the field visit by conducting personal interview. Data in Table 2.2 shows the registered numbers, mandatory provision of having technician (Overseer level), and their activeness, thereby net consumption was analyzed.

At the time of renewal, agencies must submit their last year transaction record, however most of the D-level contractor agencies get renewed mentioning zero transaction on previous fiscal year. The story is same in all of the visited districts. Large majorities of 'D class' contractor agencies were not found active and therefore, were not capable to recruit technicians. In total, the absorption capacity of civil overseers of these contractor agencies is calculated around 3000.

### 2.1.3.4 Private Construction

Although private sector is not interested to invest large amount of budget in road constructions, some hydroelectricity projects are already been constructed by private sector. Some other infrastructure development activities like private residential complex and residential buildings are the areas where significant amount of investment was made by private sector. Lack of data of the private buildings in rural areas makes it difficult to analyze situation in such areas. However, municipalities get revenue while providing permission for house construction. Therefore these agencies keep record of such information. As such, primary data were collected from some of the municipalities about the private building construction activities. The data in Table 2.3 present trend of construction during the last five years.

**Table 2.3: Private House Construction Trends**

SN	Name of Municipality	064/65	065/66	66/67	67/68	68/69	69/70
1	Janakpurdham Municipality	618	806	731	706	734	345
2	Lahan Municipality	167	215	305	304	344	487
3	Siraha Municipality	1	4	2	12	12	14
4	Biratnagar Municipality	995	1171	1246	1113	1041	1083
5	Pokhara Sub-Metropolitan City-		1926	2124	2053	2117	1945
6	Butwal Municipality	774	587	624	645	683	715
7	Prithwi Narayan Municipality		95	84	82	237	154

Source: Field Survey, 2013

Presently, in majority of municipalities, submission of engineering design-map of planned construction is made mandatory to get construction permit. However, designing by architect professionals is not mandatory. As such, special design technicians were not employed for designing construction works except large infrastructure development projects and housing and business complex. According to the officers from related divisions of municipalities, in view of quality and strength of construction, making the provisions of designing of construction works from related technicians is also under discussion. If government policy addresses this issue, demand for architecture overseers will be increased in the future.

### 2.1.2 Electrical and Electronics

The proportion of population that has access to electricity has been increasing every year. With expansion of electrification and tendency of population using electrical appliances, demand of electricity is also increasing. Government of Nepal had commissioned a study in 2009 to formulate 20 years working plan of electricity production and distribution. This commission has projected the demand of electricity for next twenty years starting 2009. The contribution of electricity in the

total energy consumption, which was 1.82% in 2005, is projected to reach 3% in 2015 and 17% in 2030. As per this projection, the annual growth rate of power demand is depicted in Table 2.2.

The same report indicated lack of middle level technical human resources among others as the main bottleneck to construct hydropower projects as well as the extension of transmission lines. Moreover, CTEVT is also indicated as a responsible agency to supply the middle level technical human resources. Although, this report is silent on the type and numbers of such technical human resources, the electrical overseers and sub-overseers are the expected categories of such HR (MoEn, 2009).

Table 2.4: Projection on Trend of Electricity Demand

SN	Fiscal Year	Demand of Energy (GW/Hour)	Demand in MW	Annual Growth Rate in %
1	2011-12	4851.3	1056.9	10.1
2	2012-13	5349.6	1163.2	9.3
3	2013-14	5859.9	1271.7	9.1
4	2014-15	6403.8	1387.2	8.9
5	2015-16	6984.1	1510.0	8.7
6	2016-17	7603.7	1640.8	7.9
7	2017-18	8218.8	1770.2	7.7
8	2018-19	8870.2	1906.9	7.6
9	2019-20	9562.9	2052.0	7.5
10	2020-21	10300.1	2206.9	7.1
11	2021-22	11929.1	2363.0	7.7
12	2022-23	12870.2	2545.4	7.7

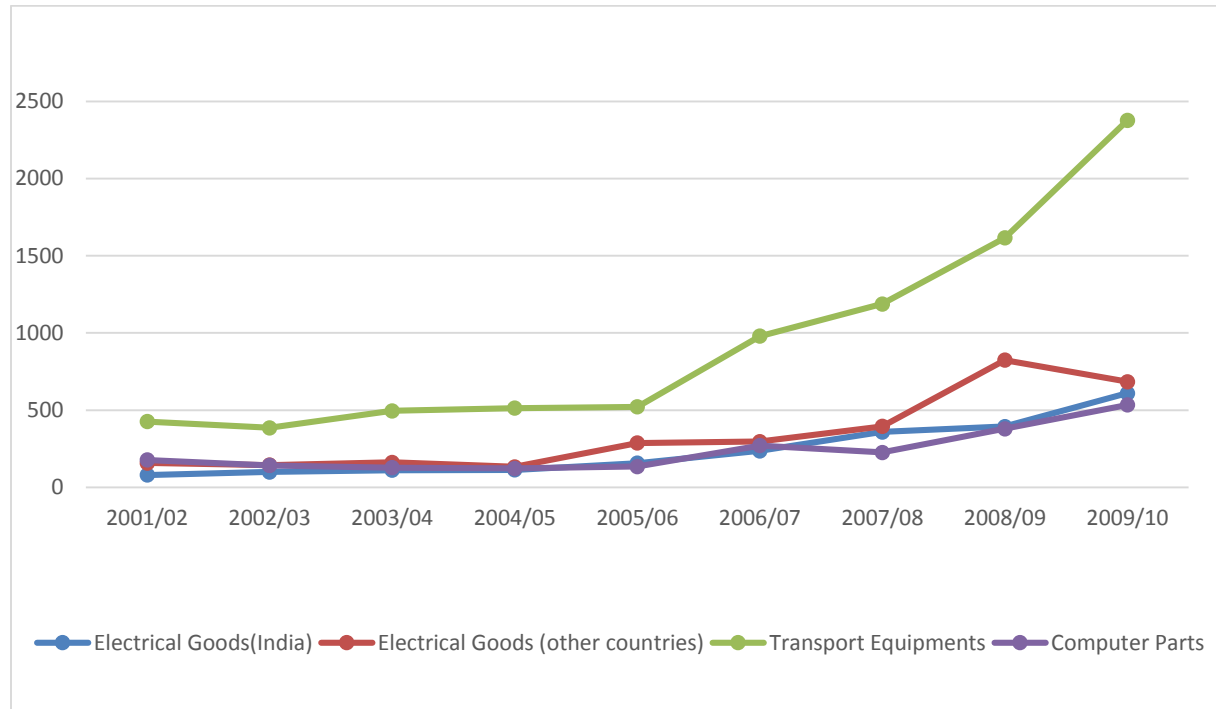
Source: Report of Twenty Years Hydro Plan Formulation Task Force, 2009.

Although economic growth rate is the main determinant of employment opportunities within the country, the growth rate of economy is not always equal with that of employment. Employment growth rate is also varies with sources of economic growth rate. To be clearer, growth rate of service sectors is more responsible to create jobs in the economy whereas huge capital intensive mega projects contribute little on it. On one hand, the available data and information which were gathered during the analysis does not allow to quantify the exact need of human resources in the country. On the other hand, the fluctuation of the economic or sector wise growth rate makes the projection further uncertain and unreliable.

The demand of HR in electrical and electronics trade is also the function of use of electrical appliances in the country which is explained by the volume of imports and production of such appliances. But in the situation where production of such appliances are not in significant number, the trend of imports is considered for calculation of such trend. Chart 2.1 shows the trends of

imports of such appliances during the last decade. Analyzing the previous trends, only the imports of transport equipment is soaring with high rate. Unlike, the trends of imports of both electrical equipment (both India and other countries) and computer parts have not witnessed any remarkable increment during the analyzed period which does not suggest any remarkable demand of human resources in corresponding sectors. However, during the last two years, the trends of imports of computer parts is gradually taking new height, which leads us to different conclusion regarding the projection.

Chart 2.2: Import Trends of Last Decade



Source: Economic Survey, 2013/14-15/16

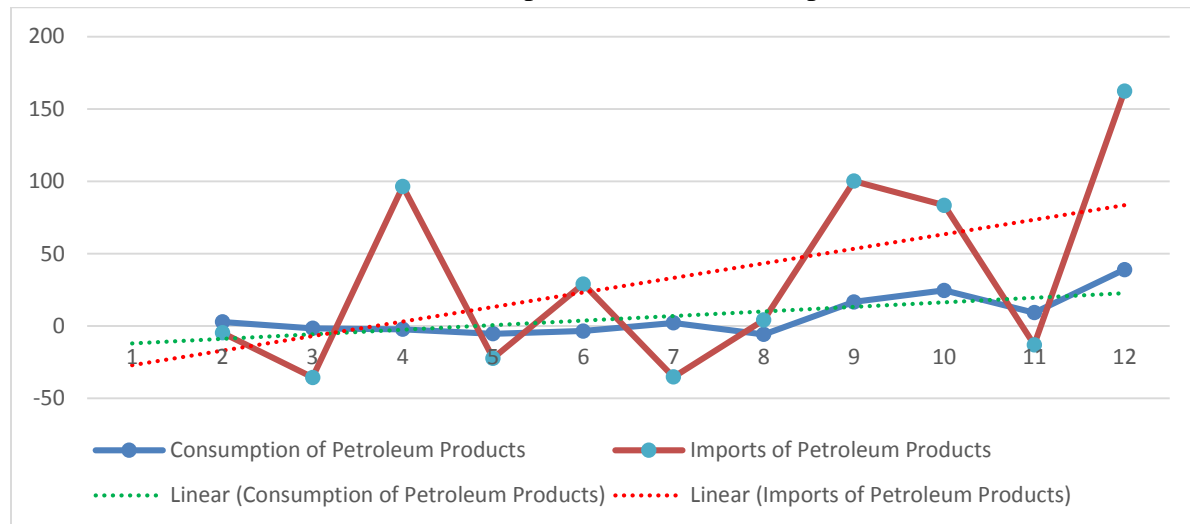
The Electricity, Gas and Water sub-sector of the national accounting is very much representative most of the above mentioned activities. Moreover, the current Three Year Plan 2013/14-2015-16 has projected the growth rate of this sector to reach 8.2%. The rate of increase in employment of this sector is calculated based on this rate with the help of derived coefficient of employment elasticity of output growth which is discussed hereafter in topic 2.4.

### 2.1.3 Mechanical

The demand of technical human resources in mechanical engineering sector is the function of mechanization of people's activities including use of vehicles, heavy equipment's, and industrialization of the country among others. Some of these activities are quantifiable but many are not and therefore, it is difficult to measure by a single indicator. Although, single index is not available to measure the mechanization of peoples' activities, we can use the dummy indicator to measure the use of vehicles and heavy equipment and industrialization of the country. The past

trend of imports of electrical and mechanical equipment can be a good indication of the mechanization trends of people's activities, which can be used for future projection.

Chart 2.3: Trends of Petroleum Consumptions and Vehicle Imports



Source: Economic Survey, 2012/13

The use of vehicles and consumption of petroleum products and length of road can be another reliable indicators to speculate the need of human resources in mechanical engineering sectors especially in auto-mechanics. While analyzing the past trends of these factors as depicted in Chart 2.2, they follow the stochastic trend rather than deterministic trend. This trend therefore can hardly be a reference to project the tentative numbers of human resources for future needs. As depicted earlier in Chart 2.1, the trends of imports of transport equipment has been sky rocketed to take new height in every fiscal year. These two indicators suggests for 5-10 percent increment in mechanical activities in the country during the analyzed period.

The past trend does not always give the picture of the future, the government plan and policy and its implementation sides can play the decisive role to guide the future. As mentioned earlier investment in transportation is getting high priority from government sides. The total length of road was 25,133 Km until the end of fiscal year 2012/13. Of the total length, 7799 km was of blacktop quality, 6830 km gravel and 10,504 earthen road. The current three years plan document has aimed to construct additional 3000 km of roads and upgrading 2100 km existing roads which is 11.3% increments in the existing road facilities. Altogether mechanical professionals are not only dependent upon transportation, the total industrial sector including manufacturing, mining and quarrying are the employment sectors for mechanical professionals. In the current Three Years Plan 2013/14-15/16, the growth rate of mechanical sector is projected to be 6.7. Similar to the above mentioned sectors, the employment growth in this sector is also calculated based on derived coefficient of elasticity of employment growth to output.

### **2.1.3 Computer and Information Technology**

The computerization of each manual activities leads to increase the demand of computer technicians. Presently, almost all banking and business companies adopting computerized web-based system in their transaction process which is also gradually followed by government agencies to replace manual system by web-based system.

The demand of computer technicians also depends upon the tendency of general public to adopt computer-based system and the growth rate of both service sector and industrial sectors. In 2008, only 3.1% of Nepalese had computers, however, as per the Nepal Living Standard Survey, 43% of households have accessed the internet service within the reach of 30 minutes (CBS, 2010/11). On the one hand, the proportion of population with access to telephone was 1% in 1995/96 which was increased to 6.1% in 2006 and 12.5 % in 2010/11. Although, comparable data of different time period was not available, the use of computer in the country is also rapidly increasing in the present years. The data in Chart 2.1 also shows that the imports of computer parts is increasing rapidly in the present years. All these statistics provide enough ground to assume the rising demand of computer technicians in the coming years. This sector is associated with all sub-sectors of service as well as industrial sector so the growth rate of total GDP of the economy is considered while calculating the projection coefficient for the demand of computer professionals as well as the professionals in information technology sectors.

### **2.1.4 Emerging Professions in Engineering Sectors**

Engineering sector is highly technical sector which is faster in adopting advance technologies by phasing out old technologies than other sector. The change in technology gives birth to new profession thus requires specific professionals. Beside this, the present globalized world facilitates the transfer of technology in faster pace than before. Some emerging professions in engineering trade are seems to be demanded in coming years. In this regard, a report prepared by CTEVT, Research and Information Division based on advertisement analysis, have explored the figure that there are demands of engineers and assistant engineers in the market of gulf countries in the profession like Chemical Engineering, Material Engineering, System Engineering, Estimate Engineering, Production Engineering, Hydraulic Engineering among others. In other advance countries, such type of engineering professionals are counted as highly demanded jobs ( www.eng..). But, in the context of Nepal, even the curricula have not been developed yet. CTEVT should therefore initiate to develop curricula which prepare the ground for delivery of the program.

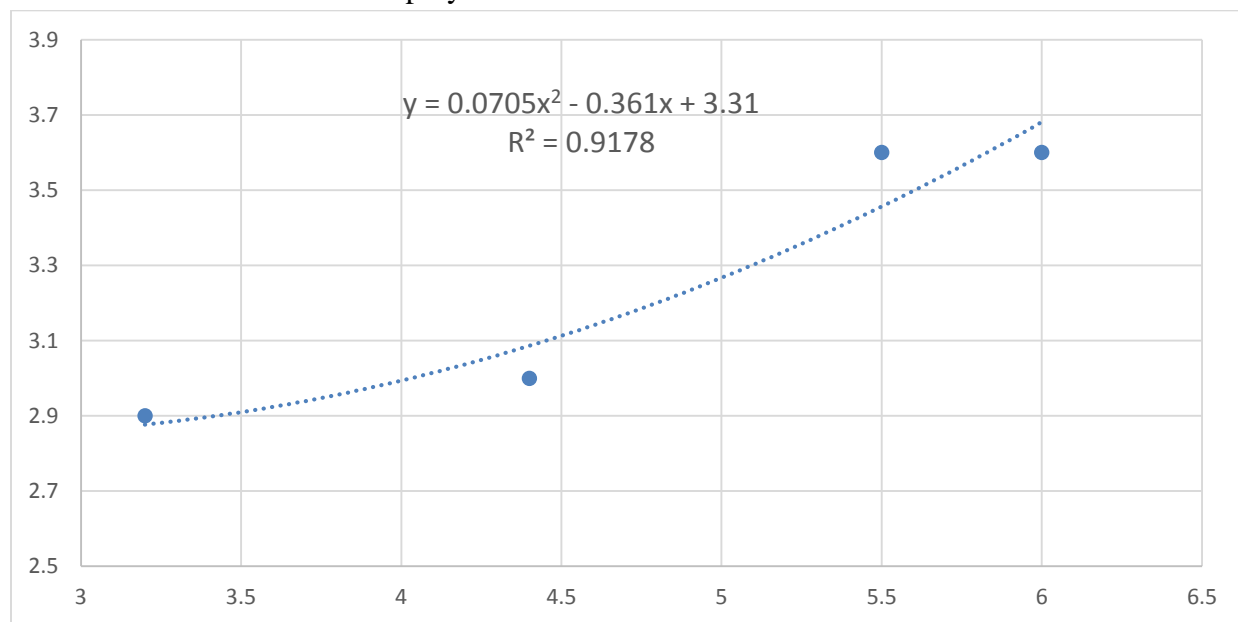
## **2.4 Projection Methodology**

As mentioned earlier, the employment need in any sector of economy is directly proportional to the growth rate of this sector. The increase in output always leads to increase in employment but the rate may be different. This rate which is defined as employment elasticity of output, depends upon the composition of factors of production used in any particular economy. Due to lack of time

series data of long interval, the coefficient of employment elasticity of output is not solely derived from primary data. This coefficient was also referred from the national and international literatures.

Boltho and Glyn (1995) found elasticity of employment with respect to output growth in the order of 0.5 to 0.6 for a set of OECD countries. An International Labour Organization Report (1996) concluded that the responsiveness of employment growth to GDP growth has not declined in industrialized countries as a whole. However, a country-by-country analysis revealed mixed results. Padalino and Vivarelli (1997) found significant differences in employment elasticity between different countries, with an elasticity of approximately 0.47 for the United States, 0.24 for Austria and 0.76 for Spain. Similarly, Walterskirchen (1999) indicated strong positive relationship between employment and economic growth with employment elasticity for EU of 0.65 over the period 1988-1998. In reference of national income accounting, Wail N. David in his book Economic Growth mentioned that one third part of GDP is attributed to the physical capital and next two third part is paid to the labour. This means that the employment elasticity of labour is almost .66 percent in developing countries (Wail, 2009).

Chart 3.1: GDP Growth vs Employment Growth



Source: Consecutive Three Years Plan of 2010/11-12/13 and 2013/14-15/16

No study was available to us regarding the derivation of employment elasticity of output growth based on Nepalese context. According to Three Years Plan 2010/11-12/13, GDP growth was 4.4% at the base year whereas the corresponding employment growth is only 3. The same plan had targeted the GDP growth rate of 5.5 for the whole plan period, the corresponding target of employment growth is only 3.6. According to the current three years plan 2013/14-15/16, the corresponding figure of GDP growth is 3.2 and 6.0 vs employment grow rate of 2.9 and 3.6 percent respectively. By using these four figures, the employment elasticity of output growth is derived as



0.71. The employment elasticity of income growth does not follow the linear path. Moreover, a polynomial function more favors the relationships. The equation depicted in the chart 3.1 was used to find out the growth rate of employment with the given growth rate of GDP.

Without proper information regarding the labour market status of graduates of respective field identified by the valid research, the above mentioned coefficient mislead the calculation. However neither the detail labour market study nor follow up study of graduates was available to us. In this situation the students' enrollment rate and flow of applicants in the entrance are considered as the indicators to determine saturation level of the labour market of respective categories of professionals. Considering these three factors, the need of HR in particular profession is calculated which is mentioned in the consecutive tables presented hereafter.

Based on the derived graduation rate and number of presently available institutes, probable number of graduates is calculated and presented in in the Table 2.6. In an average 868 Civil Overseer, 108 Mechanical Overseer, 476 Computer Overseer graduated with the present enrollment capacity. However, it does not mean that all those graduates seek employment immediately after graduation. Some graduates may join to further study or some may migrates to foreign employment. Detail analysis regarding this issue is beyond the scope of this report. Projection was made in this report under the assumption that the rate of flow of additional HR in the labour market would equal to the employment growth if the labour market is in saturation level. The annual requirement of HR is therefore projected based on the present graduation rate, employment elasticity of output growth, and saturation level of labour market.

Table 2.5: Derivation of Employment Elasticity to Output

SN	Name of Programs	Saturation Level of Labour Market	Targeted Sectoral growth	Projected Employment Growth	Reference of Targeted Growth Rate	Basis of projection	
1	Diploma in Civil Engineering	Under Supplied and required 10% additional number	5.5	3.46	Construction Sector of TYP 2013/14-15/1	$y = 0.0705x^2 + 0.361x + 3.31$ , where y = employment growth rate and x = output growth rate	
2	Diploma in Electrical Engineering	Saturated up to 2016	8.2	5.09	Electricity Gas and Water sub-sector of TYP 2013/14-15/16		
3	Diploma in Mechanical Engineering	Under Supplied and required 10% additional number	4.7	3.17	Industry, Mining and Querying Sub-sector of TYP 2013/14-15/16		
4	Diploma in Electronics Engineering	Saturated up to 2018	8.4	5.25	Total Economic growth rate of TYP 2013/14-15/16		
5	Diploma in Architecture Engineering	Saturated up to 2020	5.5	3.46	Construction Sector of TYP 2013/14-15/16		
6	Diploma in Computer Engineering	Saturated up to 2018	6.0	3.68	Total Economic growth rate of TYP 2013/14-15/16		
7	Diploma in Information Technology	Saturated Till Date	6.0	3.68	Total Economic growth rate of TYP 2013/14-15/16		
8	Diploma in Survey Engineering	Saturated Till Date	5.5	3.46	Construction Sector of TYP 2013/14-15/16		
TSLC Level							
1	Civil Sub-Overseer	Saturated up to 2015	5.5	3.46	Construction Sector of TYP 2013/14-15/16		
2	Junior Computer Technicians	Saturated up to 2017	6.0	3.68	Total Economic growth rate of TYP 2013/14-15/16		
3	Electrical Sub-Overseer	Saturated up to 2016	8.2	5.09	Electricity Gas and Water sub-sector of TYP 2013/14-15/16		
4	Mechanical Sub-Overseer	Under Supplied and required 10% additional number	4.7	3.17	Industry, Mining and Querying Sub-sector of TYP 2013/14-15/16		
5	Basic Surveying	Saturated up to 2015	5.5	3.46	Construction Sector of TYP 2013/14-15/16		

Table: 2.6 Probable Entrance in to labour Market

SN	Name of Program	Average Enrollment*	Present Pass Rate (%)**	Average Graduation/ per institute#	Number of Institute@	Probable annual entrant in labour Market##	Basis of Calculation
Diploma Level Program							
1	Diploma in Civil Engineering	46.2	60	28	31	868	<ul style="list-style-type: none"> <li>• The enrollment rate is based on the record provided by CTEVT, Controller of Examination, Registration Division</li> <li>• Present graduation rate is derived by aggregating the result of III year II part group in 2070 considering the result of back paper of same year and speculation of repetition rate of unsuccessful candidate conducting small focus group of employees working in the related division.</li> <li>• Per Institute graduation rate mean the average number of graduate from any program which is the pass percent of present enrollment rate</li> </ul>
2	Diploma in Mechanical Engineering	42	85	36	3	108	
3	Diploma in Computer Engineering	35.6	80	28	17	476	
4	Diploma in Electrical Engineering	41.3	75	31	10	310	
5	Diploma in Electronics Engineering	24	87	21	7	147	
6	Diploma in Architecture Engineering	34	83	28	4	112	
7	Diploma in Information Technology	48	95	46	1	46	
8	Diploma in Survey Engineering	48	95	46	1	46	
TSLC Level							
1	Civil Sub-Overseer	29	60	18	33	594	
2	Mechanical Sub-Overseer	40	59	24	6	144	
3	Electrical Sub-Overseer	26	58	15	20	300	
4	Basic Surveying	32	52	16	9	144	
5	Junior computer Technician	23	60	14	21	294	

Source: \* Registration Record, CTEVT, Controller of Examination  
\*\* General analysis of result of regular and back paper examination of 2070  
# derived from enrollment rate and pass rate.  
@ CTEVT, A Glimpse 2070  
## Derived from graduation rate and number of institute

## **2.5 Projection of the Required HR**

Basically we have considered some facts and some assumptions to project the required number of HR. The employment growth rate as derived earlier only tells the annual increment of requirement but it does not tell anything about the base number (exact figure of employed people in labour market with particular skills in particular time). Because of lack of such figure, we assume that the annual increment of the entrant of labour market will also be required in the same rate as the rate of employment growth rate if the labour market is at saturation level.

Similarly the saturation level of labour market is estimated based on the ratio of enrollment capacity and entrance examination appearance number for diploma level programs and registration rate for TSLC level graduates as depicted in Annex I

## 2.6 Conclusions

The past trends of sectoral growth rate of construction sub-sector, which is the good indicator to determine both the dynamics and dimension of infrastructure development activities in the country, is just creeping ahead with negligible rate of 3.5% in last decade. The situation was almost same in all other related sectors like electricity, gas and water, transport storage and communication, and manufacturing. Moreover, notable scarcity of middle level engineering professionals was not visible in labour market for average quality workforce except some categories, however additional quality makes some differences to their employment. Unlike the past trends, government plan and policies reflects rather optimistic scenario targeting the rate of growth rate of 5.5% for construction sub-sector, 8.2% for the sub-sector of electricity, gas and water and 4.7% for industry, mining and quarrying based on the proposed investments plan in infrastructure development activities including road construction, construction of mega- projects in hydroelectricity, expansion of irrigation facilities, and development of large residential areas among others. Moreover, scarcity of workforce is also pointed by some other studies as one of the major hurdles to implement the proposed plan of these development activities.

Being a public organization, CTEVT should not only response the current demand of labour market but also analyze and project future requirements and prepares workforce accordingly. Demand of human resources in engineering sector is closely associated with the infrastructure development activities as well as the industrialization of the country. So the demand of human resources in engineering profession is directly proportional to the volume of investment in these sectors however, the employment elasticity of these investments varies as per the sectors.

The growth rate of human resource should be made compatible with the national plan and policies for preparing conducive environment to implement related development interventions. Although, significant expansion of the supply capacity can strongly be denied, gradual and overtime expansion is the most. Moreover enhancement of quality rather than expansion of quantity of training programs is the primary concern of present time. The rate of expansion of training capacity should therefore limit within the certain level which is different for different trade as suggested in the main volume of the report.

## 2.7 Recommendation

Based on the analysis in the study and above mentioned conclusions, the following points are recommended regarding the future requirements of technical human resource.

- ❖ None of the categories of middle level engineering professionals is scarce in domestic labour market however, the proposed public infrastructure development activities will demand additional civil and architect overseers and sub-overseers. Almost 40% additional human resources are supposed to be required in these two professions gradually up to 2023.

- ❖ Presently, electrical overseers are over supplied in the job market. Keeping eyes on the proposed plan of hydropower sector, rapid increase of electrification trend, and per capita demand of electricity, electrical sub-overseer and overseer seems to be needed in significant number in the coming decade. Moreover, the available supply will sufficient to fulfill the demand of coming three years. Since then, some additional supply will be needed gradually up to 2023 (See projection figure in annex 1)
- ❖ The increasing use of computer and computerized system, telecommunication and other digital technologies in recent years suggest for higher demand of computer technician in coming decade however middle level technicians may not be the requirements. In this high-tech sector, either advance knowledge is required for system development or simple training is enough for applying these technologies. The demand of middle level computer technicians does not seem to be increased more than 15% during the targeted period.
- ❖ The increasing mechanization of peoples' activities in current years is reflected by the increasing trends of vehicles use, transportation facilities, petroleum consumptions and slight growth of manufacturing sectors in the last decade. Analyzing the past trends in these activities, demand for additional workforces is expected in this sectors too. Annual increment of supply of Mechanical HR up to 10% will be needed by 2023.
- ❖ Programs in the new trades like chemical engineering, power engineering and system engineering are also emerging as potential employment sectors under engineering trades. Curriculum development activities should be initiated for these trades.
- ❖ Tracer study of graduates of each of the running program should be conducted once in each five years which gives not only the employment status of graduates but also the saturation level of labour market.
- ❖ The programs in which supply inward flow of students is far lower than the enrollment capacity were compelled to stop the program until the recovery towards full capacity.
- ❖ Increasing the number of institutions is the easier alternative to increase the supply of workforce in the labour market. The average graduation rate is too low because of under-capacity enrollment and low pass rate of graduates in engineering trade, if these two areas were improved, excess supply of HR can be expected thus proportionately lower number of institutions will be enough to supply the same quantity of HR.

## PART III

### HEALTH TRADE

#### 3.1 Introduction

CTEVT has been mandated to prepare basic and middle level technical human resources since it established in 1989. Later in 2007, the mandate was extended up to higher level technical education. However, initiation towards making use of this mandate is yet to be taken. Before establishment of CTEVT, TU was the only organization mandated to prepare technical human resources at all trades and levels. Because of its wider responsibility, it could not manage to prepare the technical human resources as per the countries needs. This situation paved way for the establishment of CTEVT.

To accomplish the mandate of preparation of technical human resources as per the countries requirement, CTEVT not only manages its own schools called 'constituents schools', it also provides affiliation to private technical schools. Presently, there are 40 constituent schools (including polytechnics which are presently under construction), more than 400 private technical schools and 73 community schools. All these schools offer various skills training and technical education programs with duration ranging from few months to 3 years. Among the technical schools, majority (62%) offer health related TVET programs. The data in Table 3.1 details on health related programs.

Table 3.1: Current Health related TVET programs

Diploma Level Programs				TSLC Level Programs			
SN	Name of Program	No	%	SN	Name of Program	No	%
1	PCL Nursing	96	42.67	1	Community Medical Assistant	76	48.10
2	General Medicine	45	20.00	2	Auxiliary Nurse Midwifery	45	28.48
3	Certificate in Medical Laboratory Technician	46	20.44	3	Laboratory Assistant	29	18.35
4	Diploma in Pharmacy	26	11.56	4	Axillary Ayurveda Health Workers	6	3.80
5	Certificate in Dental Hygienic	8	3.56	5	Community Oral Hygiene	2	1.27
6	Certificate in Ayurveda General Science	3	1.33	6	Acupuncture		
7	Certificate in Homeopathy	1	0.44	7			
8	Total	225	100.00	8	Total	158	100.00

Source: CTEVT: A Glimpse, 2013

Of the total health related programs, 158 Technical SLC Level and 225 diploma level programs having running throughout the countries. Besides these existing institutes, large numbers of organizations have applied for affiliation to offer health related technical programs.

### 3.2 HRH Projection Models

Although, simultaneous equations are used in international literatures for making HR projection in health sector, these models require relevant and reliable quantitative data. Because of unavailability of such type of data, simultaneous equations method was not applicable in this study. This study is completed under the availability of limited time series as well as cross-sectional data. In this regard, two different projection approaches are prescribed by World Health Organization (WHO) they are need based approach and demand based approach. Although both approaches are discussed in this report, projection in this study is only based on need based approach due to the limitation of data for demand based approach.

#### 3.2.1 Demand Based Approach

Demand-based approach considers the actual demand of HRH in the country. This approach also takes account of purchasing power and health awareness of the citizens besides the standard norms set by international institutions like World Health Organizations and other national authorities of health sector. Under this approach, demand of HRH is speculated based on the past trends, future plan and present health policies of government. In the present liberalized economy, health service is not only the domain of public sector. Significant numbers of hospitals are established under private sector management and notable numbers of human resources are also consumed by these organizations.

Table 3.2: Projected Need of HRH by 2017

SN	HRH Category	Available Number (2012)	Employed in Public Sector (%)	Requirement by 2017		
				Public	Private	Total
1	Staff Nurse	1585	61	3416	4016	7432
2	ANM	1820	75	11657	3954	15611
3	Pharmacists	38	37	162	345	507
4	Asst. Pharmacists	69	58	251	312	563
5	Lab Assistant / Lab Technician	583	65	871	276	1147
6	Radiographer	48	29	181	509	690
7	Assistant Radiographer	158	39	249	265	514
8	AAW/AHW	4334	98	6464	9	6473
9	Health Assistant/ Kabiraj/ Hakim	1558	90	1179	488	1667

Source: Human Resource for Health, Strategic Plan for 2003-2017



In 2003, according to Ministry of Health, 17,899 health related institutions were available throughout the country including PHC outreach clinics. Of the total hospital beds, 4458 were available in the health related institutions under the public sector. At the same time, 77% of total supply of HRH was employed in public sector. The data in table 3.2 explores the corresponding figures by various HR category. In addition to this figure, the table further presents the tentative number of the HR requirements under both public and private sector by 2017 (MoH, 2003).

According to the same report a total of 8262 hospital beds were available throughout the country, out of which public sector hospitals had 4458 beds and private sector hospitals have 3804 beds. Bed numbers were expected to reach 13,969 in totality and 5159 under private sectors by 2017 ( MoH, 2003). But at present, as per the data provided by Ministry of health, there are more than 30 thousands beds available throughout the country including government, private and teaching hospitals as well as hospital run by missionaries. The projection of bed number is therefore no longer useful to project the HR demand of the country (MoHP).

In the year 2011, Ministry of Health and Population (MoHP) formulated strategic plan to make projection on the HRH needs. Projection in this report only deals with public sector and make projections of demand accordingly. As per this plan, the projected public sector's requirements under various categories is presented in Table 3.3.

Table 3.3: Public Sector Requirements of HRH by 2015

SN	Categories of HRH	Demanded Number in Public Sector	Justification
1	Medical Doctor	932	
2	Staff Nurse	8690	
3	Health Assistant	3536	
4	AHW	-	To be recruited from Internal promotion
5	ANM	-	To be recruited from Internal promotion
6	Lab Technician	435	
7	Anesthesia Assistant	141	
8	Physiotherapy Assistant	28	
9	Ophthalmic Assistant	65	

Source: Human Resource for Health, Strategic Plan for 2011-2015

In December 2011, MoHP developed projection for key cadres as shown in the table 2.3. It is estimated that approximately 14,210 doctors/ nurses and paramedics staff would be needed between 2011 to 2015. The Nepal Ayurveda Medical Council estimates that it would need an additional 2642 Ayurveda health providers over the next 5 years. In 2012 the Nepal Pharmacy

Council indicated that it would need a total of 4292 staffs by 2025 for all the retail and wholesale pharmacy units in the country (NHSSP, 2012 ).

CTEVT has been managing several health related TVET programs since long in the past, however, it is still unable to manage programs in every category of Health. Ministry of Health and Population has identified needs of additional programs. Based on this projection, MOHP had communicated a letter to CTEVT in 2067/12/9 for the appropriate management for preparation of these HRH categories. The detail figure of this projection is presented in Table 3.4.

Table 3.4: Demand of HRH in Additional Programs and Level

S N	Name of Programs	Projected Number	Level
1	Radiography Assistant	5000	TSLC
2	Physiotherapy Assistant	5000	TSLC
3	Optical Fitting and Dispensing	1600	TSLC
4	Ophthalmic Science	7000	Diploma
5	Operation Theater Assistant	2000	Diploma
6	Homeopathy	1000	Diploma
7	ECG/ECO	3000	Diploma
8	Orthopedic Assistant	3000	Diploma
9	Dental Mechanics	3000	Diploma
10	Acupuncture	5000	Diploma
11	Physiotherapy	3000	Diploma
12	OT Technician	1500	Diploma
13	Dialosis Technician	1500	Diploma

Source: MoHP, 2009

### 3.2.2 Needs-Based Approach

Need based approach pictures only the ideal situation on availability of health services but does not considers other factors that determines the demand of health services such as health awareness and purchasing power of the people. The needs of health services was analyzed separately for Nursing, Pharmaceuticals and Paramedics in the following sub-topics.

#### 3.2.2.1 Nursing Professionals

Health service needs is determined by morbidity which is further determined by personal as well as environmental hygiene. However, the estimation of HR requirement based on these factors is beyond the scope of this report. Here, we borrowed the previously established assumptions with regards of HRH projections. World Health Organization (WHO) has set a threshold of 23 doctors/ nurses and midwives per 10,000 population as a minimum condition to achieve the health related MDGs. However till 2011, total of 10,753 doctors and 32,948 nurses are registered under the

medical and nursing council respectively. As per the figure reported by World Health Statistics report, the density of doctors to 1000 population in Nepal is 0.4 whereas the corresponding ratio of Sri-Lanka is 0.6, China 1.6, UK 5.4, USA 5.5 and Cuba 5.9.

The above mentioned figure depicts that the density of HRH personnel depends on development level of a country. This is because citizens in developed country generally have higher health awareness and purchasing power than in developing countries. The Human Development Index can be taken as a proxy of development level. Chart 1 shows the relationship between the HDI from Human Development Report 2010 and corresponding density of Nurses and Midwives available in the country in the same year. The exponential relationship depicted in chart 3.1 allows to determine the change in density of Nursing and Midwives/1000 population due to change in HDI. The value of R-square and the depicted equation is the evidence of significant positive correlation between these variables. The obtained R-square value (0.8868) shows that almost 89% of variation in HR density is explained by human development index.

Chart 3.1: Density of Nursing /1000 versus the Human Development Index



Source: WHO, 2010 and UNDP 2010.

Obviously, the density of desired HRH to 1000 population increases along with country's development level. Need based projection approach will lead to wrong conclusion, if the ratio is considered constant in a long term. A dynamic projection approach is therefore appropriate for such projection. The formulated exponential regression model as depicted in the equation 1 is therefore applied to estimate the required density of HRH in different levels of development.

$$\frac{Nupro}{1000\ pop.} = 0.0335e^{6.541HDI} \dots\dots\dots 1$$

Where,

Nupro: Nursing professionals

Pop.: Population

Since this analysis attempts to project the HR requirements for the coming decade, the value of HDI is the main basis for the projection. In this regard, current three years plan (TYP 2013/14-15/16) has aimed to graduate Nepal from least developed country to developing country, however HDI is not considered as a parameter for such purpose. The different three parameters other than HDI such as Per Capita Income, Human Assets Index and Economic Vulnerability Index are considered for such purpose. In this case, attempt was made to analyze the tentative value of HDI that Nepal likely to achieve at the time of graduating to developing country.

Since 1971, the four countries were graduated to developing countries from LDCs- Botswana (1994), Cape Verde (2007), Maldives (2011) and Samoa (2014). Moreover, Equatorial Guinea and Vanuatu are scheduled to be graduated by 2017. HDI value of all of the countries lies between 0.6 to 0.7 except Equatorial Guinea (NPC, 2014). The Table 3.5 categories the countries as per the value of HDI in an interval of .1 and their corresponding mean value of Nursing Density per 1000 population. The average ratio of Nursing Density per 1000 population of the countries whose HDI lies between 0.6 to 0.7, is calculated as 2.89. So it can be assumed that at the time of graduation, Nepal will also achieve the same HDI score.

Table 3.5: Density of Nursing by Range of HDI Value

SN	Category of Country by HDI Value	Mean of Density of Nursing/1000	Number	Std. Deviation
1	Countries with HDI Value < .400	.4512	6	.28463
2	Countries with HDI Value >.401 &<.500	.7650	3	.08954
3	Countries with HDI Value >.501 &<.600	.7710	2	.44972
4	Countries with HDI Value >.601 &<.700	2.8890	4	1.26792
5	Countries with HDI Value >.701 &<.800	5.2159	9	.98950
6	Countries with HDI Value >.801 &<.900	8.7257	12	4.20510
7	Countries with HDI Value >.901	15.4070	1	.
8	Total	5.0043	37	4.45546

Source: WHO Global Atlas, 2010

The Table 3.6 depicts the projected figure of HDI together with the needs of Nursing Professionals in two different situations-preferred situation and normal situation. The situation described in previous paragraphs is the preferred situation where the requirement of nursing professionals is projected 92836. Based on the fact that none of the national development plan has achieved its

desired outcomes in totality, there is also less likelihood for achieving the goal of the current Three Year Plan. A different value of HDI is speculated for the coming decade based on last four years' trend. The average annual increment of HDI in the last four years was only 0.012. With the assumption that the current situation will continue for few years, the annual increment of HDI can be expected in the same rate as it was in the last four years and reach only up to 0.568 by 2022. The Table 3.6, presents the detail figure in this regard.

Table 3.6: Density of Nursing & Midwives per 1000 population

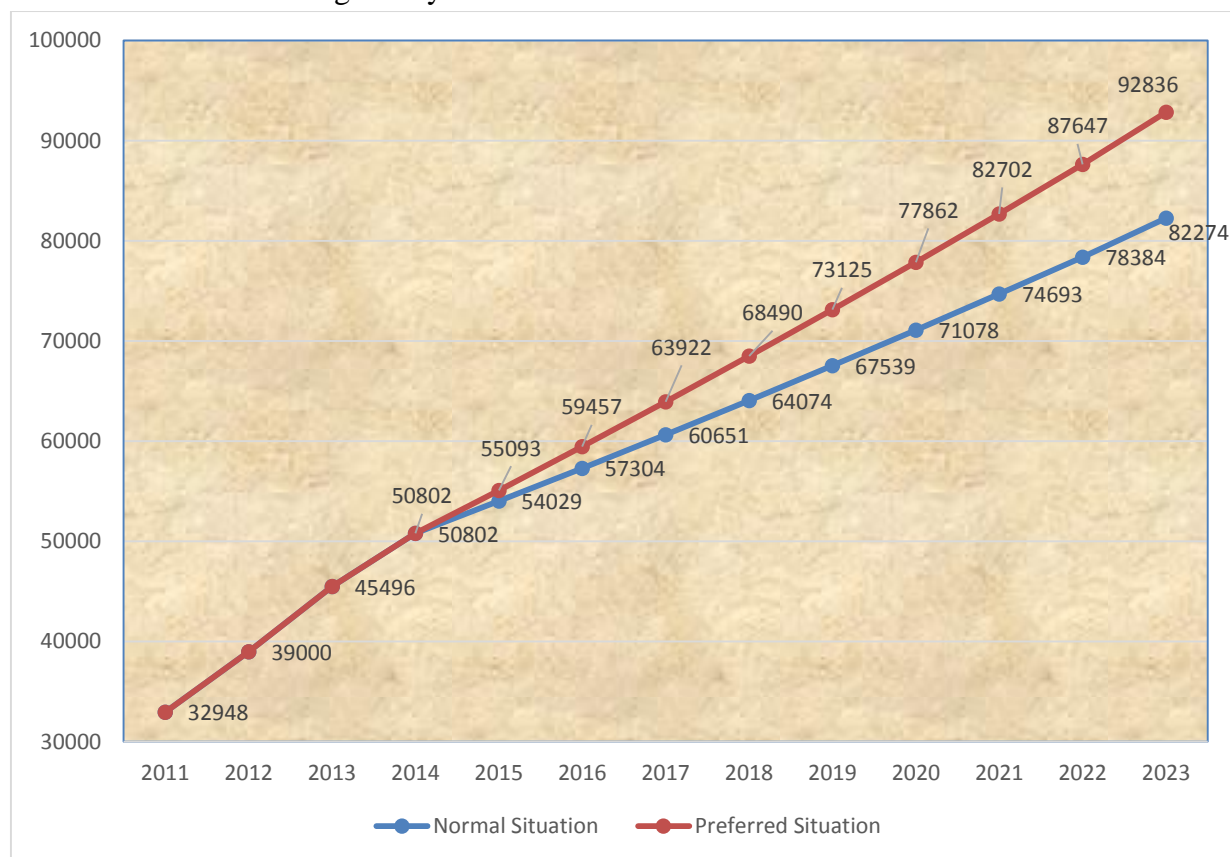
SN	Fiscal Year	Population in million	Normal Situation			Preferred Situation		
			HDI	Den./1000	Total Need	HDI	Den./1000	Total Need
1	2011	26.49	0.458	1.24	32848	0.458	1.24	32948
2	2012	26.85	0.461	1.45	38933	0.461	1.45	39000
3	2013	27.21	0.463	1.67	45441	0.463	1.67	45496
4	2014	27.56	0.475	1.84	50710	0.484	1.84	50802
5	2015	27.92	0.486	1.84	53389	0.505	1.97	55093
6	2016	28.27	0.498	1.84	56100	0.526	2.10	59457
7	2017	28.62	0.510	1.97	58862	0.547	2.23	63922
8	2018	28.98	0.521	2.10	61695	0.568	2.36	68490
9	2019	29.33	0.533	2.10	64559	0.589	2.49	73125
10	2020	29.68	0.545	2.23	67472	0.610	2.62	77862
11	2021	30.04	0.556	2.36	70460	0.631	2.75	82702
12	2022	30.4	0.568	2.36	73500	0.652	2.88	87647
13	2023	30.81	0.580	2.49	76717	0.688	3.01	92836

Source: Population Census 2011,

The projection of HRH not only depends upon the HRH to population ratio but also the total population of the country. As per the Census 2011, total population of Nepal is 26,494,504 and the inter census population growth rate is (between 2001 and 2011) 1.35%. The current Three Year Plan (2013/14-15/16) has also targeted to keep the annual growth rate of population within the same rate (1.35%). Moreover, In the approach paper to the Graduation from the Least Developed Country by 2022, the annual growth rate of population is assumed to be decreased to 1.20 by 2020. Based on the nursing to population ratio and number of population, the requirement of nursing professional by 2022 is depicted in the same Table 3.6.

In Chart 3.2, HR requirement in Nursing and Midwives under both situation is depicted. The projected model also resembles the actual situation of 2010 and 2013, and 2014 where number of nursing staff is 32,948, 45,496 and 50,827 respectively. Hence the formulated model not only justifies higher significance level, but also simulates the actual situation.

Chart 3.2: Need of Nursing HR by Fiscal Year 2023



Source: Current Analysis, 2014

The above projection only quantifies the needs of nursing professionals by the year 2022. However, it neither tells anything about the needs of other health professionals nor it makes level wise allocation (nursing and midwives) of this projected figure. To make the projection on requirements of other remaining categories of health professionals, two different approaches were used by classifying the remaining health professionals by pharmaceutical staffs and paramedical staffs, which are described differently in the coming topics. For the distribution of projected number nursing professions into nursing and midwives, the corresponding ratio of their sanctioned posts in government health services is used. (See Annex III)

### 3.2.2.2 Needs of Pharmaceutical Personnel

The need of pharmaceutical personnel is also closely associated with the number of physicians available in the country since most of the medicines and other medical equipment are sold based on the prescriptions of physicians. Presently, diploma in pharmacy is set as the minimum qualification to get the permission to run dispensary or medical store. Such provisions opens large demand of pharmaceutical staffs in private sector market. The ratio between the physicians and pharmaceutical personnel can be expected as fixed in a certain circumstances. The required

numbers of pharmaceutical personnel is projected by the help of this ratio where this ratio is derived by taking the mean of various recorded overtime.

Data of 26 countries regarding the density of physician and pharmaceutical personnel in different time period is obtained from the web site of World Health Organization (WHO) (See Annex 4). The ratio which is used for the projection of pharmaceutical personnel was derived by taking the mean value of this ratio which is 4.11. This means one pharmaceutical personnel is required in each 4.11 number of doctors. Similarly, ratio between doctors and midwives as standardized by WHO is 1:3 (three nurses and midwives equivalent with one doctors) (Rao, 2012). By the same token, we derived the required numbers of pharmaceutical staffs based on the required numbers of nurses and midwives as presented in Table 3.5. Problem was still there to allocate this number as per different level (Pharmacist and Assistant Pharmacist). As per the data presented in Table 3.2, the report of Human Resource for Health, Strategic plan for 2003-2017, the projected requirement for Pharmacists was 507 and Assistant Pharmacist was 563 which is in 9:10 ratio. While using the same ratio, required number of pharmaceutical staffs under both categories is depicted in Annex 2 and 3.

### **3.2.2.3 Needs of Paramedics, Laboratory and Traditional Health Professionals**

Beside physicians and nursing professionals, other various categories of HRH are also the requirements of health sector. They are Health Assistants, Community Medical Assistants, Laboratory Technicians, Laboratory Assistants, Vaidhya, Kabiraj among others. The need of such professionals also depends on almost the same factors as the needs of physicians and nursing professionals depend on and the desired proportion among these human resources is almost same with in the particular stage of development. As Nepal is in LDC category, it is assumed that the desired ratio among the various categories of health professionals will be the same till it graduates to developing countries.

The similar type of data which was used for the projection of nursing professionals was not found regarding all of the categories of health professionals. It is therefore, the methodology applied neither for nursing professionals nor for pharmaceutical professionals can be repeated here to project the requirements in remaining categories of health professionals. The Table 3.8 details the breakdowns of the proportion of sanctioned posts regarding all categories of health professionals with in the health service of government of Nepal. This proportion is used to derive the required HR based on the projected figure of nursing professionals. The detail of the projection up to 2022 in various categories of health professionals is depicted in Annex III.

In the table below, the community medical assistant (CMA) are found employed in largest proportions (42.3%) among the assistant level health personnel in public service. Similarly, Auxiliary Nurse Midwifery (17.6%) occupies the second largest share followed by Health Assistant (13.8%) and Staff Nurse (12%) respectively.

Table 3.6: Number and Proportion of Approved Positions under the Health Services

SN	Sanctioned Posts	Actual Number	Percentage
1	CMA (Community Medical Assistant)	4352	42.3
2	ANM (Auxiliary Nurse Midwifery )	1808	17.6
3	HA (Health Assistant)	1422	13.8
4	Staff Nurse	1239	12.0
5	Lab Assistants	406	3.9
6	AAHW (Assistant Ayurvedic Health Worker)	365	3.5
7	Kaviraj	326	3.2
8	Lab Technician	212	2.1
9	Dark Room Assistant	79	0.8
10	Assistant Pharmacist	41	0.4
11	Dietician	13	0.1
12	Physiotherapist	12	0.1
13	Cartographer	5	0.0
14	Ophthalmology Assistant	3	0.0
15	Anesthetic Assistants	2	0.0
16	Total	10285	100.0

### 3.2.3 Supply Side Issues

All the nursing staffs (including ANM) who want to practice within the country must be registered in Nursing Council and paramedics and pharmacists in Health Professional Council and Pharmacy Council respectively. The total number of professionals registered under these Councils till 2011 is presented in table 2.6. The same table also presents the number of probable entrants of respective categories of HRH based on the capacity, enrollment trend and present pass rate. The probable number of entrants of health professionals in labour market is the function of the total number of enrollment capacity of institutions of the respective trades. But, capacity of institutions is not always fulfilled and all the enrolled candidates complete the course. The probable number of annual entrant to labour market in particular occupation therefore does not only depend upon the total enrollment capacity of institutions but also the enrollment rate of the program and pass rate of the students. Based on these three parameters, the probable number of entrants of HR professionals is calculated and depicted in table 3.6.



Table 3.7: Probable Entrants in Labour Market

SN	Categories of HRH	Available till 2011	Enrollment Capacity of 2014	Enrollment Ratio/ Institute	Pass Rate	Probable Annual Entrants <sup>4</sup>
<b>1</b>	<b>Nursing</b>	<b>33723</b>	<b>5640</b>			
a	Staff Nurse	16299	3840	40.00	98.50	3782
b	ANM	17424	1800	38.41	70.19	1213
<b>2.</b>	<b>Paramedics</b>	<b>40580</b>				<b>0</b>
a	HA	2780	1800	39.00	65.78	1154
b	CMA	29309	3040	38.16	80.47	2333
c	Lab Technician	536	1380	25.82	72.89	865
d	Lab Assistant	5828	1160	34.81	72.89	735
e	Assist. Pharmacist		1040	38.78	52.19	526
f	Dental (Certificate)	37	320	32.80	72.50	190
g	Dental TSLC	356	80	32.81	65.00	42
h	Ophthalmologists	390	40	40	90.00	36
i.	Radiography (Dip)	164	540	25.67	96.71	446

Source: CTEVT, Registration and Examination Record, 2070

### 3.3 Conclusions

Although, The Interim Constitution of Nepal, 2007 has recognized health as the fundamental rights of the people, the health services access to people is not in desired level. The access of health services to people depends upon the availability of HRH among other factors. Moreover, the production and supply of HRH has also the crucial role to upgrade the human development level of the country.

On one hand, the availability of HRH in Nepal is still lower than the minimum requirement as defined by WHO. Large numbers of health professionals are already in labour market and seeking for employment on the other. The purchasing power and health awareness of the people is also responsible for the demand of HRH. The higher purchasing power and health awareness of citizens always leads to higher demand of HRH. Therefore, the demand of HRH as proportion to population can't be constant overtime and depends on the development level of the country. Focusing on the requirements for graduating to developing country from LDC by 2022 as envisioned by current Three Years Plan 2013/14-2015/16, preparation of HRH in higher number and proportion is the must. Moreover HRH in some categories are the outmost demand of the present.

<sup>4</sup> The following formula will be considered to calculate this figure ( Probable annual entrants = Enrollment capacity\*enrollment rate \*Pass rate )

The need of labour market should not be analyzed individually by fragmenting quality, quantity and location. They are the matter of joint analysis. Supply has also the capability to create its own demand if it is escorted with quality. Proportionate distribution of supply mechanism as per the region is another factor that can acts as the lubricants to bring labour market in equilibrium.

### **3.4 Recommendations**

Based on the analysis and above mentioned conclusion, some points are recommended for further action.

- ✚ Some specific categories of workforce like junior Physiotherapist (TSLC Level), Optical Fitting and Dispensing Assistant (TSLC Level), Operation Theater Assistant (Diploma Level), etc (see Table 3.4) are highly demanded in the market, however neither the private technical schools are granted affiliation to run these programs nor run by CTEVT itself. So process towards preparation of these workforce should be started immediately
- ✚ Present supply of nursing professionals is sufficient to meet the present needs however, some additional HR seems to be needed by 2023, so as to prepare enabling environment for graduating Nepal to developing country from LDC.
- ✚ Some additional human resources seems to be needed in paramedic field like Community Medical Assistant (CMA) and Health Assistant (HA) by the year 2023 as depicted in the Annex II & III. Since the proportion between CMA and HA is varied as per the availability of those technicians and income level of citizens, midterm analysis is also needed to finalize the proportion.
- ✚ Proportionate distribution of all the programs by both geographical regions and development regions is the most. A different analysis should be carried out to identify the region with demand of such human resources.
- ✚ Regular follow up study of the graduates in every trade and programs is the most since it not only explores the employment status of graduates but also reflects the trends of changing needs of labour market.
- ✚ The observed mismatch between the labour market requirement and the output of TVET institutions is mainly due to the quality of the workforce. Enhancement of quality should be emphasized alongside the quantity of production.
- ✚ Lower enrollment as well as pass rate of the student is observed in most of the trades and programs ( except PCL Nursing) which leads to lower supply of HR in the job market. The efficient utilization of present capacity is sufficient to increase 10-20 percent of present supply of HR.



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**Annex I: Projection Table for Engineering Trade**

S. N.	Name of Program	Number of Additional Human Resources in the academic year										
		Present	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1	Diploma in Civil Engineering	868	924	980	980	980	1036	1036	1036	1120	1120	1176
2	Diploma in Mechanical Engineering	108	108	108	144	144	144	180	180	180	216	216
3	Diploma in Computer Engineering	476	476	476	476	476	476	504	504	532	532	560
4	Diploma in Electrical Engineering	310	310	310	310	341	341	341	372	434	434	465
5	Diploma in Electronics Engineering	210	210	210	210	210	210	231	231	252	252	252
6	Diploma in Architecture Engineering	112	112	112	112	112	112	112	112	140	140	140
7	Diploma in Information Technology	46	46	138	138	230	230	230	322	322	322	322
8	Diploma in Survey Engineering	46	46	138	184	184	184	230	230	230	230	230
<b>TSLC Level Programs</b>		0	0	0	0	0	0	0	0	0	0	0
1	Civil Sub-overseer	468	468	468	486	504	522	540	540	558	576	594
2	Mechanical Sub-overseer	120	120	120	120	120	120	144	144	144	144	144
3	Electrical Sub-overseer	225	225	225	225	240	240	255	270	285	285	300
4	Basic Surveying	64	64	64	64	64	64	64	80	80	80	80
5	Junior Computer Technicians	126	126	126	126	140	140	140	154	168	168	168

**Annex II: Projected Need of HRH (A. Based on Normal Situation)**

S.N.	Categories of HRH	Needs of HRH in										Remarks	
		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023		
Population in Ten Millions		2.76	2.80	2.83	2.86	2.90	2.93	2.97	3.00	3.04	3.08	Projected based on 1.35 GR	
Projected ratio of N & MW/1000 population		1.84	1.93	2.03	2.12	2.21	2.30	2.39	2.49	2.58	2.67	Detail is given in Table 2.5	
<b>A</b>	Tentative Need of	<b>Nursing</b>	<b>50802</b>	<b>54029</b>	<b>57304</b>	<b>60651</b>	<b>64074</b>	<b>67539</b>	<b>71078</b>	<b>74693</b>	<b>78384</b>	<b>82274</b>	Based on the eq. 1
1		ANM	30452	32387	34350	36356	38408	40485	42607	44773	46986	49318	
2		PCL Nursing	20350	21642	22954	24295	25666	27054	28472	29920	31398	32957	
<b>B</b>		<b>Paramedics</b>	<b>115649</b>	<b>122996</b>	<b>130450</b>	<b>138071</b>	<b>145862</b>	<b>153751</b>	<b>161808</b>	<b>170036</b>	<b>178438</b>	<b>187295</b>	Based on composition of civil Service
1		CMA	72352	76948	81612	86380	91254	96189	101230	106378	111634	117175	
2		HA	23603	25102	26623	28179	29769	31379	33023	34702	36417	38225	
3		Lab Technician	3592	3820	4051	4288	4530	4775	5025	5281	5542	5817	
4		Lab Assistant	6670	7094	7524	7964	8413	8868	9333	9807	10292	10803	
5		Pharmacy Assistant	2168	2305	2445	2588	2734	2882	3033	3187	3345	3511	
6		Dark Room Assistant	1473	1567	1662	1759	1858	1959	2061	2166	2273	2386	
7		Cold Chain Assistant	4064	4322	4584	4852	5126	5403	5686	5975	6271	6582	
8		Family Planning Assistant	1727	1837	1948	2062	2179	2296	2417	2540	2665	2797	
<b>C</b>		<b>Traditional</b>	<b>11456</b>	<b>12184</b>	<b>12922</b>	<b>13677</b>	<b>14449</b>	<b>15230</b>	<b>16028</b>	<b>16843</b>	<b>17676</b>	<b>18553</b>	Based on ratio with physicians
<b>D</b>	<b>Total</b>	<b>177907</b>	<b>189209</b>	<b>200676</b>	<b>212399</b>	<b>224385</b>	<b>236520</b>	<b>248914</b>	<b>261572</b>	<b>274497</b>	<b>288122</b>	Based on composition of civil Service	

**B. Based on Desired Situation**

S.N.	Categories of HRH	Needs of HRH in										Remarks
		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	
	Population in Ten Millions	2.76	2.80	2.83	2.86	2.90	2.93	2.97	3.00	3.04	3.08	Projection is based on 1.35 annual growth rate
	Projected ratio of N & MW/1000 population	1.84	1.97	2.10	2.23	2.36	2.49	2.62	2.75	2.88	3.01	Detail is given in Table ...
<b>A</b>	<b>Nursing</b>	<b>50802</b>	<b>55093</b>	<b>59457</b>	<b>63922</b>	<b>68490</b>	<b>73125</b>	<b>77862</b>	<b>82702</b>	<b>87647</b>	<b>92836</b>	Based on the eq. 1
1	Staff Nurse	30452	33024	35641	38317	41055	43834	46673	49574	52538	55649	
2	ANM	20350	22069	23817	25605	27435	29292	31189	33128	35109	37187	
<b>B</b>	<b>Paramedics</b>	<b>115649</b>	<b>125417</b>	<b>135353</b>	<b>145517</b>	<b>155915</b>	<b>166467</b>	<b>177251</b>	<b>188269</b>	<b>199526</b>	<b>211338</b>	Based on composition of civil Service
1	CMA	72352	78463	84679	91038	97543	104145	110891	117784	124827	132217	
2	HA	23603	25596	27624	29698	31820	33974	36175	38423	40721	43132	
3	Lab Technician	3592	3895	4204	4519	4842	5170	5505	5847	6197	6564	
4	Lab Assistant	6670	7234	7807	8393	8993	9601	10223	10859	11508	12189	Best on average ratio with physicians
5	Pharmacy Assistant	2168	2351	2537	2727	2922	3120	3322	3529	3740	3961	
6	Dark Room Assistant	1473	1598	1724	1854	1986	2121	2258	2398	2542	2692	Based on composition of civil Service
7	Cold Chain Assistant	4064	4407	4757	5114	5479	5850	6229	6616	7012	7427	
8	Family Planning Assistant	1727	1873	2022	2173	2329	2486	2647	2812	2980	3156	
<b>C</b>	<b>Traditional</b>	<b>11456</b>	<b>12423</b>	<b>13408</b>	<b>14415</b>	<b>15444</b>	<b>16490</b>	<b>17558</b>	<b>18649</b>	<b>19764</b>	<b>20935</b>	
<b>D</b>	<b>Total</b>	<b>177907</b>	<b>192933</b>	<b>208218</b>	<b>223854</b>	<b>239849</b>	<b>256082</b>	<b>272670</b>	<b>289620</b>	<b>306937</b>	<b>325109</b>	



**Annex III: Ratio between Physicians and Pharmaceutical Personnel**

SN	Year	Name of Country	Density of Pharmaceutical Personnels/1000	Density of Physicians /1000	Physician/Pharmaceutical Staffs
1	1996	Cambodia	0.042	0.105	2.50
2	1998	Argentina	0.42	3.15	7.50
3	2000	Barbados	0.285	1.37	4.81
4	2001	Afghanistan	0.02	0.19	9.50
5	2001	Bolivia	0.55	1.22	2.22
6	2001	Grenada	0.27	0.72	2.67
7	2003	Fiji	0.1072	0.45	4.20
8	2004	Cabo Verde	0.09	0.23	2.56
9	2009	Australia	1.038	2.99	2.88
10	2009	Canada	0.92	2.06	2.24
11	2010	Austria	0.676	4.8	7.10
12	2004	Iran	0.2	0.87	4.35
13	2004	Iraq	0.53	0.66	1.25
14	2009	Iraq	0.17	0.69	4.06
15	1990	Japan	1.2192	1.7	1.39
16	2006	Jordan	1.152	2.3	2.00
17	1998	Kiribati	0.05	0.3	6.00
18	1993	Maldives	0.585	0.67	1.15
19	2011	Malta	0.802	3.2	3.99
20	2007	Nigeria	0.136	0.4	2.94
21	2006	Oman	0.702	1.7	2.42
22	1995	Oman	0.164	1.1	6.71
23	2011	San Marino	0.725	4.8	6.62
24	2010	Singapore	0.395	1.92	4.86
25	2010	Switzerland	0.579	4.08	7.05
26	1991	Thailand	0.079	0.23	2.91
27	1998	Tunisia	0.174	0.73	4.20
28	2008	Tuvalu	0.1818	0.91	5.01
sum					115.06
Mean					4.11