Final Report

On

Detail Study of Thermo-Mechanically Treated (TMT) Bar Manufacturing Industry in Nepal

Government of Nepal
Ministry of Industry, Commerce and Suppliers

Department of Industry

Tripureswor, Kathmandu,Nepal

Study Conducted By:

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We hope this study will be useful to prepare further policy and directives related to TMT manufacturing industry in context of Nepal.

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ABBREVIATION

AD	Anno Domini
BAU	Business as Usual
BC	Before Christ
CA	Constitutional Assembly
CRM	Continuous Rolling Mill
CTD	Cold Twisted Deformed
DG	Diesel Generator
DoI	Department of Industry
EMS	Environmental Management System
FGD	Focuss Group Discussion
GDP	Gross Domestic Product
GJ	Giga Joule
GM	General Manager
HG	High Growth
KII	Key Informant Interview
KVA	Kilo Volt Ampere
LEAP	Long Range Energy Alternative Planning
MG	Medium Growth
MJ	Mega Joule
MS	Mild Steel
MT	Metric Tons
MW	Mega Watt
NBSM	Nepal Bureau of Standards and Metrology
NS	Nepal Standard
NSRMA	Nepal Steels Rolling Mills Association
OHSAS	Occupational Health and Safety Management System
QMS	Quality Management System
R&D	Research and Development
Rs	Rupees
SEC	Specific Energy Consumption
TJ	Tera Joule
TMT	Thermo Mechanically Treated
TOD	Time of Day
ToR	Terms of Reference
TPD	Tons Per Day

CHAPTER I: INTRODUCTION

1.1 Background

The Thermo-Mechanically Treated (TMT) Bars are manufactured with a solid and hard outer surface with a pliable inner core. These bars are by default resistant to corrosion and rust, making them for constructing sensitive structures such as high rise residential buildings and bridges in humid areas.

Thermo mechanical processing, is a metallurgical process that combines mechanical or plastic deformation process like compression or forging, rolling etc. with thermal processes like heat-treatment, water quenching, heating and cooling at various rates into a single process. The quenching process produces a high strength bar from inexpensive low carbon steel. The process quenches the surface layer of the bar, which pressurizes and deforms the crystal structure of intermediate layers, and simultaneously begins to temper the quenched layers using the heat from the bar's core.

Steel billets are heated to approximately 1200°C to 1250°C in a reheat furnace. Then, they are progressively rolled to reduce the billets to the final size and shape of reinforcing bar. After the last rolling stand, the billet moves through a quench box. The quenching converts the billet's surface layer to marten site, and causes it to shrink. The shrinkage pressurizes the core, helping to form the correct crystal structures. The core remains hot, and austenitic. A microprocessor controls the water flow to the quench box, to manage the temperature difference through the cross-section of the bars. The correct temperature difference assures that all processes occur, and bars have the necessary mechanical properties. The bar leaves the quench box with a temperature gradient through its cross section. As the bar cools, heat flows from the bar's centre to its surface so that the bar's heat and pressure correctly tempers an intermediate ring of marten site and bainite. Finally, the slow cooling after quenching automatically tempers the austenitic core to ferrite and pearlite on the cooling bed. These bars therefore exhibit a variation in microstructure in their cross section, having strong, tough, tempered martensite in the surface layer of the bar, an intermediate layer of martensite and bainite, and a refined, tough and ductile ferrite and pearlite core.

After thermos-mechanical treatment (TMT), bars do not need more work hardening. As there is no twisting during TMT, no torsional stress occurs, and so torsional stress cannot form

surface defects in TMT bars. Therefore TMT bars resist corrosion better than cold, twisted and deformed (CTD) bars.

After Thermo mechanical processing, some grades in which TMT Bars can be covered includes Fe: 415 /500 /550/ 600. These are much stronger compared with conventional CTD Bars and give up to 20% more strength to concrete structure with same quantity of steel.

Iron & steel industry is a largest construction material manufacturing industry, provides large numbers of employment opportunities in Nepal. Major Raw materials like MS billet, wire rods, HR sheets, CR sheets are mainly imported from India. Construction works from houses to big projects have picked up significantly across the country at present which has swelled the demand for construction materials, including that of iron and steel.

The demand for construction materials suddenly sky-rocketed after the government lifted ban on construction of new buildings and houses that was imposed after the earthquake. The market share of Indian iron and steel has gone up following excessive demand. Otherwise, domestic production is sufficient to meet the normal demand of the commodities.

The annual domestic demand of iron and steels is around 1200,000 metric tons and domestic manufacturers are able to meet this demand. The demand for iron and steel is increasing by 20 per cent annually.

The industrialization of Nepal gained momentum after the political changes in 1990. The liberal and open market policies helped the industries to grow. First time Panchakanya Steel introduced TMT bar in Nepal in the year 2002. The per capita annual consumption of iron and steel products in advanced economies is 100 kg. In China, it is 200 kg, whereas in developing countries it is 50-60 kg. In India, the per capita consumption of iron and steel products is 60 kg. However, it is hardly 30 kg in Nepal.

Nevertheless, the consumption may increase as hilly regions occupy much areas of Nepal. On this basis, the demand for iron and steel products in our country is around one million metric tones annually. It is increasing by 10 percent yearly. And, the domestic industries are fully capable of meeting the demand.

The demand was high due to the devastating earthquake of 2015. It was the result of an unusual situation. During the period, development work and the construction of houses were

stopped. After the situation became normal, the backlog gathered pace and new projects were also initiated. The demand for iron and steel construction materials reached 200,000 metric tons per month back then. It actually was a demand bubble. Long hours of power cuts were also there during that time severely affecting the capacity utilisation of Nepali iron and steel plants. The increment in imports was due to the fact that the domestic industries could not meet the demand. Now the demand has come to the actual level, and domestic manufacturers have been supplying the market to meet the demand.

1.2 Objectives

To analyze the current status of TMT bar manufacturing industries with respect to demand, supply, energy consumption and challenges for sustainability.

1.3 Scope of the Study

The scope of the study has covered the following area:

- Annual Demand of TMT Bars and its import status.
- Industry Details: (Name of industries, their detail address, production capacity, investment, number of employee, Consumption etc.)
- Capacity Utilization
- Energy consumption
- Demand Forecast
- Trend and status of Billet import for TMT bar production industries.
- Availability of Raw Materials domestically for TMT bar manufacturing industries for upcoming years.
- Technology adopted
- Challenges faced by the TMT Bar manufacturing Industries
- Financial position and area for improvement (policy level, association level and industries level)
- Possible Suggestions

1.4 Legal Provision of TMT Bar Manufacturing Industry in Nepal

- Industrial Enterprises Act, 2016
- Foreign Investment & Technology Transfer Act, 2019
- Private Firm Registration Act, 1957

- ❖ Company Act, 2007
- ❖ Labour Act, 2074
- ❖ Environmental Protection Act, 2076 (2019)
- ❖ Environment Protection Rule 2077 (2020)
- ❖ Consumer Protection Act, 2054 (1998)
- ❖ Investment Board Act, 2019
- ❖ Custom Act,2065 (2007)
- ❖ Nepal Standards (Certification Mark) Act, 2037 (1980)
- ❖ Forest Act,1992
- ❖ Industrial Policy, 2010

1.5 Limitations of the Study

- Due to COVID-19; some industries could not be visited and data could not be collected in detail. In such cases the source of secondary data has been collected from sources like DOI, NBSM, NSRMA.
- Although total no. of employees' data has been provided by the industries; they were hesitated to classify/categorize them in permanent, temporary, daily wages.
- Some of the industries are manufacturing other products (Angle, Channel, I-beam, GI wire, Gabion boxes etc.) from the same premises under same industries, hence total consumption of electricity, total number of employees, total investment; may have some deviations; exactly only for TMT bar industries.

CHAPTER II: LITRATURE REVIEW

2.1 History of TMT Bar in Nepal

History reveals that steel was discovered by China under the reign of Han Dynasty (202 BC – 220 AD). In Nepal Himal Iron and Steel (P) Ltd was established in 1961 and produced CTD bars. In order to lead Nepal into self-sufficiency and to accelerate Nepal's infrastructure growth, Maniharsha Jyoti built the first Nepalese iron and steel factory in the jungles of Parwanipur, Parsa.

The industrialization of Nepal gained momentum after the political changes in 1990. The liberal and open market policies helped the industries to grow. However, the Maoist insurgency during 1996 to 2006 put a major roadblock in the pace of the country's industrialization at that time. New industries did not come and the existing ones did not expand their capacities.

First time Panchakanya Steel introduced TMT bar in Nepal in the year 2002. The situation improved after the first CA elections in 2008 and the successive governments focused on infrastructure development. Foreign aid was spent on the construction of physical infrastructures. It led to the rise in the demand of iron and steel rods and other related products. Meanwhile, the rising inflow of remittances also had a cyclic effect on the market of iron and steel rods. The increase in production by old industries with more demand can bring new investment. Over the last 5-6 years, the industries have enhanced their production capacity and new investments have increased in this sector. These are some positive aspects among the number of problems in the sector.

2.2 Demand of TMT Bar in Nepal

The per capita annual consumption of iron and steel products in advanced economies is 100 kg. In China, it is 200 kg, whereas in developing countries it is 50-60 kg. In India, the per capita consumption of iron and steel products is 60 kg. However, it is hardly 30 kg in Nepal.

Manufacturers now run their factories in full-fledged manner as the government has reduced the power cut drastically but the demand is much lower than the production capacity. This will directly increase the production and contribute towards substituting imports from India.

According to entrepreneurs, the demand for iron and steel is increasing by 20 percent annually.

Nepal is a developing country with huge potential of investment in the sector of Hydropower. Industrial development is at a pre mature state and requires a lot of technical and financial investment along with a strong industrial policy. Due to the increasing construction work and developmental activities, Steel rolling mill has a potential to grow in future. The annual demand for the steel rod is 500 thousand metric ton, with domestic industries fulfilling up to 80%. The demand of steel is expected to grow in coming days. The growth of steel rod demand is studied in growth scenario as business as usual (BAU), Medium Growth (MG) and High Growth (HG) with a growth rate of 4.45%, 5.4% and 6.5% respectively. The historical data for steel rod demand and the value addition of the manufacturing sectors from different sources has been used to calculate the elasticity of demand for steel rod. After the log-linear regression method the value of elasticity is calculated to be 2.23. Present demand of 500 thousand MT is expected to reach 2.145 million MT in 2030 with a cumulative demand of18.28 million MT from 2015 to 2030 in case of BAU growth scenario. (Business Age, March 2017)

Before the earthquake, the demand for re-bar was approximately 50,000 tons per month. The annual domestic demand of iron and steels in 2017 was around 7,00,000 metric tons and domestic manufacturers were able to meet this demand. The demand now increased to 12 to 14 lakh metric tons annually and there are 30-40 lakh metric tons production capacity of after completion of few mega industries in 2020.

2.3 Details of TMT Manufacturing Industries

As per the list published in DoI from the beginning to 2076/10/2, there are 83 Iron and Steel industries registered in Nepal, out of which 54 are TMT Bar manufacturing industries. Among them few are in installation phase and few are not in operation.

Nepal Standard NS 191 is mandatory (as published in Nepal Gazette on 10th Ashoj 2051) in TMT bar among 11 other products. According to NBSM, there are 31 NS certified TMT bar manufacturing industries out of which two are from foreign investment and are under certification process.

नेपाल राजपत्र

श्री ५ को सरकारद्वारा प्रकाशित

खण्ड ४४) काठमाडौं, असोज १० गते २०५१ साल (संख्या २४

सूचना २

श्री ५ को सरकारले नेपाल गुणस्तर प्रमाण चिन्ह ऐन, २०३७ को दफा १० को उपदफा (१) र दफा ११ को उपदफा (१) ले दिएको अधिकार प्रयोग गरी नेपाल अधिराज्यभित्र उत्पादन गरिने र आयात गरिने फलामे छड (Cold Twisted Deformed Steel Bar) को गुणस्तर नेगुण १९१–२०४६ (कंक्रिट प्रवलीकरणको लागि प्रयोगमा ल्याइने इस्पातको आकृति डण्डी तथा तार भएको) अनुसार हुनु पर्ने गरी तोकेको छ ।

आज्ञाले,
विमलप्रसाद कोइराला
श्री ५ को सरकारको का.मु. सचिव

Table 2.1 Mandatory product list

Mandatory Product List:

S.N.	Product	NS
1	Ordinary Portland Cement (OPC)	49
2	Portland Slag Cement(PSC)	384
3	Portland Pozzolana Cement(PPC)	385
4	LPG Cylinder	369
5	Dry Cell and Battery	280
6	Iron Bar	191
7	GI Wire	163
8	Composite Gas Cylinder and Tubes	NS-ISO 1119-1,2,3
9	PVC Cable	344
10	LPG Regulator	530
11	Valves Fitting For LPG Cylinder	374

Mandatory Process:

1. LPG Bottling Operation NS 533

2.4 Energy Consumption

Main sources of energy used in the Metal & Steel industries in Nepal are furnace oil, electricity, and coal. Coal is mainly used in the re-heating furnace for billet heating. Furnace oil or diesel is also used in place of coal by some industries. Electricity supplier to the industries is Nepal Electricity Authority mostly through 66/33 KV and 11 KV supply with time of day (TOD) metering system. Iron and Steel industries are installed with heavy motors and electrical energy is mainly used for the drives of rolling mill, billet sharing, pumps, compressor, blowers and wire plant motors. Thermal energy is required for heating the billets in furnace. Source of thermal energy is coal, furnace oil or diesel. Around 50 percent of the industries use furnace oil while remaining 40 percent of industries use coal as fuel for the furnace. All surveyed units have their own DG set to supplement the power supply during power failure from the central grid. The supplies from the DG set are mainly for the lighting and maintenance activities of the industries. The production of almost all the industries is stopped during the load shedding.

The 21 units of Metal industries covered by the study have a total production capacity of 713,510 tons and they produced 401,378 tons of metal product (2010/11). They consumed

59.874 million units of electricity (KWh) and thermal energy equivalent to 590,317 GJ worth NPR 1,002.6 million. The average specific energy consumption (SEC) is found to be 149.17 KWh of electricity and 1,470.73 MJ of thermal energy per metric ton. CO_2 generation is estimated to be 46,015 tons, which is equivalent to 114.64 kg per ton of production.

Energy accounts for a significant share of the manufacturing cost. Nepalese industries are found to be using both electrical and thermal energy inefficiently and so there are huge possibilities of improvement in the consumption of energy in the industrial sectors. This obviously helps in reducing the production cost of the products and at the same time it enables the industry to come up with more profit and to compete with other foreign industries. Steel rolling industry being an energy intensive industry have numerous areas for increasing energy efficiency and reducing emission.

According to a study on the "Effect of Implementation of Best Available Technologies in Steel Rolling Mill Sector of Nepal" by Sudan Neupane et. al in 2015, consists of calculating present potential energy saving and developing future energy demand using Long range Energy Alternative Planning (LEAP) for the steel rolling mills of Nepal. The energy demand for the base year 2015 in BAU, MG, and HG is 906.5 Tera Joule (TJ). The final energy would increase to 2906.4, 3703.4 and 4889.3 TJ respectively in 2030 and the cumulative energy demand for BAU,MG and HG scenario would be respectively 33.14PJ, 40.289PJ and 50.85PJ. Compared to the BAU scenario, the cumulative energy demand rise would be 21.5% for MG and 53.4% for HG scenario. The CO2 emission for the base year 2015 in BAU, MG and HG is 63.8 thousand MT. The final CO2 emission would increase to 273.7, 370.5 and 524.4 thousand MT in 2030. The cumulative emission for BAU, MG and HG scenario would be respectively 2.33, 2.83 and 3.57 million MT. Compared to BAU scenario, the cumulative scenario would rise by 21.5% for MG and 53.4% for HG scenario.

There is huge demand of energy (electricity) in the industrial sector of Nepal but due to the crisis the demand has not been fulfilled. Industrial sectors account for 7.9% share of energy. The GDP Share is 15.2% and the growth rate of industry is 2.7% from 2000 to 2014 AD

2.5 Capacity Utilization of TMT Bar Manufacturing Industries

In 2017 AD, the industry was running at approximately 60 to 65 percent capacity utilization. At that time the whole country was in phase of reconstruction (individual household including other infrastructure) due to the catastrophic earthquake in April 2015. Now the

capacity utilization has been decreased to 40-50 percent as the demand is less than production capacity increased by new large scale Iron and Steel Industries.

2.6 Import Status of Billet

The import of MS Billet main raw material for the steel bars amounted to Rs. 21.10 billion for the first six month of fiscal year 2073-74. Almost 90 percent of raw materials are imported from India and remaining from third countries. However the import quantity has been increased in 2075/76 as the new rolling mills with large capacity were running this year.

2.7 Production of Billet in Nepal

Iron ore is the basic raw material used in the iron and steel rolling industry. It is one of the most common materials found on earth and is mined in open pit mines and transferred by sea and rail to iron and steel plants in several parts of the world.

Rolling mill uses MS Billet as raw materials purchased mostly from India. Apart from billet, few industries have their own ingot manufacturing from MS Scraps. Very few industries like Jagdamba Steels, Narayani Ispat, Ashok Steel, have their continuous casting mill which produce MS Billet using MS Scraps and Iron Ore as raw materials.

2.8 Technology adaption by TMT Manufacturing Industries in Nepal

Most of the rolling mills have adopted Thermex and Tempcore technology in Nepal.

The TEMPCORE™ process is a quench and self-tempering process invented and developed by CRM Group for the manufacturing of high quality concrete reinforced bars (a.k.a rebars). CRM Group is the owner of the TEMPCORE™ brand name all over the world. This trademark can thus only be used after agreement and proper licensing from CRM Group. CRM Group has celebrated in 2018 the 100th industrial implementation of the TEMPCORE™ process. To date, the engineering department of CRM Group has designed and commissioned 68 high performance TEMPCORE™ plants worldwide. Beyond that, 32 mills in India have received the TEMPCORE™ agreement after a detailed technical audit of their operation and products.

THERMEX is a patented Quenching and Self-Tempering process to produce steel bars, developed in the 1980's in Germany. The bars made in India using this technology are sold under the generic name of TMT bars to indicate that they were produced using the Quenching and Self-Tempering process.

2.9 Challenge faced by TMT Manufacturing Industries in Nepal

The iron and steel industry has been facing a lot of problems with the main ones being the inadequate supply electricity, deficient connectivity to transport products from one part of the country to another and lack of a skilled workforce. The supply of electricity has improved in recent months, but it is still inadequate, say industrialists. Despite the reduction in power cuts, there is no improvement in the quality due to problems such as low voltage and tripping. The supply system must be upgraded to solve this problem. Meanwhile, the pace of improvement and innovation in steel is also low due to the lack of R&D facilities. Industry can produce better products and manufacture innovative items if the government provides us with research opportunities and design facilities.

2.10 Financial position of TMT Manufacturing Industries in Nepal

As per Industrial Policy, 2010, the fixed capital up to 50 million rupees is categorize as small industry, capital of 50 to 150 million rupees is medium scale and above 150 million rupees is large scale industries. The policy has been revised and changed the fixed capital investment for small, medium and large scale. According to industrial enterprises act 2016, the fixed capital up to 100 million rupees is categorize as small industry, capital of 100 to 250 million rupees is medium scale and above 250 million rupees is large scale industries.

According to the financial position mentioned during the company registration and industry registration, most of the rolling mills are large scale having above 250 million rupees fixed capitals.

2.11 Production Process and Technology

2.11.1 Production Process

Rolling mill

The production process of all the listed products is described in the subsequent paragraphs along with process flow charts.

Thermo-mechanical treatment (TMT) process will be followed. It involves the simultaneous application of heat and a deformation process to an alloy, in order to change its shape and refine the microstructure. Thus hot rolling of metals, a well-established industrial process is a thermo-mechanical treatment which plays an important part in the processing of may steels

from low carbon, mild steels to highly alloyed stainless steels. The production process of proposed rolled products (bars, angles, strips, and channels) is given below;

Billet shearing in billet handling bay: Billets should be cut into pieces by the torch at the billet handling bay, at the length of suitable size for reheating furnace.

Billet reheating: The cut billet will be loaded on the billet charging conveyor by a crane and transferred to the furnace charging roller table in order to be carried to pusher. Billet charging pusher is used to charge the billets into reheating furnace, where billets shall be heated up to about 1250 degree centigrade so as to be pliable for next rolling process. The reheated billet then slides down on the chute installed at the furnace exit on to the furnace delivery side roller table, from where it is transported one by one onto the approaching roller table located between the furnace and table of the roughing mill.

Rolling in 3 stage mills: The hot ingot first passes through the roughing mill where the reduction in its cross section takes place. It then passes through the intermediate mill where it is subjected to further reduction. It is only in the finishing mill that the ingot gets its required dimension.

When the preheated ingot from the furnace is introduced into the roughing mill, reduction in its cross section area takes place followed by increase in its length as it passes through the rolls due to the pressure exerted by the rolls. As in this case the elongated metal is passed through each pass manually with the help of tongs. Some space is kept between the rolls, which provide the metal rod with the ribs necessary for stability. The selection of the number of stands to be used depends upon the required diameter.

After the roughing mill the elongated metal is then passed through the intermediate mill where again there is further reduction of the cross section area and here it is passed through each pass automatically. In between its movement from the roughing mill to intermediate mill a small portion of the elongated metal rod at the end is cut with the help of a shearing machine. This is done because during the course of its travel through the rolls of the mills, the impurities get concentrated at the end which if not removed will create hindrance in passage of material through different passes.

Finally the metal rod reaches the finishing mill where it attains its desired diameter by passing through the required diameter. In this process, the metal rod passes through the rolls

carrying straight lugs. The final size of products will be accomplished at the final stand of finishing mill.

Once out of the finishing mill the metal rod goes to the cooling bed where the hot metal rod is cooled with water. Water is used for cooling TMT bars with the help of cooling pipes. The cooling system employed is called charged quenching system which leads to a short and intensive cooling of the surface. Because of the reduction in the temperature at a rate higher than the critical rate for martensite quenching the surface layer of the re-bar is converted to a hardened structure while the core remains austenitic. After the intensive cooling, the bar is exposed to the air and the core reheats the quenched surface layer by conduction, therefore tempering the external martensite.

Finishing in the cold shear and leveler: Cooled products are transported to shear gauge. At this point they are cut to required length by a cold shear. Products cut to length are then loaded on the shear table and then transferred onto the taken out equipment where they are again put in order and taken out onto a leveler run in table connected to leveler. Products transferred on leveler run in table are fed into the leveler to be straightened and leveled. Straightened products are transferred onto bundling bed by overhead crane.

Figure 2.1 Process Flow Chart for TMT Bar manufacturing

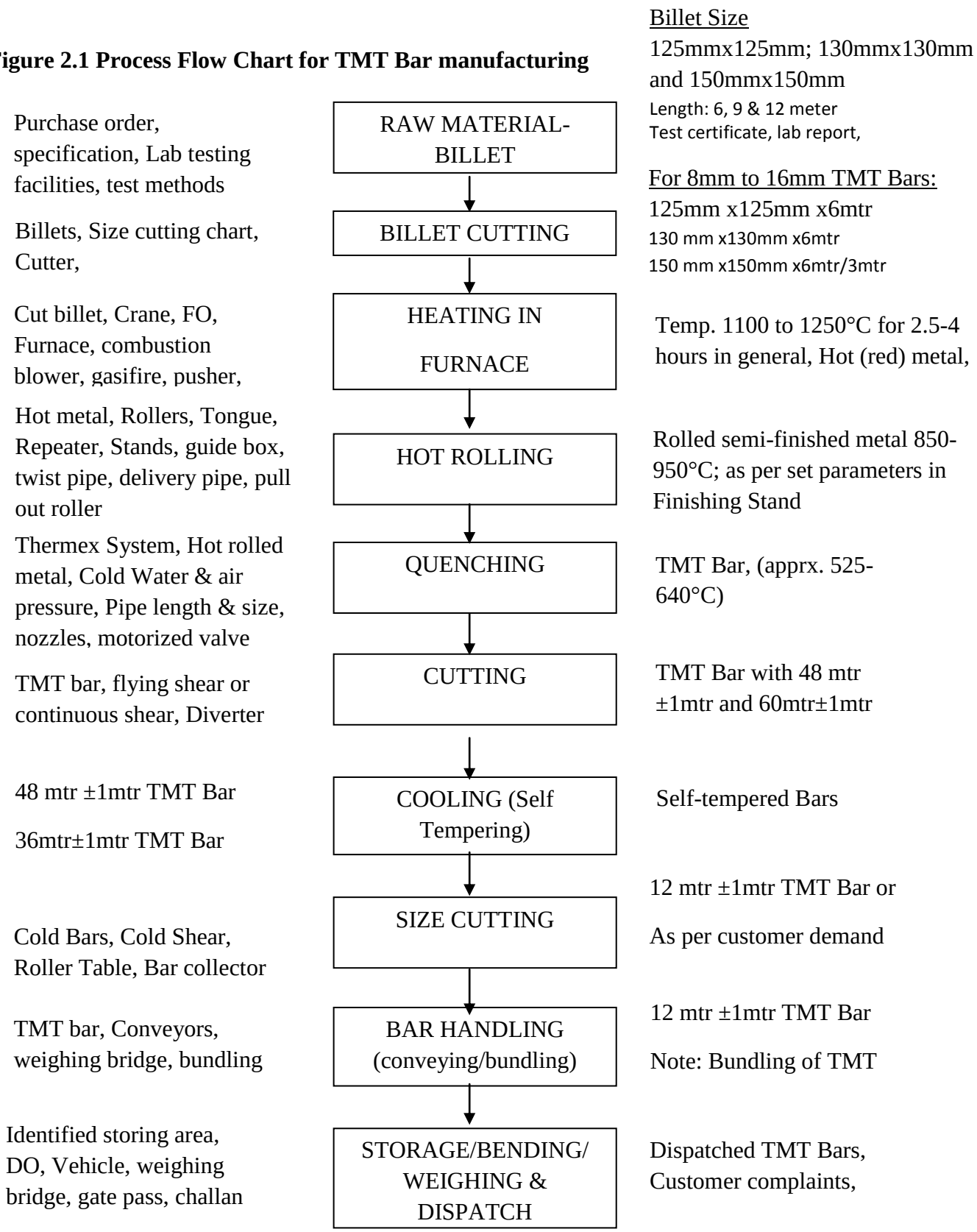
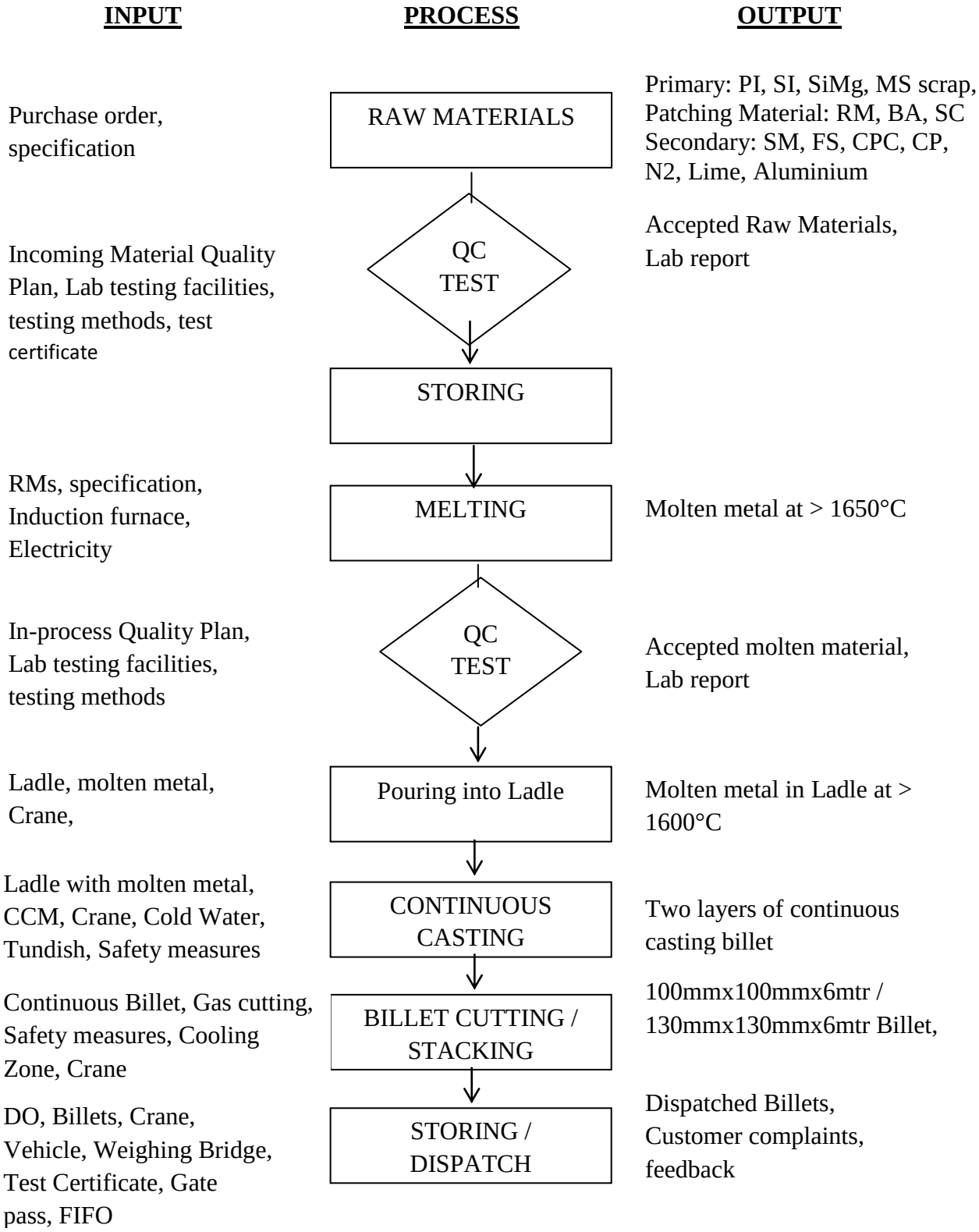


Figure 2.2 Process Flow Chart for Billet Manufacturing



2.12 Environmental and Legal Issue

2.12.1 Environmental Legal Provision

All the TMT Bar Manufacturing Industries are required to obtain license before establishment and operation. Provision of compulsory licensing has given room for Nepal to facilitate and regulate the TMT Bar Manufacturing Industries. Several laws and policies have different provisions for overall management, operation and smooth functioning of TMT Bar Manufacturing Industries in Nepal. The following paragraphs and subsequent sections will describe such policies and laws in brief.

The first policy determined the categorization and establishment of the industry is the Industrial Policy 1974, which has defined the industry in the form of undertaking as sole proprietorship, partnership, cooperative, private and public limited company of cooperation duly registered to carry one industry like manufacturing, tourism, service assembling or transit and recreation.

The Ninth Five-year Plan (1997-2002) had unlocked the approach for the private sector to finance in hydropower development and manufacturing industries seeing that the growing demand for energy and products could not be contented by the government sector alone. This plan proposed deterring itself away from avoidable administrative and other forms of burden to emphasis on engaging the private sector in development activities. As a result, a number of TMT Bar Manufacturing Industries were established. A number of private entrepreneurs applied for the establishment of the TMT Bar Manufacturing Industries in this plan period and the Government duly approved for operation during the same period.

The Industrial Policy, 2010 was formulated with the objective of bringing positive changes in the overall economic and social sectors of the country by means of rapid industrial development. The policy has been formulated in order to accelerate the pace of industrialization in response to the diversity in the service industry and opportunities arising out of them. The policy has reinforced large-scale industries like TMT Bar Manufacturing Industries to operate in the country and also has listed TMT Bar Manufacturing Industries in the prioritized industrial group.

The Government of Nepal has typically prioritized the TMT Bar Manufacturing Industries by introducing few incentive mechanisms. One such incentive was to provide road and electricity facilities to the TMT Bar Manufacturing Industries to be established in designated

districts. This policy has attracted many industries in those districts and now the Nepalese TMT Bar Manufacturing Industries production can fulfill annual domestic demand.

Environmental Legal Provision

The TMT Bar Manufacturing Industries sector is the largest industrial source of pollution, emitting sulfur dioxide, nitrogen oxide and carbon monoxide. These industries generate all three stages of pollution i.e. Solids (metal scraps/wastes), liquid (Waste water) and the gaseous state (TSP, SOx, NOx, CO). The business survives and grows in the environment. In today's business world, environment issue has been a hot topic and center concern for every business sector. In this prospect, the Government of Nepal has articulated various rules and acts to address the environmental issues related to all kinds of industry. The environmental governance includes organization, policy instrument, rules, procedures, norms that regulate the process of environmental protection. There exist various laws that are enforced by government to secure and maintain the environment in well state prioritizing sustainability of environment and industry.

The aim is to reach environmental goals along with communication and sustainable development with effective strategies and initiatives to address the issues.

TMT Bar Manufacturing Industries production results in the release of a significant amount of solid waste materials and gaseous emissions. The TMT Bar Manufacturing industry is under close observation these days because of the bulks of CO2 emitted. In actual fact, this industrial sector is thought to represent 5–7 percent of the total CO2 emission. The chief environmental issues related with TMT Bar Manufacturing Industries production are consumption of raw materials and energy use as well as emissions to the air. The legal act and regulations imposed by government that an industry must follow to operate their industry are:

- Environment Protection Act (2019)
- Environment Protection Rules (2020)
- Land Acquisition Act (1977)
- Forest Act (1993)
- Forest Rules (1995)
- National Environmental Impact Assessment Guidelines (1993).

There are various legal provisions that are made to address environmental issues under these rules and regulations that must be followed by TMT Bar Manufacturing Industries prior and during the operation. Some of them are as follows:

Forest Act, 1993 calls for carrying out EIA of the development proposals if they are to be implemented in the forest areas and/or passes through the forest area. Section (68) of the Act empowers government to give consent to use any part or any category of forest areas, in case of the absence of alternative, for the implementation of the national priority proposal with the assurance that it does not pose any significant adverse effect in the environment. The National Parks and Wildlife Conservation Act, 1973 contains a number of environment-friendly provisions and prohibit activities that will have adverse impact on the environment. The Forest Rules, National Parks and Conservation Area Management Rules also contain a number of regulatory measures to minimize environmental impact within the forests, national parks, wildlife reserves and conservation areas;

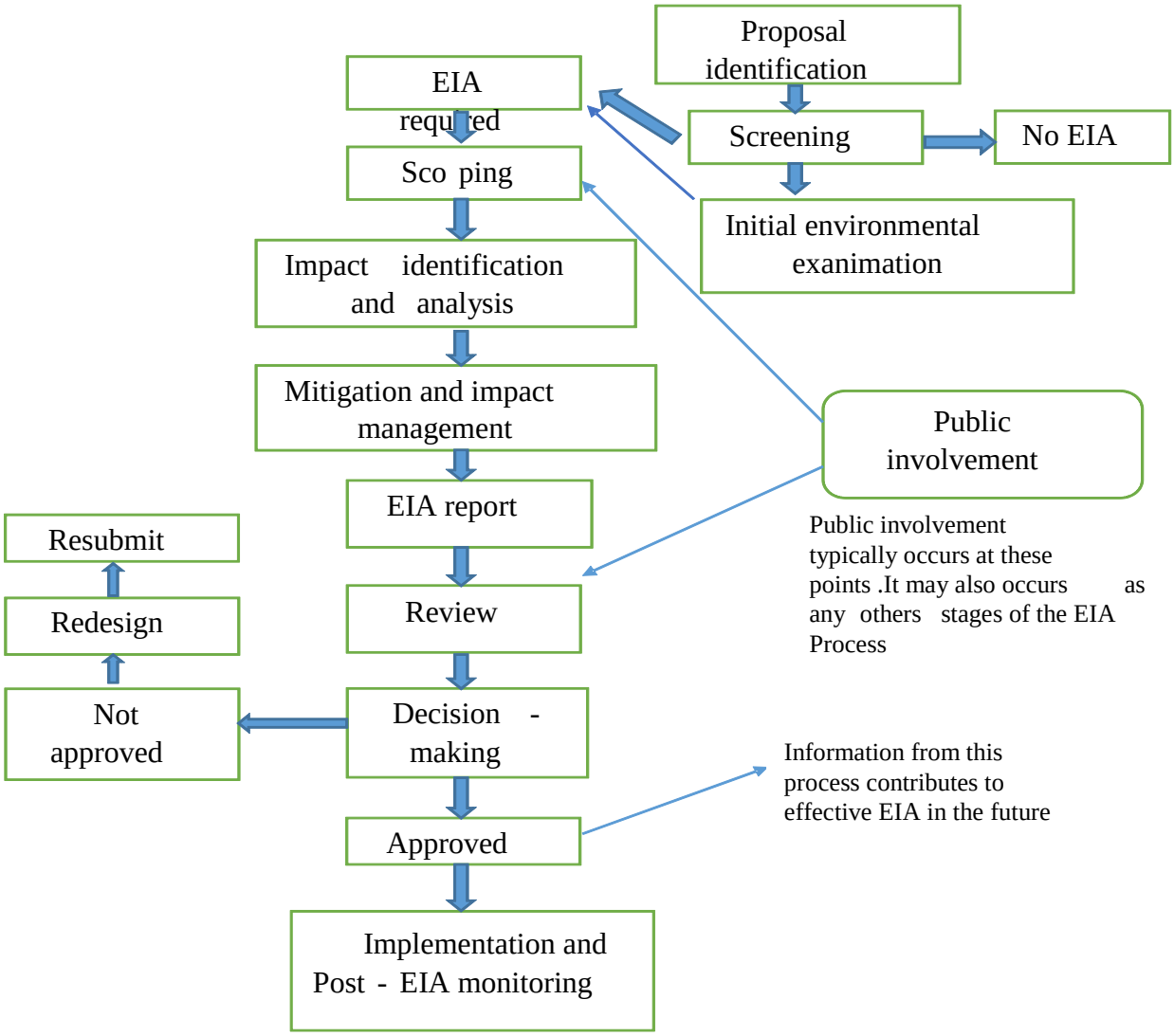
Environment Impact Assessment

EIA started in the 1960's with the formulation of National Environment Protection Act, 1969 in USA. Later amended and made more prevalent in Environment Protection Act (EPA), 1997. In case of EIA, the Ministry of Forest and Environment is the authority for report approval and the concerned ministry is responsible for monitoring.

EPR 1997 has some provisions for the EIA study. As per Schedule 2 A (12) of EPR 1997, the establishment of hotels, resorts, safaris, educational institutions, hospitals and industries of other construction activities inside national parks, sanctuaries, conservation areas, buffer zones, and environment conservation zones require EIA study.

Likewise, as per Schedule 3, (Kha) No. 28 of EPR 2020; Operation of any plan, project with investment of more than two billions require EIA.

Figure 2.3 EIA Report Review & Approval Process



Initial Environmental Examination

Schedule -2 of Environment Protection Rules (EPR), 2020 lists proposal requiring an Initial Environmental Examination (IEE).As per the EPR, 2020, Section Kha (Industry Sector), No. 77 an IEE is required for Operation of any plan, project or program with an investment cost of Rs. Two Hundred Fifty Millions to Two Billions.

National ambient air quality standard

The Government of Nepal introduced National Ambient Air Quality Standard in 2012 to maintain limitation to the subsequent parameter.

Table 2.2 National ambient air quality standard for Industries

Parameters	Averaging time	Maximum concentration (mg/m3)
TSP	24-h	230
PM10	24-h	120
SO2	Annual 24-h	50 70
NO2	Annual 24-h	40 80
CO	8-h	10,000
Lead	Annual	0.5
Benzene	Annual	5
PM2.5	24-h	40
O3	8-h	157

Generic Standard for Industrial Effluents to be discharged into public sewerage

The Government of Nepal introduced this Standard in 2060 BS to maintain limitation to the subsequent parameter.

Table 2.3 Generic Standard for Industrial Effluents to be discharged into public sewerage

Characteristics	**Tolerance Limit**
Total Suspended solids, mg/L, Max	600
pH	5.5 to 9.0
Temperature, ^{0}C, Max	45
Biochemical oxygen demand (BOD) for 5 days at 20 degree C, mg/L, Max	400
Oils and grease, mg/L, Max	50
Phenolic Compound mg/L Max	10
Cyanides (as CN), mg/L, Max	2
Sulphides (as S), mg/L, Max	2.0
Chloride (Cl), mg/L, Max	1000
Insecticides	Absent
Sulphates (SO_4), mg/L, Max	500

Fluorides (as F), mg/L, Max	10
Arsenic (as As), mg/L, Max	1.0
Cadmium (as, Cd), mg/L, Max	2.0
Total Chromium, mg/L, Max	2.0
Copper (as Cu), mg/L, Max	3.0
Lead (as Pb), mg/L, Max	0.1
Mercury (as Hg), mg/L, Max	0.01
Nickel (as Ni), mg/L, Max	3.0
Selenium (as Se), mg/L, Max	0.05
Zinc (as Zn), mg/L, Max	5
Ammonical nitrogen, mg/L, Max	50
Chemical Oxygen Demand, mg/L, Max	1000
Silver, mg/L, Max	0.1
Total Dissolved Solids, mg/l, Max	2100
Mineral Oils, mg/L, Max	10
Inhibition of nitrification test at 200ml/L	< 50%

Table 2.4 Generic Standard for Industrial Effluents to be discharged into Inland Surface

Characteristics	**Tolerance Limit**
Total Suspended Solids, mg/L	30-200
Particle size of total suspended particles	Shall pass 850-micron Sieve
pH	5.5 to 9.0
Temperature	Shall not exceed 40 degree C in any of the stream within 15 meters downstream from the effluent outlet.
Biochemical oxygen demand for 5 days at20^{0}C, mg/L	30-100
Oils and grease, mg/L, Max	10
Phenolic compounds, mg/L, Max	1.0
Cyanides (as CN), mg/L, Max	0.2
Sulphides (as S), mg/L, Max	2.0

Radioactive materials a. Alpha emitters, c/ml, Max b. Beta emitters, c/ml, Max	 10^{-7} 10^{-8}
Fluorides (as F), mg/L, Max	2.0
Arsenic (as As). mg/L, Max	0.2
Cadmium (as, Cd), mg/L, Max	2.0
Hexavalent chromium (as Cr), mg/L, Max	0.1
Copper (as Cu), mg/L, Max	3.0
Lead (as Pb). mg/L, Max	0.1
Mercury (as Hg). mg/L, Max	0.01
Nickel (as Ni), mg/L, Max	3.0
Selenium (as Se), mg/L, Max	0.05
Zinc (as Zn), mg/L, Max	5
Ammonical nitrogen, mg/L, Max	50
Chemical Oxygen Demand, mg/L, Max	250
Silver, mg/L, Max	0.1

National Diesel Generator Emission Standard, 2012

The MoSTE introduced in October 2012 the National Diesel Generator Emission Standard (NDGES) for new and in-use diesel generators with a capacity of 8 kW-560 kW (under the 1997 Environment Protection Act). In doing so they followed the Indian standards for construction equipment rather than for diesel gen sets. Hence the Nepal emission standards for new and in-use diesel gen sets are less stringent than in India. The emissions standards set for new diesel generator imports is equivalent to Bharat Stage III standards and, for in-use diesel generators, is equivalent to Bharat Stage II. The emissions limits are set for four major pollutants: CO, HC, NOx, and PM. The emissions limit for PM for new DG sets less than 19 kW is 0.80 g/kWh; for 19 to <37 Kw the emissions limit is 0.60g/kWh, for 37 to <75 kW , it is 0.40g/kWh, for 75 to <130 kW, it is 0.30g/kWh, for 130 to <560 kW, it is 0.20g/kWh.

National Noise Quality Standard, 2012

The Ministry of Science, Technology and Environment published the national noise quality standard in 2069/7/13 in Nepal Gazette. Noise limits for industrial area is 75 decibel in day and 70 decibel in night, business area is 65 decibel in day and 55 decibel in night, rural

resident area is 45 decibel in day and 40 decibel in night, city resident area is 55 decibel in day and 50 decibel in night, mixed resident area is 63 decibel in day and 55 decibel in night, peace area is 50 decibel in day and 40 decibel in night.

Relevant Laws

TMT Bar Manufacturing Industries are attracted by several laws. The major provisions of such laws are as follows:

- **Constitution of Nepal**

The Constitution of Nepal, through National Policies, has outlined various policies for industrial development in Nepal. Clause (d) of Article 51 has the following provisions in this regard:

(1) Strengthening national economy through the participation and free development of public sector, cooperative sector and private sector;

(2) Achieving economic prosperity with maximum utilization of available resources and means by stressing on the roles of private sector in the economy;

(3) Providing for regulation to maintain fairness, accountability and competitive atmosphere in all activities of economic sector to promote and mobilize them for the overall national development;

(4) Diversifying and expanding markets for production and services through the development and expansion of industries and promotion of exports by identifying the areas of comparative advantages;

(5) Protecting consumer rights by maintaining ethical, disciplined and business fairness by controlling anomalies and malpractices such as black marketing, monopoly, artificial scarcity and unhealthy competition and making national economy competitive;

(6) Prioritizing domestic investment based on Nepalese labor, skill and raw material for the development of the economy of the country through the protection and promotion of national industries, resources and means;

(7) Accordingly prioritize domestic investment in service sector to promote it as a competitive industry for development of national economy;

(8) Encouraging and mobilizing foreign capital and technology investment for infrastructure development in the area of export promotion and import to suit national interest.

With these clause, the Constitution has emphasized the need for national industries to develop the national economy as well as maintaining quality by protecting consumers' rights.

- **Company Act, 2006**

This Act is the governing law for the establishment and operation of any company in Nepal. It has described the procedures to establish the company, composition of Board, managerial aspect of any company and exit policies. Furthermore, this Act has the provision of ownership categorization, obligations of the companies and relation to the Government of Nepal.

- **Industrial Enterprise Act, 2016**

This Act has given continuity to the general classification of industries on the basis of (a) size of fixed asset investment and (b) nature/sector of business. However, on the basis of size of fixed assets investment, the Act has newly added "micro industries" within the classification. Furthermore, "Industries based on Information, Transmission and Communication Technology" has been added as a new classification on the basis of the sector of the business. The Act lists the industries falling within each classification and grants authority to the Industry and Investment Promotion Board to recommend to the Government of Nepal to alter the classification of industries.

The primary purpose of such classification appears to be the provision of fiscal and non-fiscal incentives on the basis of classification. However, such an approach is likely to create problems especially when a business in question does not fall under the category of "industries". For example, previously the Government of Nepal classified "investment business" as one of the categories of the industries and this category permitted foreign investment in Nepal. However, as the Act does not include such category on the list, the DOI might disapprove foreign investment under 'investment business' unless the same is notified by the Government of Nepal through Nepal Gazette.

- **Investment Board Act, 2019**

Primarily, this Act was enacted to facilitate large investors in potential areas such as hydropower, industries and large projects. This Act has established the Investment Board of Nepal with the jurisdiction of any industry costing a minimum of ten billion rupees.

The Investment Board Act is to mobilize the investment of public private partnership, co-operatives and national as well as foreign private sector for the economic development to accelerate the process of industrialization in a systematic manner to develop strong dynamic and competitive economy by constructing infrastructure and to make meaningful contribution towards poverty reduction by creating opportunity for employment.

The Investment Board Act Article 9 clause (k) and (I) defines the investment to be made in any infrastructure of service industry having fixed capital of ten billion rupees or having more than ten billion rupees project cost, for the purpose of this clause, infrastructure or service industry mean construction industry, mine industry, tourism industry or air industry.

- **Private Firm Registration Act, 1957**

This Act describes every step/procedure to be taken to establish a private firm. As a rule, a fee is required to register the company. The registration fee differs for a private company and Public Company. There is certain distinction between Private and Public company. The companies that generate money through public participation are public companies and those companies which are run by owner without the permission to have public participation in purchase of shares are private companies. Private companies are not allowed to have stock flow for the public.

Registration within 3 months after registration of company, the company receives the certificate of registration. A registered company in Nepal needs to be in Nepal Under the rule of the company Act. The registration number of the company, address of the company and other details of the company should be outlined and set where the company is established. These details must be provided to the Company Register Office within three months after the registration of the company.

- **Labor Act, 2017**

This Act is enacted and implemented to establish good industrial relations. Similarly, this Act establishes the rights and responsibilities of the labor working in any formal sector. The Labor Act is applicable to all entity, which has been defined to include company, private

firm, partnership firm, cooperatives, association or other organization ("entity") in operation or established, incorporated, registered or formed under prevailing laws to undertake industry or business or provide service with or without profit motive.

The Labor Act is applicable to all entities regardless of the number of laborers (worker/employees), this also includes domestic workers. The Act has made certain provisions relating to domestic workers e.g. the Labor Act indicates the minimum remuneration of such workers, public and weekly holidays. The employer can deduct the expenses incurred in providing food and lodging from the remuneration if such is provided. Domestic workers should be allowed to celebrate festivals as per their culture, religion, tradition.

- **Consumer Protection Act, 2054**

This Act primarily ensures the rights of the consumers of any product in the country. Consumers are the customers who consume goods and services for personal purpose. So, the goods and services are consumed not only by the consumer but they can be manufacturer and service providers, suppliers and sellers as well. Any person can be a producer and distributor for one product and can be a consumer for another product or services. Hence a consumer is any individual, institution, company etc.

- **Environment Protection Rule, 2054 (1997)**

This Act is applied for all the industries and activities in Nepal. A company shall have to carry out IEE and EIA of the proposals as prescribed. A company interested in implementing any proposal shall have to submit such a proposal accompanied by the report on IEE or EIA of the proposal to the concerned agency for the approval of such a proposal.

On receipt of any proposal pursuant to Section 5 and while examining the IEE or EIA report submitted with a proposal, if such a proposal does not appear to have significant adverse impacts on the environment, the concerned agency shall itself grant approval of the proposal with IEE and shall forward the proposal along with its opinion thereon to the Ministry with EIA report.

Notwithstanding anything contained in Sub-section (1), in case of, while examining the IEE report of the proposal, it is found necessary also to carry out EIA of such a proposal, the concerned agency may issue order to carry out EIA. In case any proponent, after having assessed environmental impacts pursuant to the order so issued by the concerned agency,

submits an EIA report for approval, the concerned agency shall carry out necessary examination of such a proposal and forward the proposal along with its opinion to the Ministry concerned (Ministry of Forests and Environment for this purpose).

- **Foreign Investment & Technology Act, 1957**

This Act is in the process of amendment, rather a new Act is being drafted. The major objective of this Act is to attract foreign investment in the country. The Act also identifies the sectors for foreign investment, procedures to bring investment, repatriation provisions as well as incentives to foreign investors. This Act also ensures the One Stop Service for foreign investors.

The Act identifies technology also as investment. The Act has the provision of technology transfer and incentive mechanisms for such transfers.

- **Customs Act, 2056 (2007)**

As in all countries, the Customs Act is meant for ease international trade. The Customs Act of Nepal has several provisions on facilitating exports of domestic production. As the Government of Nepal has identified TMT Bar Manufacturing Industries as one of the main exportable items, several clauses of this Act are relevant for the TMT Bar Manufacturing Industries in the country.

The Customs Act not only talks about the exports of domestic production but also facilitates for import substitutions by applying tariffs for some goods given it does not violate the provisions of WTO. This Act also has a negative list of tradable goods.

- **Nepal Standards (Certification Mark) Act, 2037 (1980)**

This Act has been enacted in order to standardize the domestic goods and services. Every good, be it imported or domestically produced, has to get certification according to this Act. This Act was established to separate Nepal Standards and Measurement Department, which is dedicated for accreditation of the products. **NS 191:2046** Deformed steel bars and wires for concrete reinforcement is the mandatory standard for TMT bar manufacturing industries.

- **Land Acquisition Act, 2034 (1977)**

Unlike in many other countries, Nepal has a unique landholding system. The property rights lie with the individual and it is transferred to the family members. The land required for any

establishment requires acquisition by providing suitable compensation to the land owner. This is required for both public and private establishments.

This law has the mechanisms for land acquisition and compensation to it. Being an old Act (almost 42 years old), many provisions of this Act does not support the present condition. Nevertheless, this Act provides the basis for land acquisition for any investor in the country.

- **Forest Act, 1992**

The Forest Act is applicable to any industry that either touches or passes through the forests. The Act is a bit rigid for the industrial development. The provisions of replacement, compensation and time taken for the approval from competent authority are not only time taking but also put extra burden on the investors. Several provisions of this Act also relate to the Environment Protection Act, which might confuse the investors to comply all the provisions.

CHAPTER III: METHODOLOGY

3.1 Conceptualization

Depending upon the scope of study, both qualitative and quantitative data are required. While general quantitative data are mostly available through secondary sources, the specific quantitative data as well as qualitative data can be obtained from direct interviews, focus group discussions (FGD) and key informant interviews (KII). Therefore, a mixed research method has to be adopted. Thus, the questions asked will be both open- or closed-ended according to the scope of study. Semi-structured method is often preceded by observation, informal and unstructured interviewing in order to allow the researchers to develop a keen understanding of the topic of interest necessary for developing relevant and meaningful semi-structured questions. The aim of this research will be to explore more unknown thoughts and ideas from the respondent and semi-structure method is best for such type of study.

3.2 Sample Universe

The scope of the study is to analyze the present situation, identify gap between supply and demand, and analyze trends of TMT Bar manufacturing industries in Nepal. For that reason, every TMT bar manufacturing industry will be sample universe of this research purpose. The industry will be classified into the following three categories:

- Operating TMT Bar Manufacturing Industry
- Under-Construction TMT Bar Manufacturing Industry
- Registered Non-Operated TMT Bar Manufacturing Industry

There are 51 TMT Bar Manufacturing industries listed in DoI in four Provinces and 31 industries are granted to use NS by Nepal Bureau of Standard and Metrology (two are Indian Industries). For study purpose, the TMT Bar Manufacturing industries listed in the Nepal Standard (29 industries) and under process two industries (In total 31 industries) are the sample universe, since NS 191 is mandatory product certification for TMT Bar. Of those 51 industries listed in DoI categorized them into 16 large, 21 medium and 14 small scale industries. The tables 3.1, 3.2 and 3.3 provide the exact list of these industries. Most of the industries under small scale category have been upgraded to large scale industries. Some of the industries listed in DoI list have duplication list although the industry has been already transferred to others like Kausalya Iron and Steel Industries Pvt. Ltd at Rupandehi has been

now registered in the name of SR Steel Industries Pvt. Ltd in the same location and same place.

Table 3.1 List of Registered Industries in DOI

S.N.	Name Of Industry	Province	District
1.	Swodeshi Iron & Steel Udyog Pvt. Ltd.	1	Morang
2.	Pragati Iron and Steel Ind. Pvt. Ltd.	1	Morang
3.	Eastern Steel Mills Pvt. Ltd.	1	Morang
4.	Shaha Iron and Steel Industries	1	Morang
5.	Star Iron and Steel Ind. Pvt. Ltd	1	Morang
6.	Shree Ram Iron and Steel Ind. Pvt. Ltd	1	Morang
7.	Saraswoti Steel Mills Pvt. Ltd.	1	Sunsari
8.	Premier Steel Pvt. Ltd.	1	Sunsari
9.	Pathibhara Steel Industries Pvt. Ltd.	1	Jhapa
10.	Himal Iron & Steel Pvt. Ltd	2	Parsa
11.	Rajesh Steel Industry Pvt. Ltd.	2	Parsa
12.	J.D. Steel Mills	2	Parsa
13.	Sarbottam Steels Pvt. Ltd.	2	Parsa
14.	Himal Asim Steel Pvt. Ltd.	2	Parsa
15.	Shakti Steels Pvt. Ltd.	2	Bara
16.	Hama Iron & Steel Industries Pvt. Ltd	2	Bara
17.	Everest Steel Industries Pvt. Ltd.	2	Bara
18.	Jagamba Steels Pvt. Ltd	2	Bara
19.	Jenith Steel And Metals Pvt. Ltd	2	Bara
20.	Narayani Steels Pvt.Ltd	2	Bara
21.	Bandana Steel Pvt. Ltd.	2	Bara
22.	Bishwokarma Steels Pvt.Ltd	2	Bara
23.	Jagdamba Steels Pvt. Ltd. Branch Unit 1	2	Bara
24.	Godawari Steel Pvt. Ltd.	2	Rautahat
25.	Shrestha Steel Inds Pvt.Ltd	3	Chitwan
26.	Guransh Iron and Steel Ind	3	Lalitpur
27.	Zong Wang Steel China Company Pvt. Ltd.	3	Dhading
28.	Barma Steel Pvt. Ltd.	5	Rupandehi

S.N.	Name Of Industry	Province	District
29.	Panchakanya Steel Pvt. Ltd	5	Rupandehi
30.	Arun Steel Pvt.Ltd	5	Rupandehi
31.	Kaushala Iron And Steel Inds. Pvt.Ltd	5	Rupandehi
32.	Lumbini Steel Industry Pvt.Ltd	5	Rupandehi
33.	Goenka Steels Pvt.Ltd	5	Rupandehi
34.	Ambe Steels Pvt.Ltd	5	Rupandehi
35.	Ambe Steel Pvt.Ltd Unit Udyog 1	5	Rupandehi
36.	Upreti Iron & Steel Industries Pvt. Ltd	5	Rupandehi
37.	Shree Steels Pvt. Ltd.	5	Rupandehi
38.	Gauri Steels Pvt. Ltd.	5	Rupandehi
39.	Fero Steels Pvt. Ltd.	5	Rupandehi
40.	Laxmi Steels Pvt.Ltd	5	Nawalparasi
41.	Nepal Steel Pvt.Ltd	5	Nawalparasi
42.	M.S. Hightech Steel Pvt. Ltd.	5	Nawalparasi
43.	Shailung And Sme Steel Pvt. Ltd.	5	Nawalparasi
44.	Siddhi Laxmi Steel Pvt. Ltd.	5	Nawalparasi
45.	Balaji Steels Pvt. Ltd.	5	Kapilbastu
46.	Vijaya Iron And Steel Pvt. Ltd.	5	Kapilbastu
47.	P And P Steels Pvt. Ltd.	5	Kapilbastu
48.	Kamakhya Steel Pvt. Ltd.	5	Kapilbastu
49.	Kapilvastu Steels Pvt. Ltd.	5	Kapilbastu
50.	Sagarmatha Steels Industries Pvt. Ltd.	5	Banke
51.	Jay Ambe Steels Pvt. Ltd.	5	Banke

Table 3.2 List of Registered (NS 191 Certified) Industries in NBSM.

S.N.	Name of Industries	Province	District
1	Hulas Wire Industries Ltd.	1	Morang
2	Aarti Strips Pvt. Ltd	1	Morang
3	Kamala Rolling Mills Pvt. Ltd.	1	Morang
4	Pashupati Iron and Steel Pvt. Ltd	1	Sunsari
5	Premier Steel Pvt . Ltd	1	Sunsari
6	Pathibhara Steel Pvt. Ltd	1	Jhapa
7	Ashok Steels Ind. Pvt Ltd	2	Bara
8	Hama Iron and Steels Ind. Pvt. Ltd.	2	Bara
9	Jagdamba Steels Pvt. Ltd	2	Bara
10	Shakha Steel Ind. Pvt. Ltd.	2	Bara
11	Narayani Rolling Mills Pvt. Ltd	2	Bara
12	Shalimar Steels Pvt. Ltd	2	Bara
13	Narayani Ispat Pvt. Ltd	2	Bara
14	Himal Iron and Steel Pvt. Ltd.	2	Bara
15	Jagdamba Enterprises Pvt. Ltd	2	Parsa
16	Godawari Steels Pvt.Ltd.	2	Rautahat
17	Everest Rolling Ind. Pvt. Ltd	5	Rupandehi
18	Panchakanya Steel Pvt. Ltd	5	Rupandehi
19	Goenka Steels Pvt. Ltd	5	Rupandehi
20	Ambe Steels Pvt. Ltd	5	Rupandehi
21	Ferro Steel Pvt. Ltd	5	Rupandehi
22	Shree Steel Pvt. Ltd.	5	Rupandehi
23	S. R. Steels Pvt. Ltd	5	Rupandehi
24	Laxmi Steel Pvt. Ltd	5	Nawalparasi
25	Kathmandu Steel Pvt. Ltd	5	Nawalparasi
26	Siddilaxmi Steel Pvt. Ltd	5	Nawalparasi
27	Vijayashri Steel Pvt. Ltd	5	Kapilbastu
28	Bageshwori Iron and Steel Pvt. Ltd.	5	Banke
29	Jay Bageshwori Rolling mills	5	Banke
30	Saluja Steel and Power Pvt. Ltd.(Unit II)		India
31	Tata Steel Ltd		India

Table 3. 3 List of Industries Associated with Nepal Steel Rolling Mills Associations

S.N.	Institution	Providence	District
1	Premier Steels Pvt. Ltd.	1	Sunsari
2	Aarti Strips Pvt. Ltd	1	Morang
3	Hulas Wire Limited	1	Morang
4	Jagdamba Steel Pvt. Ltd.	2	Bara
5	Hama Iron and Steel Ind. Pvt. Ltd.	2	Bara
6	Saakha Steel Ind. Pvt. Ltd.	2	Bara
7	Himal Steel Pvt.Ltd.	2	Bara
8	Narayani Rolling Mills Pvt. Ltd.	2	Bara
9	Ashok Steels Pvt. Ltd.	2	Bara
10	Jagdamba Enterprises Pvt. Ltd.	2	Parsa
11	Everest Rolling Mills Pvt. Ltd.	5	Rupandehi
12	Ferro Steels Pvt. Ltd.	5	Rupandehi
13	Panchakanya Steel Pvt. Ltd.	5	Rupandehi
14	Ambe Steel Pvt. Ltd.	5	Rupandehi
15	SR Steels Ind. Pvt. Ltd.	5	Rupandehi
16	Kathmandu Steel Pvt. Ltd.	5	Nawalparsi
17	Laxmi Steels Pvt.Ltd.	5	Nawalparsi
18	Siddhi laxmi Steels Pvt. Ltd.	5	Nawalparsi
19	Shree Steel Pvt. Ltd.	5	Rupandehi
20	Vijayashri Steels Pvt. Ltd.	5	Kapilbastu

3.3 Sample Method

The research scope majorly focuses on the NS certified operating TMT Bar manufacturing industry and under construction industries. Though registered industries found on four provinces, NS certified operating industries exist in three provinces only as listed below. From the list of NS certified industries, 85 percent industries from each province has been selected for study.

Table 3. 4 List of Industries province wise and selection for study

S. N.	Province	No. of NS Certified Industries	% concentration	85% as sample
1	1	6	20.69	5
2	2	10	34.48	9
3	5	13	44.83	11
Total		**29**	**100**	**25**

Figure 3. 1 Total no. of NS 191 certified industries province wise

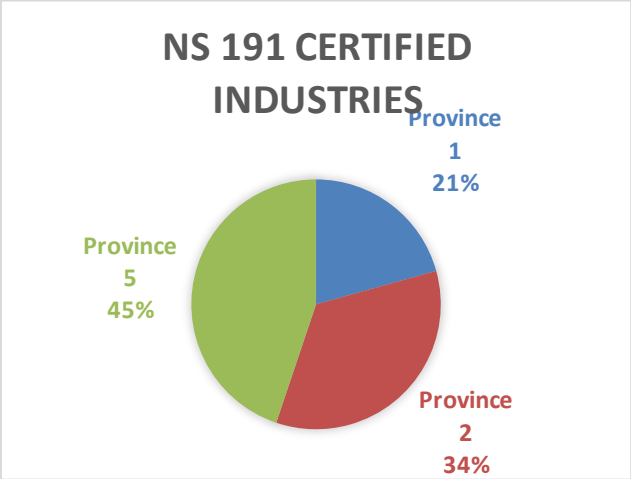
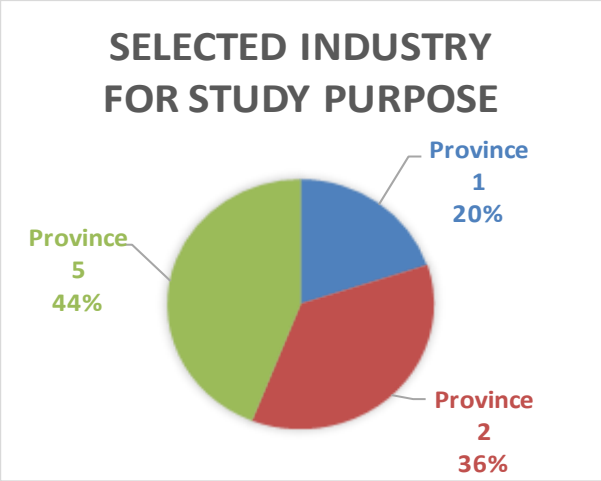


Figure 3. 2 No. of selected industries for study province wise



Source: Field Survey, 2020

Out of total 29 industries, 25 (85% from each province of existing industries) have been selected from the sample universe as shown in table 3.5

Jay Ambe Steels Pvt. Ltd. and Sarbottam Steels Pvt. Ltd. under construction and under process of NS certification.

Table 3.5 List of Selected Industries for study

S.N.	Industries	Province	District
1	Hulas Wire Industries Limited	1	Morang
2	Aarti Strips Pvt. Ltd	1	Morang
3	Kamala Rolling Mills Pvt. Ltd.	1	Morang
4	Pashupati Iron and Steel Pvt. Ltd	1	Sunsari
5	Premier Steel Pvt . Ltd	1	Sunsari
6	Ashok Steels Industries Pvt. Ltd	2	Bara
7	Hama Iron and Steels Ind. Pvt. Ltd.	2	Bara
8	Jagdamba Steels Pvt Ltd	2	Bara
9	Shakha Steel Industries Pvt. Ltd.	2	Bara
10	Shalimar Steels P. Ltd	2	Bara

11	Narayani Ispat P. Ltd	2	Bara
12	Himal Iron and Steel Pvt. Ltd.	2	Bara
13	Jagdamba Enterprises Pvt. Ltd	2	Parsa
14	Godawari Steels Pvt. Ltd.	2	Rautahat
15	Everest Rolling Ind. Pvt. Ltd	5	Rupandehi
16	Panchakanya Steel Pvt. Ltd	5	Rupandehi
17	Goenka Steels Pvt. Ltd	5	Rupandehi
18	Ambe Steels Pvt Ltd	5	Rupandehi
19	Ferro Stell Pvt. Ltd	5	Rupandehi
20	Shree Steel Pvt.Ltd.	5	Rupandehi
21	S. R. Steels Ind. Pvt Ltd	5	Rupandehi
22	Laxmi Steel Pvt. Ltd	5	Nawalparasi
23	Kathmandu Steel Pvt. Ltd	5	Nawalparasi
24	Siddilaxmi Steel Pvt. Ltd	5	Nawalparasi
25	Vijayashri Steel Pvt. Ltd	5	Kapilbastu

3.4 Tools

The tools that have been used for study purpose are as follows:

- Questionnaire survey
- Stakeholders' Discussion (Direct interviews and KII)
- Statistics and Data Analysis (Pie chart, Bar chart, etc.)

3.5 Methods

The methods have been used for the data collection

- Interview
- Observation
- Discussions and review of documents
- Data collection through structured questionnaire from concerned stakeholders

3.6 Sources of Information

The major sources of data used in the report are:

Primary Sources

- TMT Bar Manufacturing Industries
- Nepal Steel Rolling Mills Association (NSRMA)
- Experts of Rolling Mills

Secondary Sources

- Department of Industry (DoI)
- Nepal Bureau of Standards & Metrology (NBSM)
- Federation of Nepalese Chamber of Commerce & Industries
- Confederation of Nepalese Industries
- Publications of different Government agencies, semi government and private sectors
- Document analysis and review of past journals and articles related to subject
- The papers, seminar papers, approach papers produced by consultants and experts
- Department of customs
- Other published Statistical Data

3.7 Activities

The following activities have been done for the completion of the assigned project within the given time period:

- Desk review
- Accessing and coordinating with different stakeholders (Policy makers, officials from Department of Industry, representative of TMT Bar manufacturing industry and experts)
- Field Visit of the selected industries
- Review of relevant past journals and articles on TMT Bar

CHAPTER IV: RESULT AND DISCUSSION

4.1 Annual Consumption (Supply) of TMT Bar

Table 4.1 Annual consumption of TMT bars in last five years

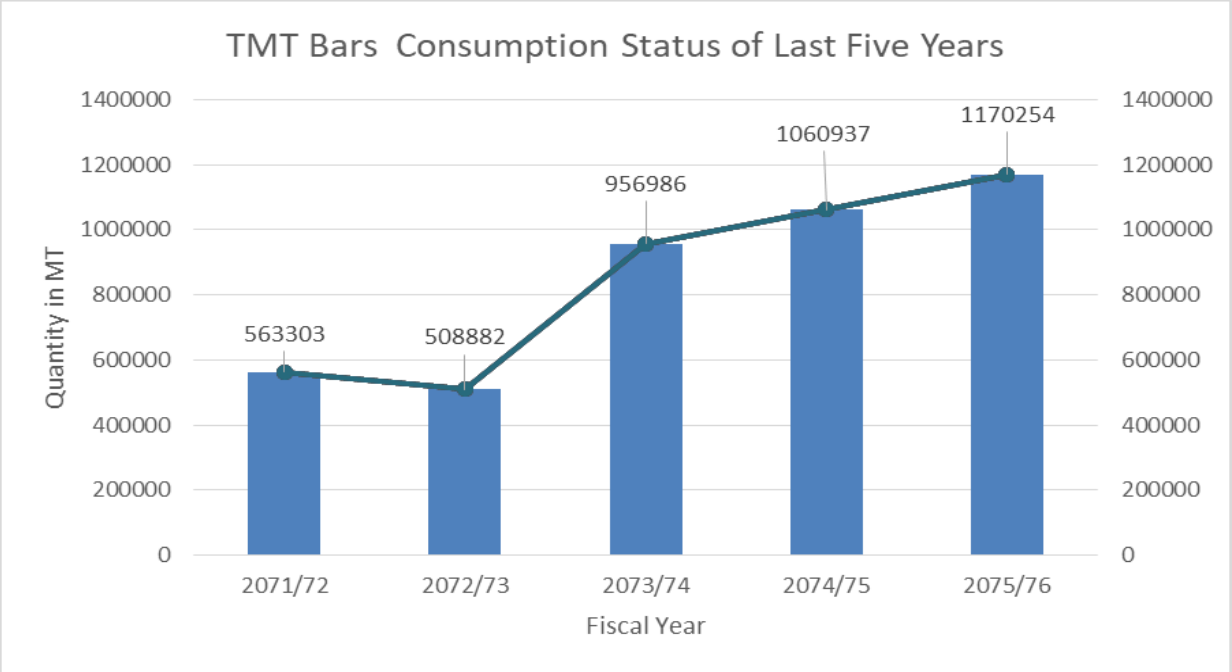
S.N.	Name of Industries	Fiscal Year (Quantity in MT)				
		2071/72	**2072/73**	**2073/74**	**2074/75**	**2075/76**
1	Hulas Wire Industries Limited	26268	26870	43277	40885	37415
2	Aarti Strips Pvt. Ltd.	0	0	0	0	16568
3	Kamala Rolling Mills P. Ltd.	13200	12300	16500	14100	6321
4	Pashupati Iron and Steel P. Ltd	25500	21700	41700	42500	45000
5	Premier Steel Pvt. Ltd.	0	0	0	0	70000
6	Ashok Steel Industries P. Ltd.	16500	13700	45600	51527	46000
7	Hama Iron and Steels Ind. P. Ltd.	22000	17100	43300	44200	32700
8	Jagdamba Steels Pvt. Ltd	222200	185800	279731	325530	326512
9	Shakha Steel Industries P. Ltd.	16500	11760	21394	14000	14500
10	Shalimar Steels P. Ltd.*	0	0	0	0	0
11	Narayani Ispat P. Ltd	0	0	0	0	52692
12	Himal Iron and Steel Pvt. Ltd.	27000	20000	45000	40300	35000
13	Jagdamba Enterprises Pvt. Ltd	20300	16275	42230	41380	52500
14	Godawari Steels Pvt. Ltd.	0	0	0	0	19460
15	Everest Rolling Ind. Pvt. Ltd	10500	13500	15500	24700	34500
16	Panchakanya Steel Pvt. Ltd.	33100	37200	59000	70200	58000
17	Goenka Steels Pvt. Ltd.	30765	13247	43278	66162	50639
18	Ambe Steels Pvt. Ltd.	22800	17400	48240	51700	35670
19	Ferro Steel Pvt. Ltd.	12670	14320	44500	42340	28000
20	Shree Steel Pvt. Ltd.	0	0	0	0	40000
21	S. R. Steels Ind. Pvt. Ltd.	0	12400	18000	27000	25000
22	Laxmi Steel Pvt. Ltd.	64000	42000	99725	105921	70000
23	Kathmandu Steel Pvt. Ltd.	0	33310	50011	58492	47450
24	Siddilaxmi Steel Pvt. Ltd.**	0	0	0	0	0
25	Vijayashri Steel Pvt. Ltd.	0	0	0	0	26327
Total		**563303**	**508882**	**956986**	**1060937**	**1170254**

Source: Field Survey, 2020

*Shalimar Steels Pvt. Ltd. has stopped its production since last one year. According to Director Mr. Jeevan Agrawal; they will not operate in future also for production of TMT bar.

**Siddhilaxmi Steel Pvt. Ltd. has target of 60,000 MT for fiscal year 2076/77.

Figure 4.1 TMT Bars consumption status of last five fiscal years



Source: Field Survey, 2020

According to field survey regarding consumption status of TMT bars of last five fiscal years from 2071/72, it was found that the TMT bars consumption was 5.63 Lakhs MT, however it was decreased in fiscal year 2072/73 to 5.08 Lakhs MT. After devastating earthquake of 2072 Baisakh, the TMT bars consumption increased from 5.08 Lakhs MT to 9.56 Lakhs MT i.e percentage increase is 88.06 in 2073/74 which kept on increasing in fiscal year 74/75 and 75/76. Analyzing the above data; from the fiscal year 071/72 to 75/76 i.e. within the period of 5 years; the demand of TMT bars has been increased by 107.75%.

4.1.1 List of industries which are not in sample survey

Although the data related with production, electricity consumption etc. has been obtained, the data regarding the sales/consumptions of the following industries have not been obtained industries wise. Approximately these industries contributes another one Lakh metric tons of TMT Bars per year (as per association data; hence the total sales increases slightly).

- Bageshwari Iron and Steel Pvt. Ltd.
- Narayani Rolling Mills Pvt. Ltd.
- Jay Bageshwari Rolling Mills Pvt. Ltd.
- Pathibhara Steel Pvt. Ltd.

4.1.2 Import Status of TMT Bar

TMT bar manufacturing industries in Nepal can fulfill all demand of TMT bars as required. Only few projects are importing TMT bar (mainly of higher sizes than 32 mm) from India and third countries. According to the survey feedback provided by Steel Rolling Mills Association of Nepal the import percentage of TMT bar in Nepal is only 0.1%.

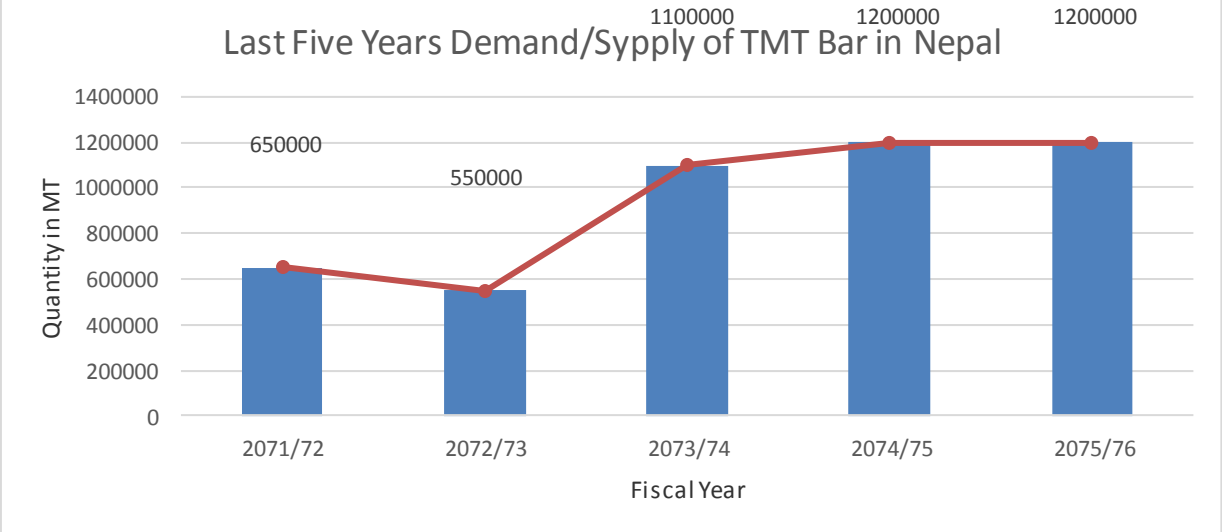
4.2 Annual Demand/Supply of TMT Bar in Nepal

Table 4.2 Last five years demand of TMT bars

S.N.	Fiscal Year	Quantity (MT)
1.	2071/72	650000
2.	2072/73	550000
3.	2073/74	1100000
4.	2074/75	1200000
5.	2075/76	1200000

Source: NSRMA, 2020

Figure 4.2 Last Five Years Demand/Supply of TMT Bar in Nepal



Source: NSRMA, 2020

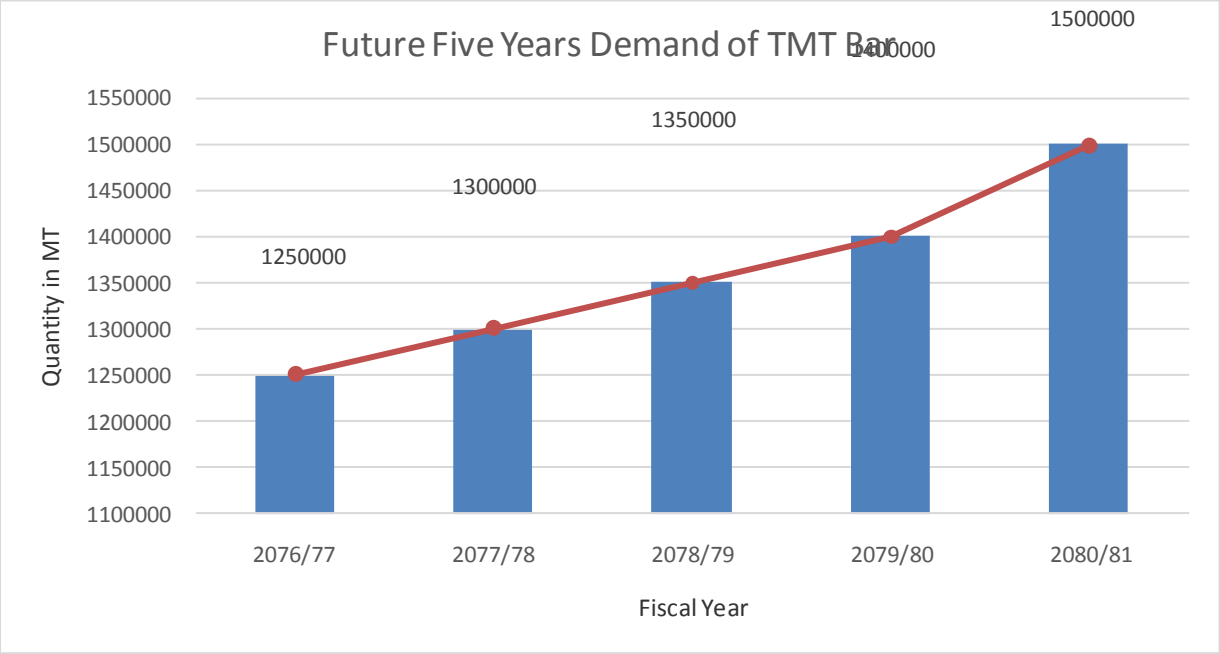
According to the survey feedback collected from Steel Rolling mills Association of Nepal, last five years demand of TMT bar is shown in the above figure. Annual demand of TMT bar was 6.5 lakhs metric tons in the year 2071/72. In the year 72/73 it was decreased i.e. only 5.5. Lakhs metric tons. However in the year 73/74 the demand was increased to 11 lakhs metric tons i.e. by 100% as compared to 2072/73 which was continuously increased in the year 74/75 to 12 lakhs metric tons and was consistent in the year 75/76. Analyzing the above data;

from the fiscal year 071/72 to 75/76 i.e. within the period of 5 years; the demand of TMT bars has increased by 84%.

Table 4.3 Future Five Years Demand TMT Bars

S.N.	Fiscal Year	Quantity (MT)
1.	2076/77	1250000
2.	2077/78	1300000
3.	2078/79	1350000
4.	2079/80	1400000
5.	2080/81	1500000

Figure 4.3 Future five years demand of TMT bars



Source: NSRMA, 2020

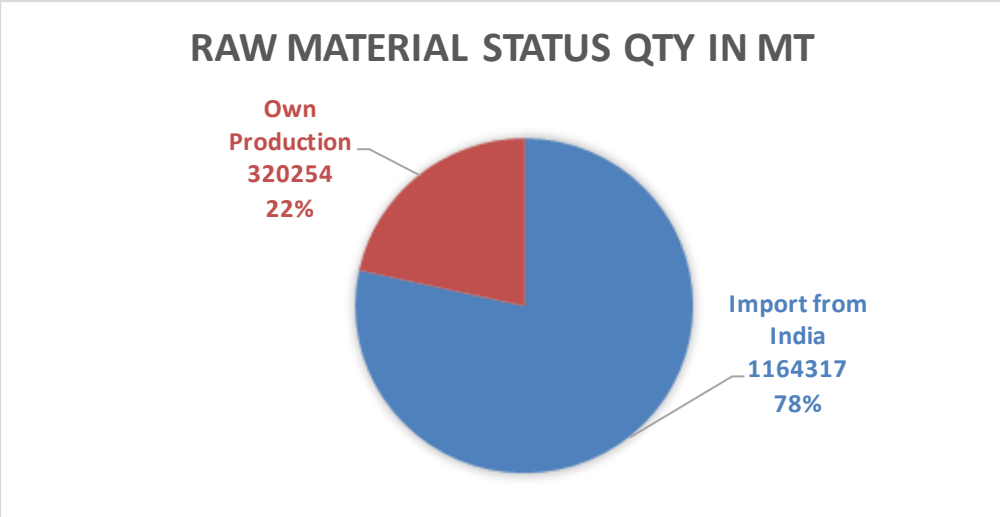
According to the survey feedback collected from Nepal Steel Rolling Mills Association, five years future demand of TMT bar is shown in the above figure. Annual demand of TMT bar will be increased by 50000 Metric tons up to 2079/80 however in 80/81 it will be increased by one lakh metric tons. Annual future demand will be increased by 4%, 3.85% and 3.70% in the year 2077/78 2078/79 and 2079/80 respectively. In the year 2080/81; it will be increased by 7.14%. Five years increment from above data shows that it will be 20%.

4.3 Status of Raw Material Availability

Table 4.4 Raw material consumption status

S.N.	Name of Industries	Quantity (MT)		
		Import	**Own Production**	**Total Purchase**
1	Hulas Wire Industries Limited	45000	0	45000
2	Aarti Strips Pvt. Ltd.	34991	0	34991
3	Kamala Rolling Mills Pvt. Ltd.	36400	0	36400
4	Pashupati Iron and Steel Pvt. Ltd.	24000	36000	60000
5	Premier Steel Pvt. Ltd	80000	0	80000
6	Ashok Steels Industries Pvt. Ltd	27200	20000	47200
7	Hama Iron and Steels Ind. P. Ltd.	33200	0	33200
8	Jagdamba Steels Pvt Ltd	180000	180000	360000
9	Shakha Steel Industries P. Ltd.	15200	0	15200
10	Shalimar Steels P. Ltd	0	0	0
11	Narayani Ispat P Ltd	21746	34254	56000
12	Himal Iron and Steel Pvt. Ltd.	50000	0	50000
13	Jagdamba Enterprises Pvt. Ltd	35550	0	35550
14	Godawari Steels Pvt. Ltd.	21000	0	21000
15	Everest Rolling Ind. Pvt. Ltd	25000	0	25000
16	Panchakanya Steel Pvt. Ltd	60000	0	60000
17	Goenka Steels Pvt. Ltd	49630	0	49630
18	Ambe Steels Pvt Ltd	35800	0	35800
19	Ferro Steel Pvt. Ltd	30100	0	30100
20	Shree Steel Pvt. Ltd.	80000	0	80000
21	S. R. Steels Ind. Pvt Ltd	29000	0	29000
22	Laxmi Steel Pvt. Ltd	22000	50000	72000
23	Kathmandu Steel Pvt. Ltd	63500	0	63500
24	Siddilaxmi Steel Pvt. Ltd	65000	0	65000
25	Vijayashri Steel Pvt . Ltd	100000	0	100000
	Total	**1164317**	**320254**	**1484571**

Figure 4.4 Raw material consumption status



Source: Field Survey, 2020

Raw materials (billets) are imported mostly from India. Some industries themselves manufacture billet and ingot. Import of billet from India contributes 78% while own production within country is 22% only.

4.4 Production and Supply

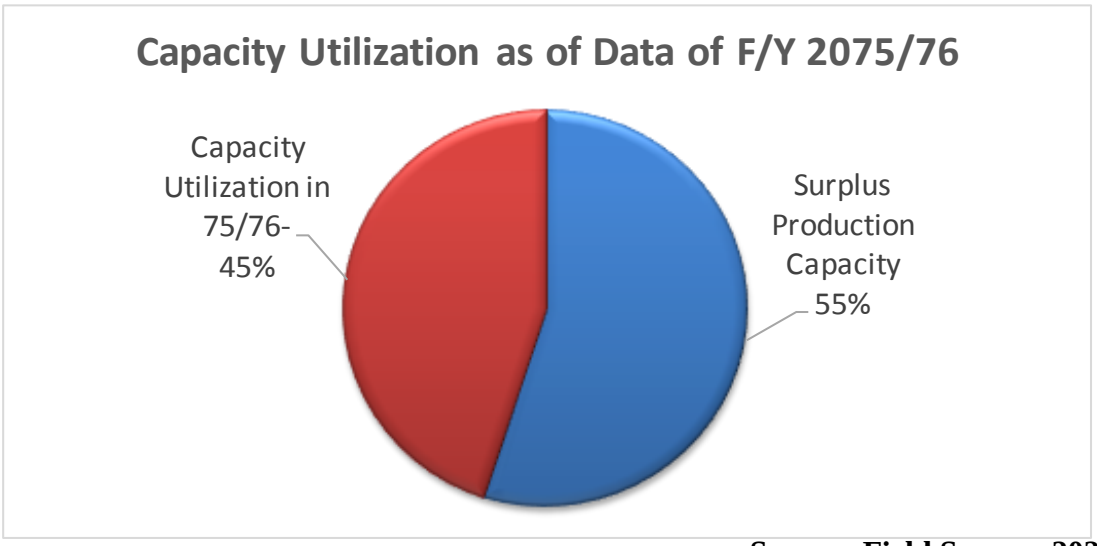
Table 4.5 Annual Production (Capacity and Capacity Utilization)

S.N.	Name of Industries	Installed Production Capacity (MT)	Existing Running Capacity (MT)	Capacity Utilization (%)
1	Hulas Wire Industries Limited	80000	40000	50.00
2	Aarti Strips Pvt. Ltd.	200000	50000	25.00
3	Kamala Rolling Mills Pvt. Ltd.	48000	15500	32.29
4	Pashupati Iron and Steel Pvt Ltd.	125000	45000	36.00
5	Premier Steel Pvt. Ltd	160000	65000	40.63
6	Ashok Steels Industries Pvt. Ltd	60000	48200	80.33
7	Hama Iron and Steels Ind. P. Ltd.	60000	33900	56.50
8	Jagdamba Steels Pvt Ltd.	450000	336665	74.81
9	Shakha Steel Industries Pvt. Ltd.	40000	15900	39.75
10	Shalimar Steels P. Ltd.	30000	0	0.00
11	Narayani Ispat P. Ltd.	180000	53000	29.44
12	Himal Iron and Steel Pvt. Ltd.	72000	35000	48.61

13	Jagdamba Enterprises Pvt. Ltd	70000	52500	75.00
14	Godawari Steels Pvt. Ltd.	70000	22250	31.79
15	Everest Rolling Ind. Pvt. Ltd	36000	34500	95.83
16	Panchakanya Steel Pvt. Ltd	200000	56000	28.00
17	Goenka Steels Pvt. Ltd	70000	49211	70.30
18	Ambe Steels Pvt Ltd	50000	36200	72.40
19	Ferro Steel Pvt. Ltd	50000	25300	50.60
20	Shree Steel Pvt.Ltd.	200000	41000	20.50
21	S. R. Steels Ind. Pvt Ltd	70000	27000	38.57
22	Laxmi Steel Pvt. Ltd	144000	72000	50.00
23	Kathmandu Steel Pvt. Ltd	100000	50000	50.00
24	Siddilaxmi Steel Pvt. Ltd	240000	0	0.00
25	Vijayashri Steel Pvt . Ltd	210000	26327	12.54
26	Jaya Bageshwari Iron and Steel Pvt. Ltd.	30000	14000	46.67
27	Bageshwari Rolling Mills Pvt. Ltd	30000	15000	50.00
28	Pathibhara Steel Pvt. Ltd.	15000	10000	66.67
29	Narayani Rolling Mills Pvt. Ltd.	30000	0	0.00
30	Sarbottam Steel Pvt. Ltd.	264000	0	0.00
31	Jay Ambe Steel Pvt. Ltd.	200000	0	0.00
Total		**3584000**	**1269453**	**35.42**

Source: field survey, 2020

Figure 4.5 Capacity Utilization



Source: Field Survey, 2020

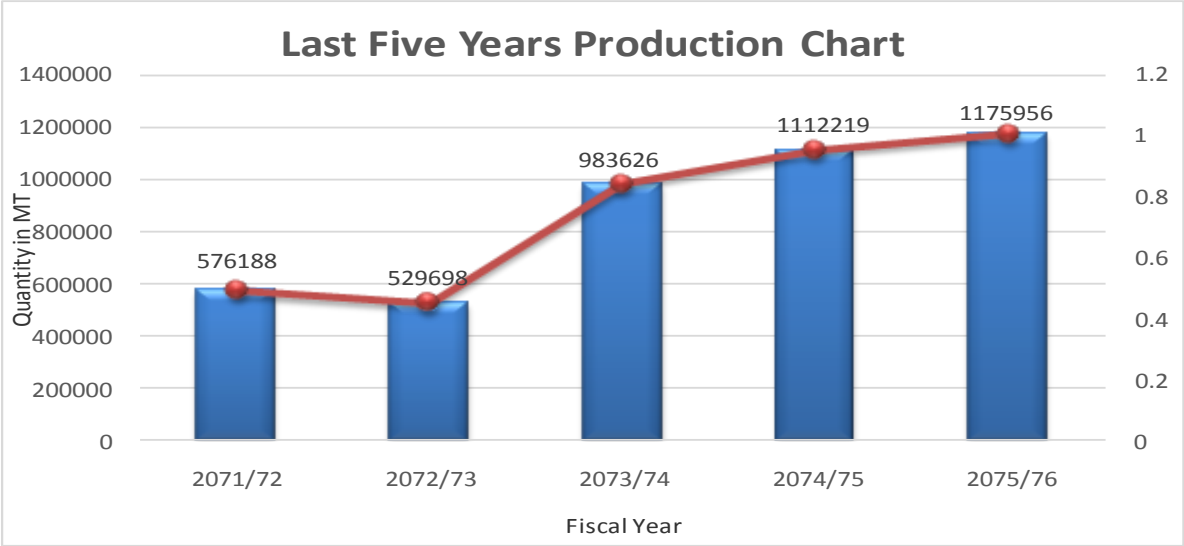
Capacity utilization of surveyed industries shows that it is about 45% in current situation. However capacity utilization in future will be approximately 36% in after operation of all TMT bar manufacturing industries in near future if demand is not increased largely and all of TMT bar manufacturing continues producing TMT bars.

Table 4.6 Annual Production of TMT Bar for last five years

S.N.	Name of Industries	Fiscal Year				
		2071/72	2072/73	2073/74	2074/75	2075/76
1	Hulas Wire Industries Limited	26568	26970	43677	41572	41786
2	Aarti Strips Pvt. Ltd	0	0	0	0	26045
3	Kamala Rolling Mills Pvt. Ltd.	13920	13110	17100	14800	6850
4	Pashupati Iron and Steel Pvt. Ltd	26100	22300	49200	46900	40500
5	Premier Steel Pvt . Ltd	0	0	0	0	71900
6	Ashok Steels Industries Pvt. Ltd	16900	14700	47900	55127	47100
7	Hama Iron and Steels Ind. Pvt. Ltd.	23100	18200	43950	45100	33600
8	Jagdamba Steels Pvt. Ltd	230800	197800	290400	335670	336664
9	Shakha Steel Industries Pvt. Ltd.	17500	12260	22494	15100	15900
10	Shalimar Steels P. Ltd	0	0	0	0	0
11	Narayani Ispat P Ltd	0	0	0	0	53000
12	Himal Iron and Steel Pvt. Ltd.	23500	17200	46700	42000	32800
13	Jagdamba Enterprises Pvt. Ltd	21100	16100	43230	41900	35140
14	Godawari Steels Pvt. Ltd.	0	0	0	19100	20160
15	Everest Rolling Ind. Pvt. Ltd	11800	14500	15900	25800	36100
16	Panchakanya Steel Pvt. Ltd	33800	38200	60200	71900	57200
17	Goenka Steels Pvt. Ltd	30000	14248	43900	66960	49211
18	Ambe Steels Pvt Ltd	23900	18900	47000	52500	34870
19	Ferro Steel Pvt. Ltd	12100	14900	45800	43340	24100
20	Shree Steel Pvt.Ltd.	0	0	0	0	41380
21	S. R. Steels Ind. Pvt Ltd	0	12900	18850	28200	26200
22	Laxmi Steel Pvt. Ltd	65100	43300	98125	106950	71100
23	Kathmandu Steel Pvt. Ltd	0	34110	49200	59300	47150
24	Siddilaxmi Steel Pvt. Ltd	0	0	0	0	0
25	Vijayashri Steel Pvt . Ltd	0	0	0	0	27200
Total Production		**576188**	**529698**	**983626**	**1112219**	**1175956**
Total Supply		**563303**	**508882**	**956986**	**1060937**	**1170254**

Source: Field Survey, 2020

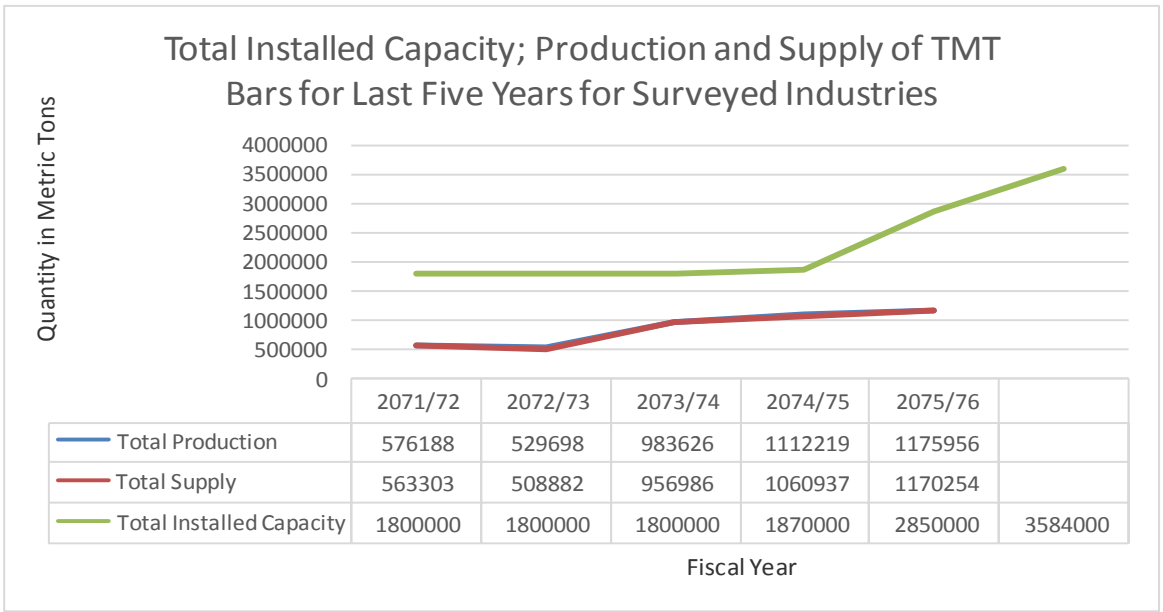
Figure 4.6 Annual Production of TMT Bar (Last five fiscal years)



Source: Field Survey, 2020

Annual Production status of TMT bars of last five fiscal years from 2071/72 to 75/76 reveals that, it was high in the year 2075/76 i.e. 11.75 Lakhs MT and low in the year 2072/73 i.e. 5.29 Lakhs MT.

Figure 4.7 Trend Analysis of Production and Demand/Supply



Source: Field Survey, 2020

The production of TMT bar is as per market demand and supply. If there is high demand then the industries increase the per day production if demand decreases then they also decrease the

daily production. Hence five year trend analysis of production vs supply shows that these are correlated. Above figure also shows same.

4.4.1 Export Status of TMT Bar

TMT bars are not exported from Nepal according to the survey.

Major obstacles for exporting TMT bars in India and third countries;

- Since there is no comparative advantage to export TMT bar in India and other countries because the major raw materials prime billet, machinery, spare parts are imported from India and third countries, most of the skilled/technical manpower are from India.
- The taxes levied by the government in custom duty, excise duty shall also increase the cost.
- The transportation cost will also be increased.
- So there is no chance to compete in the Indian and third country market for TMT bar. Moreover to export the TMT bar in India, the particular industries have to be certified to use Indian standard certification mark (ISI) in its TMT bar before exporting to India.

4.4.2 Technology Adoption

S.N.	Name of Industries	Production Process	Used Technology
1	Hulas Wire Industries Limited	Auto	Thermax
2	Aarti Strips Pvt. Ltd	Auto	Thermax
3	Kamala Rolling Mills Pvt. Ltd.	Auto	Thermax
4	Pashupati Iron and Steel Pvt. Ltd	Auto	Thermax
5	Premier Steel Pvt. Ltd	Auto	Thermax
6	Ashok Steels Industries Pvt. Ltd	Auto	Thermax
7	Hama Iron and Steels Ind. Pvt. Ltd.	Auto	Thermax
8	Jagdamba Steels Pvt Ltd	Auto	Thermax/Tempcore
9	Shakha Steel Industries Pvt. Ltd.	Auto	Tempcore
10	Shalimar Steels P. Ltd	Auto	Thermax
11	Narayani Ispat P Ltd	Auto	Thermax
12	Himal Iron and Steel Pvt. Ltd.	Auto	Thermax
13	Jagdamba Enterprises Pvt. Ltd	Auto	Thermax
14	Godawari Steels Pvt. Ltd.	Auto	Thermax
15	Everest Rolling Ind. Pvt. Ltd	Auto	Thermax
16	Panchakanya Steel Pvt. Ltd	Auto	Thermax
17	Goenka Steels Pvt. Ltd	Auto	Thermax
18	Ambe Steels Pvt Ltd	Auto	Thermax
19	Ferro Steel Pvt. Ltd	Auto	Thermax

20	Shree Steel Pvt.Ltd.	Auto	Tempcore
21	S. R. Steels Ind. Pvt Ltd	Semi-Auto	Thermax
22	Laxmi Steel Pvt. Ltd	Auto	Thermax
23	Kathmandu Steel Pvt. Ltd	Auto	Reid Bar Newzeland
24	Siddilaxmi Steel Pvt. Ltd	Auto	Tempcore
25	Vijayashri Steel Pvt . Ltd	Auto	Thermax

Source: Field Survey, 2020

Most of the TMT bar manufacturing industries have auto production process and Thermax technology of production. Only four industries have Tempcore technology, while one industries has Reid bar New-Zealand technology.

4.5 Investment and Employment

Table 4.7 Total Investment

S.N.	Name of Industries	Fixed Capital (Rs)	Working Capital (Rs)	Total Capital (Rs)
1	Hulas Wire Industries Limited	1134708892	487167890	1621878782
2	Aarti Strips Pvt. Ltd	1395300000	280000000	1675300000
3	Kamala Rolling Mills Pvt. Ltd.	420000000	303700000	723700000
4	Pashupati Iron and Steel Pvt. Ltd	380000000	360000000	740000000
5	Premier Steel Pvt. Ltd	1329895000	1851154500	3181049500
6	Ashok Steels Industries Pvt. Ltd	370000000	220000000	590000000
7	Hama Iron and Steels Ind. Pvt. Ltd.	152873000	97127000	25000000
8	Jagdamba Steels Pvt. Ltd	7280690006	2841591778	10122281784
9	Shakha Steel Industries Pvt. Ltd.	95000000	93729000	188729000
10	Shalimar Steels P. Ltd	192500000	185000000	377500000
11	Narayani Ispat P Ltd	1784718850	2492489835	4277208685
12	Himal Iron and Steel Pvt. Ltd.	345360000	19009000	364369000
13	Jagdamba Enterprises Pvt. Ltd	600000000	350000000	950000000
14	Godawari Steels Pvt. Ltd.	182500000	65000000	247500000
15	Everest Rolling Ind. Pvt. Ltd	10000000	15000000	25000000
16	Panchakanya Steel Pvt. Ltd	2200000000	1610000000	3820000000
17	Goenka Steels Pvt. Ltd	370000000	290000000	660000000
18	Ambe Steels Pvt Ltd	228000000	143500000	371500000
19	Ferro Steel Pvt. Ltd	47184000	17199000	64383000
20	Shree Steel Pvt.Ltd.	1800000000	2200000000	4000000000

21	S. R. Steels Ind. Pvt Ltd	250000000	150000000	400000000
22	Laxmi Steel Pvt. Ltd	315000000	465000000	780000000
23	Kathmandu Steel Pvt. Ltd	740000000	2170000000	2910000000
24	Siddilaxmi Steel Pvt. Ltd	153500000	96000000	249500000
25	Vijayashri Steel Pvt .Ltd	1000000000	2000000000	3000000000
Total		**22777229748**	**18802668003**	**41364899751**

Source: Field Survey, 2020

Total investment of 25 surveyed industries is more than 41 billion out of which fixed capital is 22 billion and working capital is also around 18 billion. Out of 25 industries only three industries are medium scale as per investment and 22 are large industries. Investment of remaining other industries is more than 7.7 billion i.e. total investment in TMT bar manufacturing industries is more than 48.7 billion.

Table 4.8 Source of Investment

S.N.	Name of Industries	Source of Investment (%)			Type of Investment (%)		
		Loan	Equity	Total	Internal	Foreign	Total
1	Hulas Wire Industries Limited	0	100	100	100	-	100
2	Aarti Strips Pvt. Ltd	80	20	100	-	100	100
3	Kamala Rolling Mills Pvt. Ltd.	0	100	100	100	-	100
4	Pashupati Iron and Steel Pvt. Ltd	80	20	100	100	-	100
5	Premier Steel Pvt. Ltd	80	20	100	100	-	100
6	Ashok Steels Industries Pvt. Ltd	80	20	100	100	-	100
7	Hama Iron and Steels Ind. Pvt. Ltd.	80	20	100	100	-	100
8	Jagdamba Steels Pvt. Ltd	75	25	100	100	-	100
9	Shakha Steel Industries Pvt. Ltd.	72.56	27.44	100	100	-	100
10	Shalimar Steels P. Ltd	80	20	100	100	-	100
11	Narayani Ispat P. Ltd	88	12	100	100	-	100
12	Himal Iron and Steel Pvt. Ltd.	80	20	100	100	-	100
13	Jagdamba Enterprises Pvt. Ltd	80	20	100	100	-	100
14	Godawari Steels Pvt. Ltd.	80	20	100	100	-	100

15	Everest Rolling Ind. Pvt. Ltd	80	20	100	100	-	100
16	Panchakanya Steel Pvt. Ltd	80	20	100	100	-	100
17	Goenka Steels Pvt. Ltd	80	20	100	100	-	100
18	Ambe Steels Pvt. Ltd	80	20	100	100	-	100
19	Ferro Steel Pvt. Ltd	80	20	100	100	-	100
20	Shree Steel Pvt. Ltd.	75	25	100	100	-	100
21	S. R. Steels Ind. Pvt Ltd	84	16	100	100	-	100
22	Laxmi Steel Pvt. Ltd	80	20	100	100	-	100
23	Kathmandu Steel Pvt. Ltd	80	20	100	100	-	100
24	Siddilaxmi Steel Pvt. Ltd	80	20	100	100	-	100
25	Vijayashri Steel Pvt. Ltd	80	20	100	94	6	100
	Total	**1834.56**	**665.44**				
	Average %	**73.38**	**26.62**				

Source: Field Survey, 2020

Out of 25 surveyed industries, 23 industries have full internal investment. Only two industries have foreign investment where one industry has all foreign investment. Only two industries out of 25 industries is fully operating from 100 percent equity. Other industries have more parentage of bank loan than equity i.e. in average 73.38% of bank loan and 26.62% of equity.

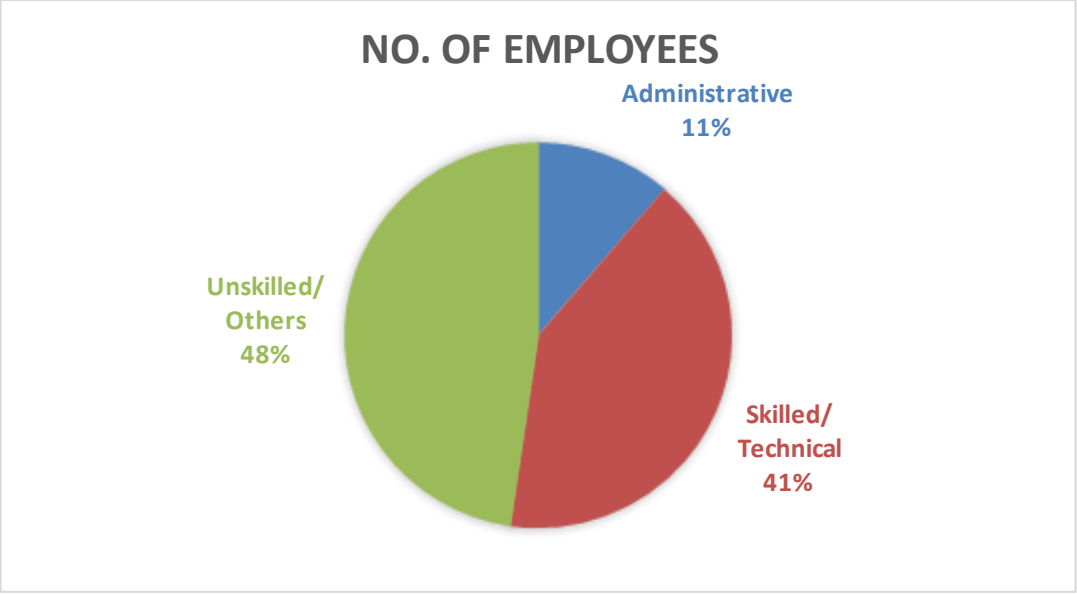
Table 4.9 Employment Generated (Type and Number of Human Resource)

S.N.	Name of Industries	Category (Number)			
		Administrative	Technical /Skilled	Non-skilled/ Other	Total
1	Hulas Wire Industries Limited	18	50	113	181
2	Aarti Strips Pvt. Ltd	10	100	40	150
3	Kamala Rolling Mills Pvt. Ltd.	30	80	40	150
4	Pashupati Iron and Steel P. Ltd	30	95	45	170
5	Premier Steel Pvt. Ltd	81	153	114	420
6	Ashok Steels Industries Pvt. Ltd	20	150	50	220
7	Hama Iron and Steels Ind. P. Ltd.	18	95	45	153
8	Jagdamba Steels Pvt. Ltd	200	1540	2469	4209
9	Shakha Steel Industries P. Ltd.	20	90	35	145

10	Shalimar Steels P. Ltd	0	0	0	0
11	Narayani Ispat P Ltd	53	175	178	406
12	Himal Iron and Steel Pvt. Ltd.	183	197	24	404
13	Jagdamba Enterprises Pvt. Ltd	30	120	90	240
14	Godawari Steels Pvt. Ltd.	25	120	40	185
15	Everest Rolling Ind. Pvt. Ltd	5	20	110	135
16	Panchakanya Steel Pvt. Ltd	29	102	206	377
17	Goenka Steels Pvt. Ltd	15	70	60	145
18	Ambe Steels Pvt Ltd	20	120	80	220
19	Ferro Steel Pvt. Ltd	15	85	45	145
20	Shree Steel Pvt.Ltd.	35	85	155	275
21	S. R. Steels Ind. Pvt Ltd	30	34	86	150
22	Laxmi Steel Pvt. Ltd	80	105	115	300
23	Kathmandu Steel Pvt. Ltd	40	50	126	216
24	Siddilaxmi Steel Pvt. Ltd	43	55	135	243
25	Vijayashri Steel Pvt . Ltd	20	113	21	154
Total		1050	3804	4422	9393

Source: Field Survey, 2020

Figure 4.8 Employment generated by category



Source: Field Survey, 2020

Out of total employment generated, administrative staffs are 11%, while skilled/technical staffs in TMT bar manufacturing industries are 48%. Coverage of unskilled/others industries are 41%. Total employees in those industries are 9393.

4.6 Challenges Faced by TMT Bar Manufacturing Industries

4.6.1 Internal Challenge

- Unavailability of technical/ skilled manpower locally
- Labor management and union problem
- Spare parts not available locally
- High turnover of skilled manpower
- Decreased project sales
- Increased complaint due to inadequate customer awareness (price based customer)

4.6.2 External Challenge

4.6.2.1 Government Policy, rules and regulations

- License given without study of demand and supply of TMT bar in Nepal
- Infrastructure developmental activities very slow
- Labor policy not feasible
- Same policy for manual and automatic system industry
- High interest rate
- No subsidy for export

4.6.2.2 Technology change

- Huge investment for technology change which is very difficult in such unhealthy and low demand market
- Low production cost of bigger industries with latest technology, so very difficult to compete with these industries with old machinery plant with high production cost.

4.6.2.3 Unhealthy competition

- Due to unhealthy competition, increased DSO (Daily sales outstanding)

4.6.2.4 Consumer awareness

- Consumer focus on price not on quality, so consumer should be aware about quality of TMT bar.

4.6.2.5 Others

- Fluctuation of foreign exchange rate
- Price fluctuation

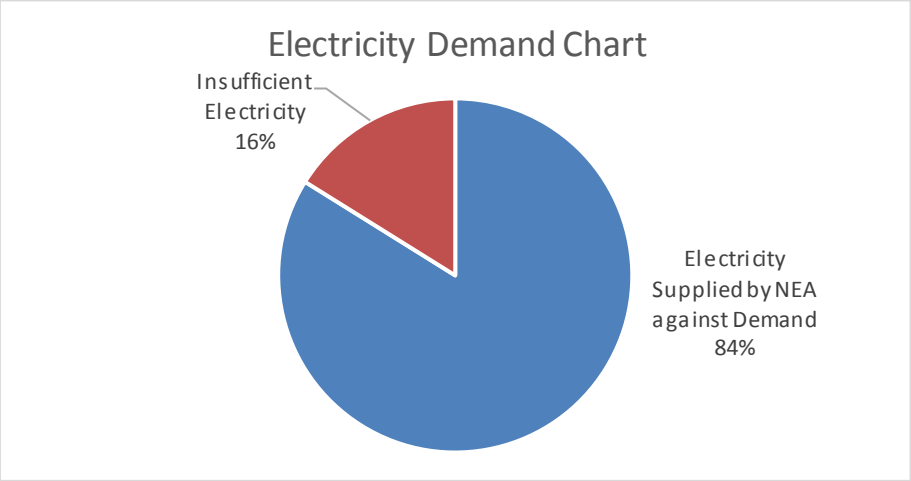
4.7 Electricity Demand and Supply

Table 4.10 Annual Electricity Demand/ Supply

S.N.	Name of Industries	Demand Capacity	Provided Capacity by NEA	Capacity of Generator KVA
1	Hulas Wire Industries Limited	5200	2500	NA
2	Aarti Strips Pvt. Ltd	20000	20000	
3	Kamala Rolling Mills Pvt. Ltd.	3000	3000	
4	Pashupati Iron and Steel Pvt. Ltd	20000	20000	320 KVA; 125 KVA
5	Premier Steel Pvt . Ltd	10500	5000	320 KVA
6	Ashok Steels Industries Pvt. Ltd	8000	6000	
7	Hama Iron and Steels Ind. Pvt. Ltd.	2500	2500	
8	Jagdamba Steels Pvt Ltd	41000	41000	
9	Saakha Steel Industries Pvt. Ltd.	6000	6000	
10	Shalimar Steels P. Ltd	5000	4000	
11	Narayani Ispat P Ltd	13000	8750	
12	Himal Iron and Steel Pvt. Ltd.	6000	6000	
13	Jagdamba Enterprises Pvt. Ltd	10000	6000	
14	Godawari Steels Pvt. Ltd.	6000	6000	
15	Everest Rolling Ind. Pvt. Ltd	1500	1500	125 KVA
16	Panchakanya Steel Pvt. Ltd	5000	4750	600 KVA
17	Goenka Steels Pvt. Ltd	6000	4000	
18	Ambe Steels Pvt Ltd	12000	7000	
19	Ferro Steel Pvt. Ltd	2500	2500	
20	Shree Steel Pvt. Ltd.	12000	6000	10000 KVA
21	S. R. Steels Ind. Pvt Ltd	3300	3300	
22	Laxmi Steel Pvt. Ltd	15000	7000	5200 KVA
23	Kathmandu Steel Pvt. Ltd	8000	4000	380 KVA and 63 KVA
24	Siddilaxmi Steel Pvt. Ltd	15000	8000	312 KVA
25	Vijayashri Steel Pvt. Ltd.	4000	4000	
26	Pathibhara Steel Pvt. Ltd.	2500	2500	
27	Jay Ambe Steel Industries	40000	40000	
28	Sarbottam Steel Industries	25000	25000	
29	Bageshwari Iron and Steel P. Ltd.	4000	4000	
30	Jay Bageshwari Rolling Mills	4000	4000	
31	Narayani Rolling Mills P. Ltd.	4500	4500	
Total		**320500**	**268800**	

Source: Field Survey, 2020 (S.N. 1-25)
DOI, (S.N. 26-29)

Figure 4.9 Electricity Demand Supplied by NEA



Source: Field Survey, 2020

Electricity demand supplied by NEA in current situation is 84%. Only 16% demand electricity is insufficient. Those industries having DG of smaller capacity, uses for other purpose than operation of plant. Only Laxmi Steels Pvt. Ltd. and Shree Steels Pvt. Ltd. used larger capacity DG for operation of plant. Total electricity demand is 256.4 MW out of which 215.04 MW has been supplied.

As per discussion with electrical expert and data provided by different industries, per ton electricity consumption for TMT bar (average for all sizes i.e. 8 mm to 32mm) is 100 unit. Hence total electricity consumption for that year is (against production of 1.26 million MT) 126 million units. Hence 126 GWH electricity was consumed in last fiscal year by TMT bar manufacturing industries.

Similarly, per ton furnace oil consumption for TMT bar is 40 Litre. Hence total furnace oil consumption for that year is (Against production of 1.26 million MT) 50400 KL.

4.8 Quality Related

4.8.1 Type of TMT Bar

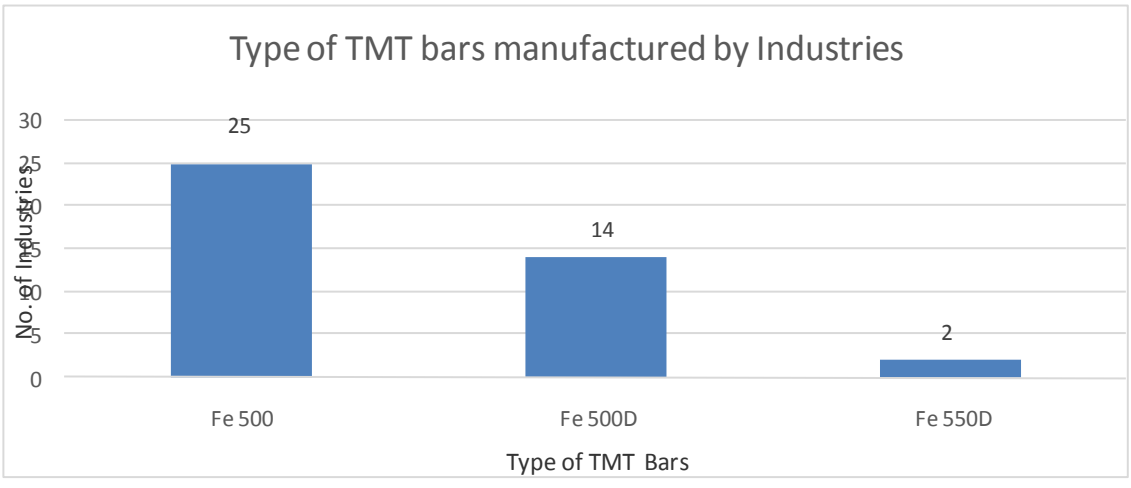
Table 4.11 Type of TMT Bar

S.N.	Name of Industries	TMT Bar Type		
		Fe 500	Fe 500D	Fe 550D
1	Hulas Wire Industries Limited	Yes	-	-
2	Aarti Strips Pvt. Ltd	Yes	-	Yes
3	Kamala Rolling Mills Pvt. Ltd.	Yes	-	-
4	Pashupati Iron and Steel Pvt Ltd	Yes	Yes	-

5	Premier Steel Pvt . Ltd	Yes	Yes	-
6	Ashok Steels Industries Pvt. Ltd	Yes	-	-
7	Hama Iron and Steels Ind. Pvt. Ltd.	Yes	-	-
8	Jagdamba Steels Pvt. Ltd.	Yes	Yes	-
9	Shakha Steel Industries Pvt. Ltd.	Yes	Yes	-
10	Shalimar Steels P. Ltd	Yes	-	-
11	Narayani Ispat P. Ltd	Yes	Yes	-
12	Himal Iron and Steel Pvt. Ltd.	Yes	Yes	-
13	Jagdamba Enterprises Pvt. Ltd	Yes	Yes	-
14	Godawari Steels Pvt. Ltd.	Yes	Yes	-
15	Everest Rolling Ind. Pvt. Ltd	Yes	-	-
16	Panchakanya Steel Pvt. Ltd	Yes	Yes	-
17	Goenka Steels Pvt. Ltd	Yes	Yes	-
18	Ambe Steels Pvt. Ltd.	Yes	Yes	-
19	Ferro Steel Pvt. Ltd	Yes	-	-
20	Shree Steel Pvt. Ltd.	Yes	Yes	-
21	S. R. Steels Ind. Pvt Ltd	Yes	-	-
22	Laxmi Steel Pvt. Ltd	Yes	-	-
23	Kathmandu Steel Pvt. Ltd	Yes	Yes	-
24	Siddilaxmi Steel Pvt. Ltd	Yes	-	-
25	Vijayashri Steel Pvt. Ltd	Yes	Yes	-

Source: Field Survey, 2020

Figure 4.10 Type of TMT Bars manufactured by industries



Source: Field Survey, 2020

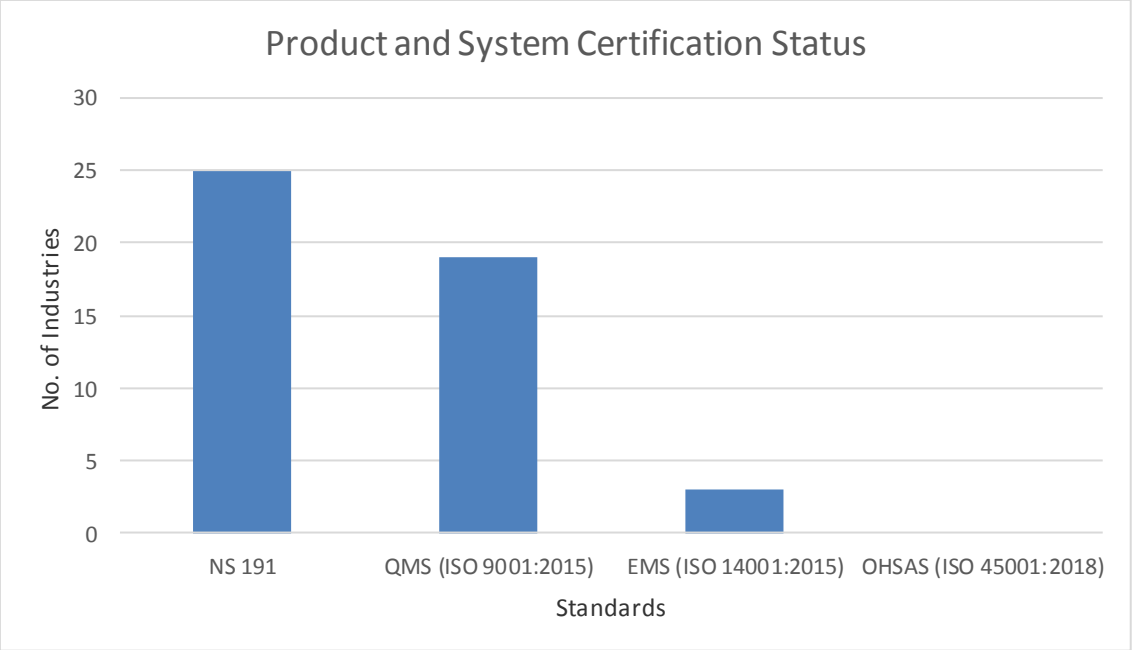
All of the industries are manufacturing Fe 500 grade TMT bars. Out of 25 industries surveyed, 14 industries are manufacturing Fe 500D grade TMT bars and two industries manufacturing Fe 550D TMT bars.

Table 4.12 Product & System Certification

S.N.	Name of Industries	Product (NS 191)	Management System Certification		
			QMS	EMS	OHSAS
1	Hulas Wire Industries Limited	NS 191	Yes	-	-
2	Aarti Strips Pvt. Ltd	NS 191	Yes	Yes	
3	Kamala Rolling Mills Pvt. Ltd.	NS 191	Yes	-	-
4	Pashupati Iron and Steel P. Ltd	NS 191	Yes	-	-
5	Premier Steel Pvt. Ltd	NS 191	Yes	-	-
6	Ashok Steels Industries P. Ltd	NS 191	Yes	-	-
7	Hama Iron and Steels Ind. P. Ltd.	NS 191	Yes	-	-
8	Jagdamba Steels Pvt. Ltd	NS 191	Yes	-	-
9	Shakha Steel Industries P. Ltd.	NS 191	Yes	-	-
10	Shalimar Steels P. Ltd	NS 191	-	-	-
11	Narayani Ispat P. Ltd	NS 191	Yes	-	-
12	Himal Iron and Steel Pvt. Ltd.	NS 191	Yes	-	-
13	Jagdamba Enterprises Pvt. Ltd	NS 191	Yes	-	-
14	Godawari Steels Pvt. Ltd.	NS 191	-	-	-
15	Everest Rolling Ind. Pvt. Ltd	NS 191	Yes	-	-
16	Panchakanya Steel Pvt. Ltd	NS 191	Yes	Yes	-
17	Goenka Steels Pvt. Ltd	NS 191	Yes	-	-
18	Ambe Steels Pvt. Ltd	NS 191	Yes	Yes	-
19	Ferro Steel Pvt. Ltd	NS 191	Yes	-	-
20	Shree Steel Pvt. Ltd.	NS 191	-	-	-
21	S. R. Steels Ind. Pvt. Ltd	NS 191	-	-	-
22	Laxmi Steel Pvt. Ltd	NS 191	Yes	-	-
23	Kathmandu Steel Pvt. Ltd	NS 191	Yes	-	-
24	Siddilaxmi Steel Pvt. Ltd	NS 191	-	-	-
25	Vijayashri Steel Pvt. Ltd	NS 191	-	-	-

Source: Field Survey, 2020

Figure 4.11 Product and System Certification Status



Source: Field Survey, 2020

Since NS 191 is mandatory product standard, all surveyed industries have this certification. Management system standards are voluntary, however 19 industries are certified with ISO 9001:2015 Quality Management System, three industries are certified with ISO 14001:2015 Environmental Management System Certification and none of the industry is certified for Occupational Health Safety System Certification.

4.8.2 Challenges to maintain quality

- Continuous uninterrupted power supply
- Billet quality not uniform in each pieces
- Voltage problem
- Difference in quality of raw materials between suppliers
- Skilled manpower frequently changed
- Experienced labor problem

4.8.3 Methods followed to minimize environmental impact by factory

- Pre-air heater (Recuperator) to convert CO gas to CO2
- Air pollution controller
- Dust collector
- Water treatment plant/Water recycle-reuse of water
- Full-fledged effluent water treatment plant to treat waste water

- Chimney installation with sufficient height to discharge gaseous emission from generator and furnace

4.9 Market Management

4.9.1 Main Market

The main market of TMT bar of all industries is Kathmandu, other major project running cities and the region where industries are in operation. Market is all over Nepal for tender related supply.

4.9.2 Sales/Distribution System

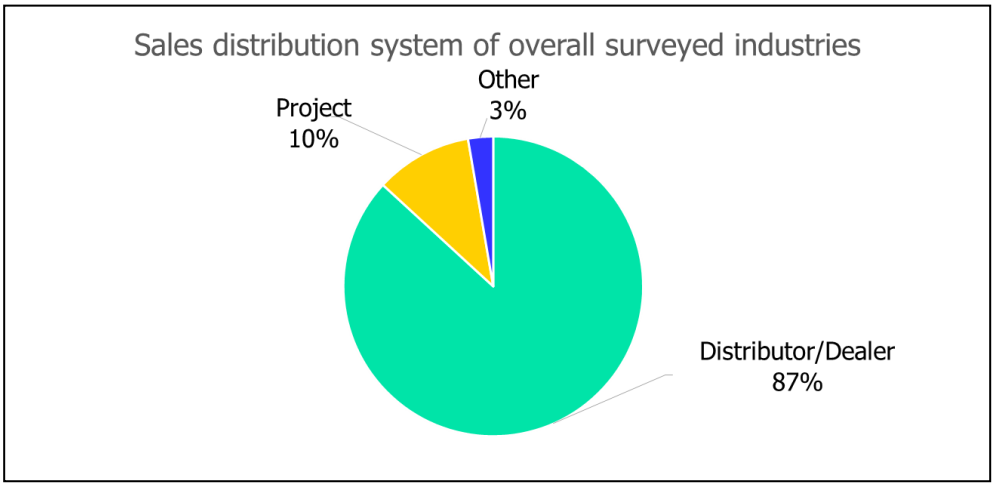
Table 4.13 Sales/distribution System Percentage

S.N.	Name of Industries	Sales in MT	Distributor/Dealer		Project Sales		Others Sales	
			Percentage	Quantity in MT	Percentage	Quantity in MT	Percentage	Quantity in MT
1	Hulas Wire Industries Limited	37415	98	36666.7	2	748.3	0	0
2	Aarti Strips Pvt. Ltd	16568	90	14911.2	8	1325.44	2	331.36
3	Kamala Rolling Mills Pvt. Ltd.	6321	98	6194.58	2	126.42	0	0
4	Pashupati Iron and Steel Pvt Ltd	45000	75	33750	10	4500	15	6750
5	Premier Steel Pvt . Ltd	70000	81.71	57197	17.96	12572	0.33	231
6	Ashok Steels Industries Pvt. Ltd	46000	98	45080	2	920	0	0
7	Hama Iron and Steels Ind. Pvt. Ltd.	32700	95	31065	3	981	2	654
8	Jagdamba Steels Pvt Ltd	326512	85	277535.2	12	39181.44	3	9795.36
9	Shakha Steel Industries Pvt. Ltd.	14500	94	13630	3	435	2	290
10	Shalimar Steels P. Ltd	0	0	0	0	0	0	0

11	Narayani Ispat P Ltd	52692	98	51638.16	2	1053.84	0	0
12	Himal Iron and Steel Pvt. Ltd.	35000	90	31500	5	1750	5	1750
13	Jagdamba Enterprises Pvt. Ltd	52500	90	47250	6	3150	4	2100
14	Godawari Steels Pvt. Ltd.	19460	90	17514	5	973	5	973
15	Everest Rolling Ind. Pvt. Ltd	34500	90	31050	10	3450	0	0
16	Panchakanya Steel Pvt. Ltd	58000	90	52200	8	4640	2	1160
17	Goenka Steels Pvt. Ltd	50639	97	49119.83	2	1012.78	1	506.39
18	Ambe Steels Pvt Ltd	35670	91	32459.7	6	2140.2	3	1070.1
19	Ferro Steel Pvt. Ltd	28000	96	26880	2	560	2	560
20	Shree Steel Pvt.Ltd.	40000	60	24000	40	16000	0	0
21	S. R. Steels Ind. Pvt Ltd	25000	85	21250	15	3750	0	0
22	Laxmi Steel Pvt. Ltd	70000	88	61600	6	4200	6	4200
23	Kathmandu Steel Pvt. Ltd	47450	70	33215	30	14235	0	0
24	Siddilaxmi Steel Pvt. Ltd	0	0	0	5	0	0	0
25	Vijayashri Steel Pvt . Ltd	26327	77	20271.79	18	4738.86	5	1316.35
Total		**1170254**	**86.82**	**1015978.16**	**10.46**	**122443.28**	**2.71**	**31687.56**

Source: Field Survey, 2020

Figure 4.12 Sales distribution system of overall surveyed industries



Source: Field Survey, 2020

Sales/distribution system of the TMT bars from industries itself is categorized as sales through Distributor/dealer, project sales and other sales. From the analysis, it was found that major sales system is through distributor/dealer which contributes 87% of total, project sales contributes only 10% while others sales is only 3%.

4.10 Expectations from Government Bodies

4.10.1 Company Registration Office

- Timely online update
- Decentralization system

4.10.2 Department of Industry

- Timely circular industrial norms
- Burning loss should be different for manual/semi-manual industry
- Survey feedback should be implemented
- Stop registration of new industry

4.10.3 Nepal Bureau of Standards and Metrology (NBSM)

- Regular inspection/monitoring
- Facility for calibration of all testing/monitoring equipment
- Sample test report should be provided to respective industry
- One sample should be left at factory/industry premises during inspection for cross verification of products in case the sample taken by NBSM doesn't comply with standard of any deviation from NS 191.

4.10.4 Inland Revenue Department (IRD)

- Corporate/industrial tax rate should be minimized
- Social service tax not feasible
- Centralized tax system
- Decrease VAT on construction materials
- Should abolish excess duty

4.10.5 Custom Office

- Clearance of goods on time
- Decrease custom tariff of raw material
- Implement proper mechanism

4.10.6 Nepal Electricity Authority (NEA)

- Quality power supply
- Tariff should be same for dedicated and normal line
- Reduce the price of power
- Uninterrupted power supply
- Power should be supplied as demanded

4.10.7 Overall:

- Collected feedback should be implemented by concerned authorities
- Raw materials should be made locally available
- Centralized/integrated survey system
- New industry registration should be stopped
- Awareness to customers for quality product
- Make environment for export by government
- Government should increase and complete infrastructure/developmental activities on time
- RCC road should be constructed by Nepal government to maintain
- Low interest rate should be given to loan for certain years for survival time
- Should evaluate demand in our country and accordingly give license for future expansion.

- Should evaluate technology used by old companies and ask them to upgrade in order to reduce their cost of production.
- Government should facilitate for technology enhancement
- Basic infrastructure should be provided by government

4.11 Suggestions/Area for Improvements

There is huge supply and demand gap, capacity is 2.5 times the present demand and most of the new industries have very high capacity and interest burden and very low utilization of production.

From Government Level/Policy Level

- All roads to be concreted
- Electricity to be subsidized
- Interest benefits
- Export subsidy
- Strong regulatory bodies

From Association level

- All information and support required by the regulators
- Conducting constructions related seminar and events

From Industry Level

- Quality and competitive production

Overall

- Electricity rate to be reduced
- Export subsidy

CHAPTER V: CONCLUSION AND RECOMMENDATIONS

5.1 Findings and Conclusion

- There are 29 TMT bar manufacturing industries which are in operation; two industries are (Jay Ambe Steel Pvt. Ltd. and Sarbottam Steel Pvt. Ltd. under construction) operating in near future. One industry (Shalimar Steel Pvt. Ltd.) has stopped its operation since last year. One industry (Narayani Rolling Mills Pvt. Ltd.) though in the list of NBSM i.e. product certified; it has stopped its production of TMT bar (Same group has another industry Narayani Ispat Pvt. Ltd. which manufactures billet and TMT Bar).
- The annual installed production capacity is approximately 2.8 million MT however annual production is only about 1.2 million MT i.e. the capacity utilization is only 46%. After operation of two new industries and all other TMT bar industries (with capacity of 3.58 million MT) in recent future, the capacity utilization will decrease to 35% only.
- Out of 31 industries, 6 (19%) have capacity utilization below 20%, 13 (42%) have 20 to 50% and 12 (39%) have more than 50%.
- The total demand electricity is about 316000 KVA (256.4 MW), out of which NEA has supplied 264,300 KVA (215.04 MW) of electricity. In percentage about 84% of electricity has been supplied and 16% of electricity demand is not fulfilled.
- Total 126 GWH electricity was consumed in last fiscal year (Against production of 1.26 million MT) by TMT bar manufacturing industries similarly 50400 KL furnace oil was consumed for that year.
- The demand of TMT bars in future will be increased by 50,000 MT per annum as per data given by NSRMA, however future demand may be affected by COVID-19 and other development activities.
- Total employment generated by these industries is more than 9000. Out of them technical manpower are more about 4000. Most of the technical/skilled manpower are from India. Out of total employment generated, administrative staffs are 11%, while skilled/technical staffs in TMT bar manufacturing industries are 48%. Coverage of unskilled/others industries are 41%.
- Total investment in TMT bar manufacturing industries is more than 41 billion of 25 surveyed industries. Total investment is 48.7 billion for all TMT manufacturing industries.

- Required raw materials i.e. billet are imported from India i.e. 78% and 22% of billet locally manufactured (Purchasing of raw materials like spongy iron, cast iron, manganese and others from India itself).
- Out of 25 industries (surveyed) only three industries are medium scale as per investment and 22 are large industries.
- Market distribution system of TMT bar is Distributor/Dealer through 87 %, Project 10 % and other is 3%.
- Out of 25 surveyed industries, 23 industries have full internal investment. Only two industries have foreign investment, one industries has all foreign investment. Only two industries out of 25 industries is fully operating from 100 percent equity. Other industries have more parentage of bank loan than equity i.e. in average 73.38% of bank loan and 26.62% of equity.
- Most of the TMT bar manufacturing industries have auto production process and Thermax technology of production. Only four industries have tempcore technology, while one industries has Reid bar New-Zealand technology.
- Machinery and spare parts are purchased mostly from India by all industries.
- Type of TMT bar manufactured by industries are Fe500, Fe500D and Fe 550D Grades. All the industries are manufacturing Fe500 Grade, 14 industries out of 25 surveyed industries are manufacturing Fe 500D also, only two industries are producing Fe 550D grade TMT bar.
- Regarding management system certification, out of 25 industries; 19 industries have been certified with ISO 9001:2015 certification; 3 industries have been certified with ISO 14001:2015 certification.

5.2 Recommendations/Way Forward

- Since capacity utilization of existing TMT bar manufacturing industries is only 46% and after operation of all industries those are in under construction will further decrease to 35%, government should now promote for export and recommend industrialists not to make further investment in TMT bar.
- It is recommended for further study from both government side and association of related products/FNCCI/CNI etc. for other such products so that the investment of the investor/ banks/ nation will not be in risk.
- It is strongly recommended that the mountain belt road and other water submerged area road should be of concrete design by which the road development will be sustainable and very durable. Ultimately it will increase the consumption of TMT bars resulting sustainability of TMT bar manufacturing industries.
- Associations, industries and related stakeholders with the help of government should train manpower from professional engineer to skilled supervisor, foreman etc.
- Because of disturbance in power supply it has been observed increase in wastage percentage cause miss roll resulting increment in production cost, so it is suggested to provide the quality (uninterruptable) power supply.
- The government should expedite its infrastructure related development expenditure from the beginning of the fiscal year, so that the supply of TMT bar will be regular resulting to sustainable production.
- Industry should focus more on work environment and employee's health safety.
- Data should be updated in DOI related to capacity increment, investment of industries, name of industries etc.

REFERENCES

CBS. (2019). *Central Bureau of Statistics*. Retrieved from https://cbs.gov.np/national-accounts/.

DOI. (2019). *Department of Industry*. Retrieved from https://www.doind.gov.np/

GIZ/ NEEP. (2012). *Report on Baseline Study of Selected Sector Industries to assess The Potentials for more Efficient use of Energy*.

Jayanth, N., & Vidyashankar, S. (2014). Optimization of Capacity Utilization in a Manufacturing Industry – A Case Study. *International Journal Of Modern Engineering Research (IJMER), 4*(3), 28-29.

Ministry of Finance. (2018). *Economic Survey.*

NBSM. (2018). *Nepal Bureau of Standards and Metrology*. Retrieved from http://nbsm.gov.np/ne/

NRB. (2018). *Economic Activities Study Report.* Nepal Rastriya Bank.

TEPC. (2019). *Trade and Export Promotion Centre*. Retrieved from http://www.tepc.gov.np/

Trading Economics. (2018). Retrieved from https://tradingeconomics.com/nepal/indicators

WCA. (2019). *World Coal Organization*. Retrieved from https://www.worldcoal.org/

New Business Age (2017.03.26); Expert views on the Iron & Steel Industries in Nepal.

ANNEXES

ANNEX A: Team Composition

S.N	Name of Expert	Position in Team	Education	Experiences	Remarks
1.	Arun Dongol	Team Leader	B.E. Electrical and electronic	15 Years	ISO 9001:2015 certified Auditor
2.	Pom Raj Bhandari	Team Member	M.B.S	10 Years	ISO 9001:2015 Certified Auditor
3	Hari Prasad Subedi	Team Member	B.Tech (Food) M. Sc. Nutr. & Diet.)	10 Years	FSMS and ISO 9001:2015 certified Auditor
4.	Pradeep Raj Sitaula	Team Member	M.Sc. (Environment) M.A. Sociology	9 Years	ISO 9001, ISO 14001, ISO 22000 Certified Auditor
5.	Sabitra Bhandari	Team Member	B.Ed.	5 Years	Computer Expert

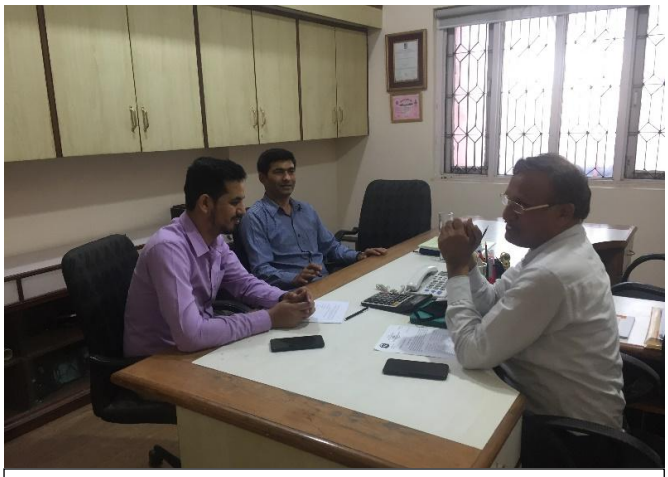
ANNEX B: List of TMT Manufacturing Industries of Nepal

S.N.	Industries	Province	District	Address	Contact Number	Remarks
1	Hulas Wire Industries Ltd.	1	Morang	Budiganga-03 Tankisinwari	021-420117	
2	Arati Stripes Pvt. Ltd	1	Morang	Tankisinwari	021-421262	
3	Kamala Rolling Mills Pvt. Ltd.	1	Morang	Biratnagar	021-526708	
4	Pashupati Iron and Steel Pvt. Ltd	1	Sunsari	Duhabi-08 Sunsari	021-572084	
5	Premier Steel Pvt . Ltd	1	Sunsari	Duhabi-02 Sunsari	021-524248	
6	Pathibhara Steel Pvt.Ltd	1	Jhapa	Birtamod-02 Jhapa	***023-545696***	
7	Ashok Steels Ind. Pvt Ltd	2	Bara	Jitpur Simara	053-520125	
8	Hama Iron and Steels Ind. Pvt.Ltd.	2	Bara	Simara Pipra	053-520088	
9	Jagdamba Steels Pvt. Ltd	2	Bara	Gadimai Bara	053-520300	
10	Shakha Steel Ind. Pvt. Ltd.	2	Bara	Gadimai Bara	9808245548	
11	Narayani Rolling Mills Pvt. Ltd	2	Bara	Chhatapipara, Bara	51-580499	Keyal Group started to produce TMT from Narayani Ispat and stopped the production from Narayani Rolling Mill
12	Shalimar Steels Pvt. Ltd	2	Bara	Rampur Tokni-03 Bara	051580410	Shalimar steel has stopped the production since last

						year.
13	Narayani Ispat Pvt. Ltd	2	Bara	Jitpur, Simara	51-418505	
14	Himal Steel Pvt. Ltd.	2	Bara	Bara	01-4253637 KTM	
15	Sarbottam Steels Pvt. Ltd	2	Bara	Bara	01-4111942 KTM	Under construction
16	Jagdamba Enterprises Pvt. Ltd	2	Parsa	Parsa	051-534441	
17	Godawari Steels Pvt. Ltd.	2	Rautahat	Chapur-09 Rautahat	01- 5537383 KTM	
18	Everest Rolling Ind. Pvt. Ltd	5	Rupandehi	Omsatiya- 02 Padsari ,Bhairahawa	071-421029	
19	Panchakanya Steel Pvt. Ltd	5	Rupandehi	Tilottama-15 Kotihawa	071-514168	
20	Goyanka Steels Pvt. Ltd	5	Rupandehi	Mayadevi-05 Semari Bhairahawa.	071-412013	
21	Ambe Steels Pvt. Ltd	5	Rupandehi	Mayadevi, Lumbini Road,Bhairahawa	01-4258128 KTM	
22	Ferro Steel Pvt. Ltd	5	Rupandehi	Omsatiya- 02 Padsari ,Bhairahawa	071-421029	
23	Shree Steel Pvt.Ltd.	5	Rupandehi	Rohini-03 Semara	071-620442	
24	S. R. Steels Pvt. Ltd	5	Rupandehi	Tilottama-16 Bihuli	071-514168	
25	Laxmi Steel Pvt. Ltd	5	Nawalparasi	Sunal-04 Charpala	071-620433	
26	Kathmandu Steel Pvt. Ltd	5	Nawalparasi	Sarawal-01, Tulsinagar,Basa	078-212143	
27	Siddilaxmi Steel Pvt. Ltd	5	Nawalparasi	Ramgram-10 Pokharapali	078-520359	

28	Vijayashri Steel Pvt. Ltd	5	Kapilbastu	Shivraj-06, Pipri	076-520026	
29	Bageshwori Iron and Steel Pvt. Ltd.	5	Banke	Parbatipur,Nepalgunj	081-529572	
30	Jay Bageshwori Rolling mills	5	Banke	Nepalgunj		
31	Jay Ambe Steel Pvt. Ltd	5	Bake	Nepalgunj	01-255551	Started trial production and applied for NS

ANNEX C: Field Study Photographs



Meeting with GM of Everest Rolling Mills Pvt. Ltd.

Meeting with Staffs of Kathmandu Steel Pvt. Ltd.

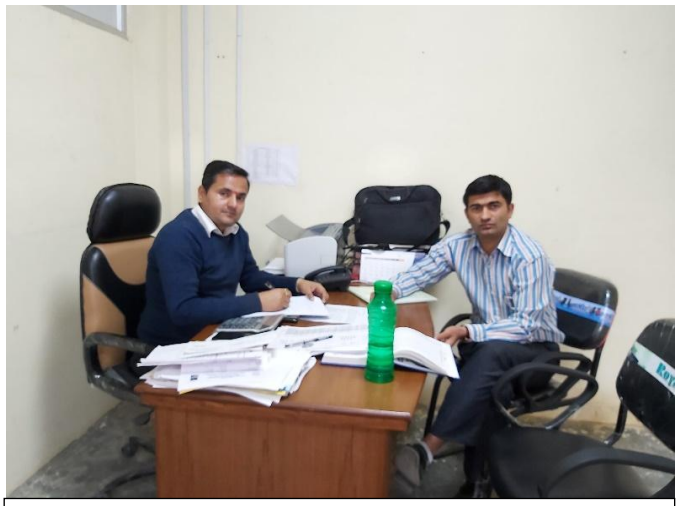
Meeting with GM of S R Steels Pvt. Ltd.

SR Steels Pvt. Ltd.

Meeting with GM of Laxmi Steels Pvt. Ltd.

Production floor of Laxmi Steels Pvt. Ltd.

Meeting with GM of Ambe Steel Pvt. Ltd.



Meeting with Operation Head of Siddhilaxmi Steel

Meeting with GM of Ambe Steel Pvt. Ltd.

Meeting with GM of Hulas Wire Industries Limited

Meeting with PM of Premier Steels Pvt. Ltd.

Report presentation in DOI

Meeting with Nepal Steels Rolling Mills Association

Meeting with Nepal Steels Rolling Mills Association

ANNEX D: Survey Questionnaire

Questionnaire for Study of TMT Bar Manufacturing in Nepal (for Industry)

(These questionnaire are prepared only for study purpose and collected information Shall be kept confidential, The study has been conducted on behalf of department of industry and the program is also sponsored by DOI)

Please fill up or tick (√) mark in the relevant answer.

Section 1: Introduction

1.1 Name of Organization:…….

1.2 Registered Office

a) Province…….. b) District……..c) Metropolitan city /Sub metropolitan city/ Municipality/Rural Municipality……

d) Ward No…….. e) Place…….f) Tel……..…

g) E. mail……

1.3 Factory

a) Province…….. b) District…….. c) Metropolitan city /Sub metropolitan city/ Municipality/Rural Municipality…….……

d) Ward No…….. e) Place…….f) Tel……..

g) E. mail……

1.4 Legal Registration

a) Proprietor b) Partnership c) Private Limited d) Company Limited

1.5 Type of Organization.

a) Small b) Medium c) Large

1.6 Authorized person (Top Management)

a) Chairman/MD/Director ..... Contact No:……

b) CEO/GM/FM .....Contact No:……

1.7 Brand Name of Your TMT Bars……

1.8 How do you identify and traceable your products ……

……..……

Section 2: Investment

2.1 Capital

a) Fixed Capital Rs. ..... b) Working Capital Rs. .....

c) Total capital Rs. .....

2.2. Source of Investment

a) 100% Equity b) .....% Loan & .....% Equity c) 100% Foreign Investment

d).....% Internal ..... % Foreign Investment

Section 3: Production Capacity

3.1 Approved Production Capacity.....

3.2 Actual Production Capacity .....

3.3 Existing Running Capacity.....

3.4 Used Capacity (capacity Utilization) on %.....

3.5 Annual Consumption (Sales).....

3.6 Variation between annual Production & consumption (Sales).....

3.7 Storage Capacity……..

3.8 Production Management in low demand.....

3.9 **Production Management in High demand.....**

Section 4: Human Resource

4.1 Type & Number of Human resource

Particular	Administrative	Technical/Skilled	Non Skilled	Other	**Total**
Permanent					
Contract Basic					
Daily Wages					
Total					

4.2 Are there any outsourced employee?

a) Consultant …..... b) Through outsourced provider agency…… c) Other ……...

4.3 Are administrative manpower easily available?

a) Yes b) No c) If no how you appoint/source……

4.4 Are technical manpower easily available?

a) Yes b) No c) If no how you appoint/ Source .....

4.5 Are non technical manpower easily available?

a) Yes b) No c) If no how you appoint/ Source .....

4.6 How you develop the employee Competency?

a) Internal training b) External training c) Both training d) other if any…

4.7 How many employ attended training…….....Parentage in total employed?

4.8 How many budget do you allocate for employee Competency Rs..... Annually?

Section 5: Electricity Consumption

5.1 Demand Electricity…….....KVA

5.2 Capacity of Transformer…….....KVA

5.3 Capacity of Generator/type……

5.4 Source of Energy Consumption (Kw/Year)

a) NEA..... b) Diesel..... c) Other…… d) total.....

5.5 Do NEA provide sufficient electricity to factory?

a) Yes b) No c) If no other source of energy in %.....

5.6 Do you have applied any mechanism to minimize energy consumption ?

a) Yes b) No c) If yes what is method……

Section 6: Raw Material

6.1 Required Annual Raw material and quantity

a) MS Billet……MT b) Ingot……MT c) Furnace Oil ……Ltr.

d) Coal……MT e) Diesel…… f) Other…….

6.2 Do you manufacture Billet?

a) Yes b) No c) if yes Quantity.....

6.3 Do you manufacture Ingot?

a) Yes b) No c) If yes Quantity.....

6.4 Use of raw material (MS Billet & Ingot)

a) Own production .....MT.....Percentage

b) Local Supplier.....MT.....Percentage

c) Other country .....MT .....Percentage

6.5 Do you sale Raw material & Where ?

a) Nepal.....MTb) India.....MT c) Other.....MT

6.6 Procurement of Raw material (MS Billet)

a)Nepal.....MT b) India.....MT c) Other Country……

If you purchase from third country please mention the name and quantity of other country.

Country	Quantity (MT)	Country	Quantity (MT)

Section 7: Technology Adopted

7.1 Import of machinery/mill and country

a) ……

b) ……

c) ……

7.2 Used Technology

Activity	**Technology Used**		
Production	Auto	Manual	Other
Bundling.	Auto	Manual	Other
Loading	Auto	Manual	Other
Unloading	Auto	Manual	Other

Section 8: Quality Related

8.1 Type of TMT

a) Fe 500 b) Fe 500D c) Fe.500 E d) Other……

8.2 Certified product standard

a) NS. 191 b) IS. ……..... c) Other……

8.3 Management System Certification

1) Quality Management System Certification(ISO 9001 :2015)
2) Environmental Management System (ISO 14001:2015)
3) Occupational Health and Safety Management System (ISO 45001:2018)
4) Energy Management System (ISO 50001)
5) Integrated Management System.

8.4 What are the Challenges to maintain the Quality?

a) .....

b) .....

c) .....

Section 9: Market Management

9.1 Main Market

a) ..... b) ..... c) .....

d) ..... e) .....

9.2 Advertisement

a) Newspaper b) T.V. c) FM d) Hording Board/banner

e) Social Media f) Other.....

9.3 Sales System

a) Through distributers b) Whole Seller c) Retailer d) Project Sales

9.4 Annual Sales.

a) Distributors .....% b) Dealer .....% c) Project ……..% d) Other…....

9.5 Major project sales in last two years

Fiscal Year	**Name of Project**	**Sales (MT)**	**% of Annual sales**

9.6 Production and Supply

Fiscal Year	Annual Production (MT)	Annual Sales (MT)	Different (MT)	Remarks
FY 2071/072				
FY 2072/073				
FY 2073/074				
FY 2074/075				
FY 2075/076				

Section 10: Price Related

10.1 Do you think price of TMT in Nepal is appropriate ?

a) Yes b) No c) Other……

10.2 Do you feel that Price of TMT Bar is comparatively same between the Industries?

a) Yes b) No c) Other……

10.3 Is the Price of TMT Bar determine by demand and supply?

a) Yes b) No

10.4 How the price of TMT are determined?

1. Demand and Supply 2. Organization Itself3. By Association 4.Government 5.Other……

10.5 Factor affecting price of TMT Bars

a) Production cost b) Demand and supply c) Price of TMT in International market d) Price of competitors e) Fluctuation of Raw material Price in international market f) Others. …….

10.6 How much profit do you add in your production cost .....%

10.7 Is TMT Bars Imported from other Country?

a) Yes b) No c) If yes from where.....

Section 11: Financial Status

11.1 Profit/Loss in last Five Years

Fiscal Year	Profit (in Amount)	Profit in % (As per sales)
FY 2071/072		
FY 2072/073		
FY 2073/074		
FY 2074/075		
FY 2075/076		

11.2 Facility Provided by Nepal Government to TMT Bars Manufacturing industries

a) .....b) .....

c) .....d) .....

Section 12: Environment Related

12.1 Do you have Conducted IEE/EIA?

a) IEE b) EIA c) Others……

12.2 What method do you follow to minimize environmental Impact by Factory?

a) .....

b) .....

c) .....

d) .....

12.3 Do you have faced any environmental Complaint?

a) Yes b) No c) If yes from where .....

Section 13: Relation and coordination with Government

13.1 Are Government policies helpful to develop the Industries ?

a) Fully helpful b) Partially Helpful c) Not Helpful

13.2 What do you expect from following Government Bodies ? Suggestion for Government Bodies?

a) Company Registration Office……

b) Department of Industry……

c) NBSM……

d) IRD……

e) Custom office……

f) NEA……

g) Others if any……

Section 14: Challenges Faced by Industry

14.1 Internal challenges

a) .....

b) .....

c) .....

d) ……

14.2 Due to Governmental (Policy and rules/ regulations)

a) .....

b) .....

c) .....

d) ……

14.3 Due to Technology Changes

1) .....

2) .....

3) .....

4) ……

14.4 Due to establishment of large Plant/ Industries.

1).....

2) .....

3) .....

4) ……

14.5 Due to Import of TMT Bars

a) .....

b) .....

c) .....

d) ……

14.6 Lack of Consumer Awareness

a) .....

b) .....

c) .....

d) ……

Section 15 : Any Suggestion

a) .....

b) .....

c) .....

d) ……

e) ……

f) ……

Authorized Representative:…… Signature:-…….

Designation: …….. Date:…….. Company Seal:

…….. END……

Questionnaire for Study of TMT Bar Manufacturing in Nepal (for Association)

(These questionnaire are prepared only for study purpose and collected information Shall be kept confidential, The study has been conducted on behalf of department of industry and the program is also sponsored by DOI)

Please fill up or tick (√) mark in the relevant answer

1. **Total TMT Factory Operation in Nepal……**

2. **Existing Demand of TMT Bar in Nepal .....MT/Per Year**

3. **Fulfillment of Demand**

   a) Nepalese Industries……% b) India……% c) Others……%

4. **Demand of TMT in Last Five Years and Future Five Years.**

Last Five Years		Future Five Years	
Fiscal Year	**Quantity (MT)**	**Fiscal Year**	**Quantity (MT)**
2071/072		2076/077	
2072/073		2077/078	
2073/074		2078/079	
2074/075		2079/080	
2075/076		2080/081	

5. **Is TMT Bars exported ?**

   a) Yes b) No

   If yes where and how much annually.....

6. **Why TMT Industries are going to be Increased ?**

   1) .....

   2) .....

7. **Are all established Industries Sustain?**

   a) Yes (give reason)……

   b) No (give reason).....

8. Do Nepalese industries export TMT Bars ?

a) Yes b) No

If yes where and how much annually.....

9. What are the facilities Nepal Government should provide to increase the export of TMT Bar?

a) .....

2) .....

3) .....

10. Is rate of Nepalese and imported TMT Bar same?

a) Yes b) No c) if Different (how much).....

11. What improvement should be made to develop and sustain the TMT manufacturing Industries?

11.1 From Government Level/Policy level

a) .....

b) .....

c) .....

11.2 From Association Level

a) .....

b) .....

c) .....

11.3 From Industry Level

a) .....

b) .....

c) .....

12. Is there any possibility of Raw material availability for future in Nepal ?

a) Yes b)) No

If Yes give reason……

13. Any Suggestion

a).....

b).....

c).....

d) ……..……..

e) ……..……

f) ……..……

Authorized Representative:…… Signature:-…….

Designation: …….. Date:…….…… Seal:

…….END……

ANNEX E: Nepal Standard (NS 191)