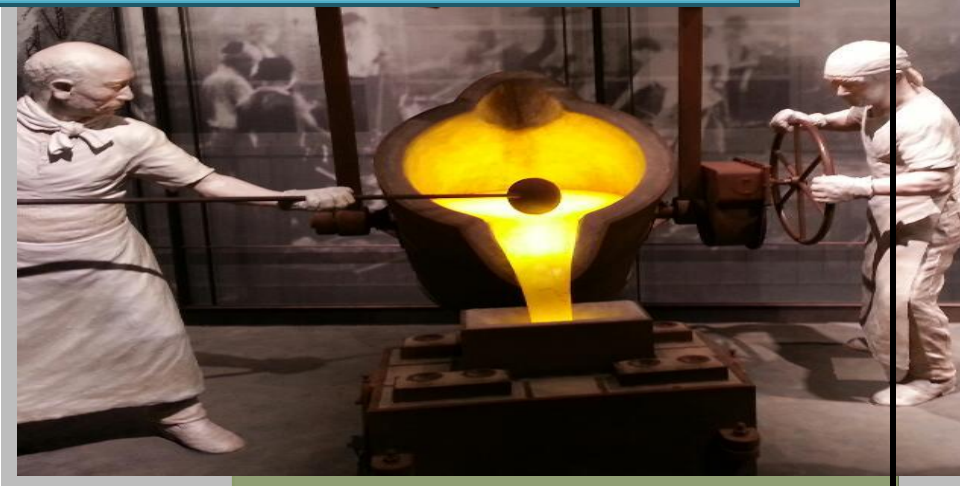


**DIAGNOSTIC SURVEY REPORT
FOR
SMALL-SCALE FORGING & FOUNDRY
INDUSTRIES
IN
NORTH EASTERN STATES & SIKKIM**



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1 INTRODUCTION

1.1 Background

Micro, Small and Medium Enterprises have been accepted as the engine of economic growth and for promoting equitable development all over the world, especially in India in view of second highly populated country in the world. Micro and small scale enterprises have existed in North East Region since ages in the form of traditional skills.

The North Eastern Region (NER) of India comprising of eight states-Assam, Arunachal Pradesh, Meghalaya, Mizoram, Nagaland, Tripura, Manipur and Sikkim is almost ten years behind the rest of India. The region is blessed with plenty of natural resources like forest and oil, tea, water (which is very scarce in most parts of India) etc, but there exists a resource slack.

It is often said that the North East offers immense potential for growth on Micro Small and Medium Enterprises (MSMEs). The geographical location which has so far been regarded as the bane of northeast has become a boon for the region with the changing policies of the government and emphasis on look east policy. The market is likely to experience considerable expansion when this materialises and therefore it is necessary that the region gears itself up to face the challenge and grab the opportunity .There is therefore need to identify areas where the region has the potential for growth.

A closer look at the status of MSME's in North East reveals that there has been a slow but steady growth of the MSME sector and along with this there has been a high incidence of sickness. Therefore, determining the factors that have held back the growth becomes important. The problems that are being experienced by the MSME units of the region include problems related to availability of credit, high cost of operation, erratic power supply, lack of infrastructure, inadequate market linkage etc.

The focus therefore needs to be on minimisation of problems if not their elimination and optimisation of the positive environment so that the growth of the sector becomes possible. To prop up the economic growth of the north-eastern region the small scale industries need to traverse a defined path that takes into its fold the diverse form of resources and demand that exist in the region. In the present day economic equations, the development of the different sectors are interdependent and so the MSME growth process in the northeast also need to take cognizance of this fact. Therefore when the growth prospect of MSME is looked into, it cannot be considered in isolation and it is seen that when development in the comprehensive manner is considered, the region offers vast opportunities for the sustenance of the MSME sector. The need is to optimally utilise this growth potential. As such it can be emphasised that such a comprehensive growth process is not only going to aid the MSME sector to flourish but at the same time bring about multi-dimensional effect on the economic front.

1.2 Objectives

The primary objective is to overcome some of the key challenges by promoting existing forging and foundry sector MSMEs of the North-Eastern States. The survey proposes to achieve the objectives through the following strategic inputs:

- Cluster based approach to strengthening production capabilities of Foundries/Forging and Metal craft Enterprises in the North east region.
- Encourage peer to peer interactions for sharing of good manufacturing practices.
- Use Interactive tools for operationalizing an interactive platform for knowledge exchange
- Benchmark selected Enterprises of the region to country's best similar cluster in similar product category and develops appropriate indicators for measuring progress.

1.3 Methodology

The study is based on secondary sources of data collected from Annual reports of MSMEs, Govt. of India, Economic survey of North East Region. The collected data is analysed with the help of percentage method and also the compound growth rate has been estimated by using log lin model.

The expected key results under the project are:

- Enhanced Scope/Business opportunity and capacity of the selected MSMEs for competitiveness using cluster-based approach. The backward sectors such as Forging, Foundry and Metals Crafting etc. would be the focus of the Survey.
- Benefit to at least two clusters each in the states of North East Region initially.
- Proposals based on local resources availability and comparative advantage of the identified clusters prepared and disseminated to prospective entrepreneurs.
- Knowledge ecosystems for faster replication and scaling strengthened and knowledge platform for promotion in the region established;
- Additionally, Proposed a Common Facility Centre for of North-East Region for promoting forging and foundry units.

1.4 Scope of the Study

The study seeks to strengthen MSME units in the region by leveraging all opportunities emerging from the Government of India's Act East Policy, as well as growing recognition of the long term advantages of export-led growth in alleviating poverty and sustainable development. The survey seeks to strengthen existing MSMEs, as well as encourage first generation entrepreneurs to set up green-field projects and support them to get off the ground.

Based on this framework, the report tries to objectify as follows:

- Identify factors of location of enterprises that may be relevant for the metal industries in terms of input, markets and clustering benefits
- Examine current scenario of metal industries in the country *vis-à-vis* NE states with respect to turnover, profitability, employment, investment, geographic advantages/ disadvantages
- Govt. schemes/ support services to promote small and micro enterprises
- Analysis of Strength, Weaknesses, Opportunities and Threats (SWOT)
- Action plan/ Road Map in terms of policy initiatives, soft and hard interventions, infrastructure and state govt. schemes
- Suggest potential candidate industries focussed on small scale Foundries/ Forging and Metal Craft Enterprises.

2 POTENTIAL OF THE REGION

2.1 Introduction

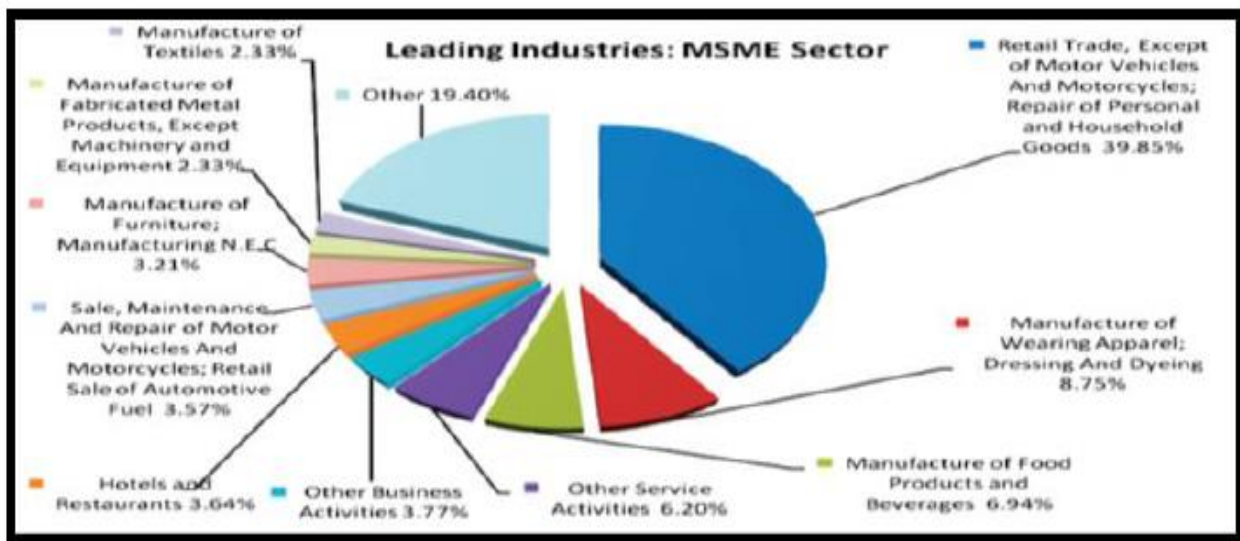
The impact of neo-liberal globalization on small and medium enterprises (SMEs) has received a lot of attention in macro-economic policy discourses in the past few years. Today, globalization is a major driver that has impact on nearly every business. One of the reasons for the international focus on SMEs is that these firms make significant contributions to the economy of both developed and under-developed countries. In Middle and East Asia for example, SMEs are major players in their countries economy; accounting for a higher percent than what it represents in the developing countries. Many SMEs are now looking to „go global“. However, most SMEs are finding it difficult to join the race, resulting in heavy losses. As is well-known, Globalization has increased competitive pressures on firms. Together with rapid technological change it has altered the environment in which SMEs operate. The bottom line is that, in an open and liberalized world, increasing SMEs competitiveness has become a major challenge. Compared to larger firms, Small and Medium-sized Enterprises (SMEs) are generally less well-equipped to face increases in international trade. As a result of their lower productivity, many have found it difficult to compete. Also, given their limited resources, they have found it more difficult to take advantage of the removal of tariff barriers. In addition they lack the economies of scale which results in lower cost per unit for the multi nationals. Pricing could be a challenge since the smaller firms are likely to have high costs per unit. Larger firms have the capacity to undercut the smaller firms prices as a consequence of this competition between smaller and large firm would erode margins of smaller firms and some of them would end up making loses and winding up. It would be difficult for smaller firms to attract a highly skilled work force because multi nationals have the capacity to pay better packages as they will have more financial resources. This would pose a challenge for smaller firms to operate efficiently and effectively. This paper attempts a critical appraisal of the micro, small and medium enterprises (MSMEs) in globalizing India with a focus on North East India.

The North Eastern Region (NER) in India, consisting of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura has abundant natural resources which can be utilized for all round economic development and employment generation in the region. The Ministry of Micro, Small and Medium Enterprises (MSME), Government of India and concerned State Government is actively promoting the development of MSME and Khadi and Village Industries (KVI) in the NER through the programmes and schemes implemented by the Ministry and its Departments.

2.2 MSMEs in India

The Micro, Small and Medium Enterprise sector is crucial to India's economy. There are 29.8 million enterprises in various industries, employing 69 million people. The sector includes 2.2 million women-led enterprises (~7.4 %) and ~15.4 million rural enterprises (51.8 %). In all, the MSME sector accounts for 45 % of Indian industrial output and 40 % of exports. Although 94 % of MSMEs are unregistered, the contribution of the sector to India's GDP has been growing consistently at 11.5 % a year, which is higher than the overall GDP growth of 8 %. The State-wise distribution of MSMEs show that more than 55% of these enterprises are in 6 States only, namely, Uttar Pradesh, Maharashtra, Tamil Nadu, Gujarat, Andhra Pradesh and Karnataka. Only about 7% of MSMEs are owned by women; and more than 94% of the MSMEs are proprietorships or partnerships. MSMEs in India manufacture over 6,000 products, comprising of Food Products (22%), Chemical & Chemical Products (12%), Basic Metal Industries (10%), Metal Products (8%), Electrical & Machinery Parts (6%) and others (36%).

Figure 1: Distribution of MSMEs in India



2.3 MSMEs in North East India

The eight North East States which cover 263179 Km² of area that is 8% of India's total area face a number of critical developmental challenges. The region is characterized by low per

capita income, low capital formation, inadequate infrastructural facilities, communication bottleneck and geographical isolation from the mainstream.

The SME sector is one of the fastest growing industrial sectors all over the world and has been showing outstanding performance over many decades as a highly vibrant and dynamic sector of the Indian economy. Medium and Small Scale industries not only play a vital role in providing a wide variety of employment opportunities at a lower capital cost but also provide assistance in industrialization of rural and backward areas like the North East of India, thereby reducing regional imbalance and assuring more equitable distribution of national income and wealth.

Today, in India, the SME sector accounts for 95 per cent of the industrial units and contributes more than 40 per cent of value addition in the manufacturing sector and about 35 per cent of exports (both direct and indirect). It is estimated that about 20 million people are employed by this sector, which is second only to agriculture.

The SME sector plays a very vital and significant role in the economy of the North East region. It is an important instrument for enterprise building, income and employment generation and asset creation. However, in order to attract more investments to the region and to ensure continuity and sustainability, infrastructures like power, industrial areas, communication, roads, railways, quality manpower etc. need to be improved considerably.

Table 1: Details of MSMEs in North East Region including Sikkim

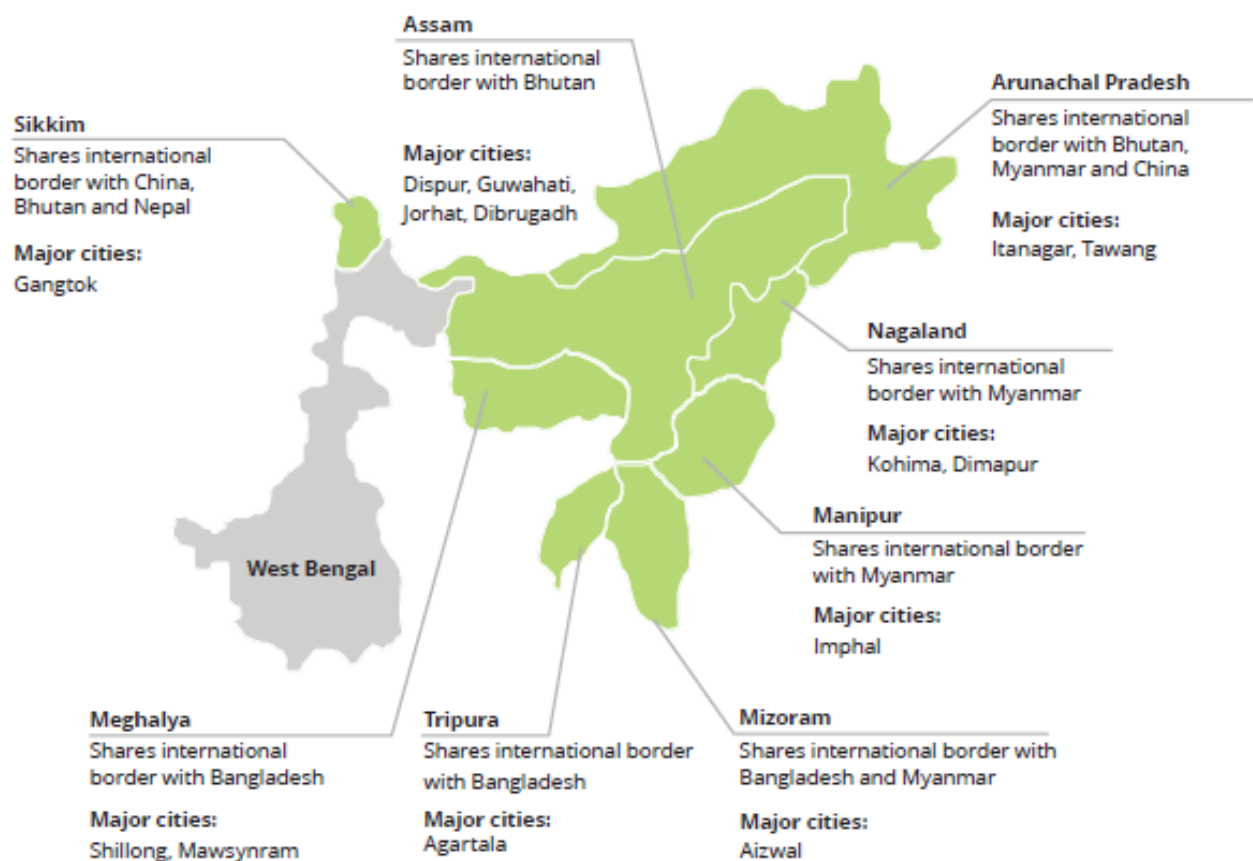
S.No.	State	Number of MSME (in lakh)
1	Sikkim	0.17
2	Arunachal Pradesh	0.41
3	Nagaland	0.39
4	Manipur	0.91
5	Mizoram	0.29
6	Tripura	0.98
7	Meghalaya	0.88
8	Assam	6.62
Total		10.64

In the present scenario, MSMEs on the one hand have access to far greater market and better technology and resources, while on the other hand globalisation has resulted in an environment of highly competitive local markets with imports from other countries flooding local markets and threatening the very existence of local MSMEs by offering better quality products, sometimes at cheaper rates. Clustering is a powerful tool that MSMEs may use to combat the challenges of globalisation.

2.4 Geographical perspective:

North East India comprising the eight States of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, and Sikkim covers an area of 262,000 sq. km. It comprises 7.8% of the land area of the country. The largest state in terms of the area is Arunachal Pradesh which occupies an area of 83,743 sq. km followed by Assam which occupies an area of 78,438 sq. km. The smallest of all the 8 states is Sikkim which has an area of 7,096 sq. km.

Figure 2: Geographical view of NE Region



The region shares international boundaries with China to the North, Bangladesh to the South West, Bhutan and Nepal to the North West, and Myanmar to the East.

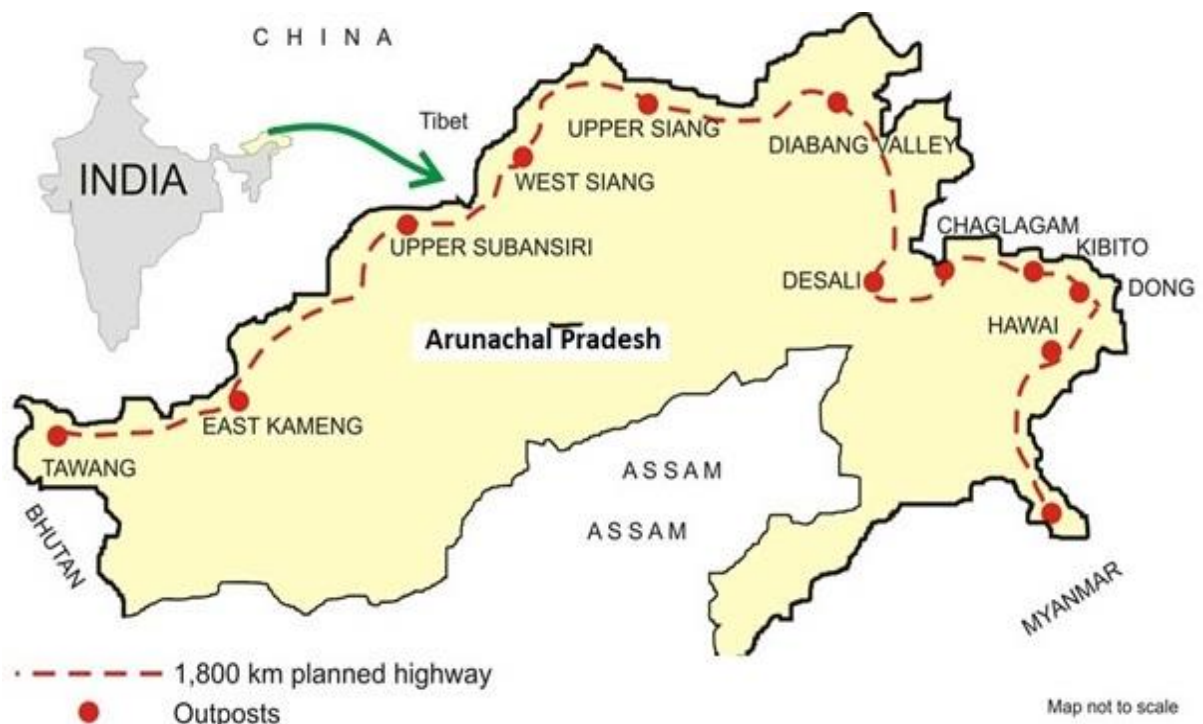
2.4.1 The North Eastern States at a Glance:

I) Arunachal Pradesh

Arunachal Pradesh the 24th state of the Indian Union, is bounded by Bhutan to the west, Myanmar to the east, China to the north and north-east and the plains of Assam to the south. Arunachal is the largest state (area-wise) in the North-East Region.

Arunachal Pradesh is known for its tourist attractions and the largest Buddhist monasteries in India. In the recent times, Arunachal has experienced some major industrial advancement, as many big players have come to recognize the potential of the state and have started investing in the various industrial sectors. The traditional jewellery from the north eastern India which are not only remarkable but also distinctive are being produced in Arunachal.

Figure 3: Geographical view of Arunachal Pradesh



The major industrial domains that Arunachal Pradesh boasts of right now include Weaving, Wood Carving, Cane and Bamboo, Ornaments and Tourism industry. Cottage units for metal crafts and ornamental beads are a possibility.

II) Assam

Assam shares its borders with Arunachal Pradesh, Nagaland, Manipur, Mizoram, Meghalaya, Tripura and West Bengal. The state also shares international borders with Bangladesh and Bhutan. Assam is India's gateway to Northeast India and acts as a vital link for trade with Southeast Asian countries. The state is best known for its tea, petroleum resources, silk and bio-diversity. Assam is the largest and most accessible of the north east India states and also the third-largest producer of petroleum and natural gas in the country and has ample reserves of limestone. The Key industrial sectors are: Tea, Energy (Coal, Oil, Gas and small

Hydroelectric Power Projects), Limestone and Cement. Food processing, horticulture and tourism, medicinal herbs/ plants and sericulture are some of the other promising sectors.

Figure 4: Geographical view of Assam



Assam is one of the most vibrant states in the North Eastern region of India and is full of most of the important natural resources that attracts the attention of many investors to set up their production and manufacturing units in the state. Assam offers a range of lucrative business opportunities in the region. Both the central and state governments have allowed exclusive incentives Assam. These include enormous subsidies to support power, transportation, land and infrastructure development for setting up businesses in the state. Assam is blessed with abundant river waters, huge hydrocarbon potential, large quantities of low ash coal resources, limestone and dolomite deposits. The natural climate of Assam is encouraging for plantation crops, tea and rubber. Some of the forest resources available in the state including bamboo, medicinal herbs and wood, which are utilised for setting up of forest-based industries.

Assam is famous for its wide range of cottage industries. Most of these are in the field of spinning and weaving. The key expertise lies in the production of pure silk. Assam produces about 10% of total natural silk of India. There are more than 7,00,000 looms in the state. Majority of these looms are primitive foot looms. This gives a very unique identity to the weaving and spinning industry in Assam. Bell-metal work is another traditional cottage industry of Assam. The various products made of bell-metal include traditional plates, cups, tumblers, pitchers, bowls, pots, hookahs and musical instruments. Brass-work is also an important traditional handicraft of Assam.

III) Nagaland

Nagaland, which shares a border with Myanmar is relatively less developed in the industrial production. Bamboo and cane based handicrafts/ jewellery, wood and metal craft, blacksmith,

furniture, textile/ handloom/ embroidery items and processed foods are the major activities. These products are highly demanded for export market also.

Figure 5: Geographical view of Arunachal Pradesh



IV) Manipur

Manipur, located on the far north east border below Nagaland. Its capital, Imphal, is surrounded by wooded hills and lakes. Manipur has recently begun taking steps to develop its tourist potential.

Figure 6: Geographical view Manipur



The available minerals which can be exploited for commercial applications are Limestone, Chromite, Nickel, and Copper. Artisan and skill development training programmes are offered by Dept. of Industries and Commerce on various trades including Foundry and Blacksmith. Indo-Myanmar Border Trade mechanism help accelerate trading between the two countries on exchangeable items basis.

Manipur Industrial Development Corporation Ltd., Manipur Handloom & Handicraft Development Corporation Ltd., Manipur Food Industries Corporation Ltd., Manipur Cycle Corporation Ltd., Manipur Cements Ltd., Manipur Spinning Mills Corporation Ltd., Manipur Drugs and Pharmaceuticals Ltd., Manipur Pulp & Allied Products Ltd. are some of the state controlled industries in Manipur. These sectors and handloom clusters require large no. of foundry and die-cast metal products and components on recurring basis.

III) Meghalaya

Meghalaya shares its border with Assam and with Bangladesh. Capital Shillong was a popular hill station during colonial times.

Meghalaya has a long international boundary with Bangladesh which sets a unique advantage of setting up of industries based on demand in that country. All units will have an advantage on account of low cost of product transportation.

Figure 7: Geographical view Meghalaya



Agriculture and food processing, floriculture, horticulture, honey processing, mining, cement, tourism, hydroelectric power, handlooms, handicrafts and sericulture.

Meghalaya, with abundant deposits of coal, limestone, kaolin feldspar, quartz, granite, industrial clay and uranium and a small deposit base of siliminite, bauxite, base metals and apatite has great industrial potential.

The Department of Commerce and Industries plays developmental and facilitation role to attract industrial investments in the state. It focuses on creating an industry friendly environment and formulation suitable policies in the State aimed at propelling fast pace modernization and strengthening of industrial units.

Meghalaya has an ideal location advantage for South East Asia Market. The neighbouring countries of India - Bhutan, Bangladesh, Myanmar has been involved with the state for business and commerce. It has a huge potential to reach other South Asian countries as well. Meghalaya is also geographically rich in minerals and has the potential for industrial setups based on these mineral resources. Types of Industry that can be ideally formed in the state are Mineral based Industry, Horticulture and Agro-Based Industry, Electronics and Information Technology, Export-Oriented Units, Tourism.

IV) Mizoram

Mizoram with Aizawl as its capital city has stunning landscape with dense bamboo jungles, rivers, and lush paddy fields. Mizoram will hold a great deal of appeal for nature lovers.

Mizoram is a highly literate agrarian economy. The key sectors are Bamboo, energy, sericulture agriculture and horticulture, tourism, food processing, IT and medicinal plants.

Figure 8: Geographical view Mizoram



The Department of Trade & Commerce oversees the Border Trade; to establish Border Trade Points as it has long international border mainly with Myanmar and Bangladesh. Access to

these two countries can provide access to South-East Asian Countries. Manufacture and sale of agricultural implements can be considered. However, the industrial potentialities need to be explored.

V) Tripura

Tiny Tripura, almost surrounded by Bangladesh. It shares borders with Bangladesh, Mizoram and Assam. Heavily forested, it's renowned for its vast array of bamboo products. Handloom weaving is also a significant industry there.

Figure 9: Geographical view Tripura



Rubber Park, Food Park, Bamboo Park and Export Promotion Park are some of the projects undertaken by the state-owned Tripura Industrial Development Corporation (TIDC). Tripura Natural Gas Company Limited deals with natural gas as an alternative fuel to gasoline/LPG/other conventional fuel in the transport sector.

Rubber, Food Processing, Tea plantation and processing, IT and Bamboo are the major clusters while the major items of export are spices, paper products, fresh fruits etc. Increasing linkages on Trade & Commerce with Bangladesh is one of the policy objectives of the Govt. of Tripura. The "Investors' Facilitation Cell" is in place to facilitate all the new and existing entrepreneurs who have already set up/ wish to set up industries in the Industrial Areas/ Estates developed and maintained by TIDC Ltd.

With the vision to make Tripura as the hub of bamboo based sustainable micro, small and medium industries in the country Tripura Bamboo Mission (TBM) has been set up by the

Government of Tripura. Integrated development of bamboo sector in the state is the major objective, to be achieved through cluster development approach. The TBM aims to provide critical production and commercial infrastructure, technology, marketing support, capacity building and product diversification, to build competitiveness and ensure sustainable development of the clusters.

VI) Sikkim

The State of Sikkim recognized as part of northeast India bordered by China, Nepal and Bhutan. The mountainous beauty and ancient Tibetan Buddhist culture in Sikkim are star attractions. Tourism is the backbone of Sikkim's economy. However, Agriculture is the major economic activity and is practiced on terraced fields. Horticulture, Forest produces; Mining Industries, Liquor Industry and Aqua Culture are some of the commercial activities in Sikkim.

Figure 10: Geographical view Sikkim



The State has a reasonable potential for industry in areas where the state enjoys a comparative advantage. The major endowments of the State are its nature and natural resources. The State has also a huge potential for hydel power. The prospect of opening up of the border trade poses both challenges and opportunities for the State. It is in this context that the importance of industry and trade lies in optimal use of its resources and to realize the State's potential of industry and trade. Sikkim has potential to become a vibrant economy based on private sector initiative, enterprise and entrepreneurship.

The state has a good resources base of minerals like zinc, lead, copper, dolomite, coal, quartzite, graphite, talc etc. Commercial exploitation of some of these minerals is being carried out by the Sikkim Mining Corporation.

The absence of profitable marketing network and the lack of appropriate processing facilities for manufacturing quality finished products have resulted in most of the products being sold at uncompetitive prices to other states as raw material. Like other NE states, the traditional, cottage industries and handicrafts enjoy a good national and international market.

The state Government has identified certain thrust areas for concerted industrial development activities. It is reported that Agro-based industries, Animal husbandry and dairy products, forest products, Handloom, Handicrafts, Tea industries and Tourism will be given priority. It strives to put thrust on precision-oriented, high-value and low- volume products, Electronic and Software.

3 EXISTING SCENARIO AND CONSIDERATIONS OF FEASIBILITY

3.1 Forging Industry

The forging industry is a key link between critical manufacturing segments--metal suppliers (both ferrous and nonferrous) and end user industries.

Forging units are usually classified basis the installed capacity of the forging unit. The forging units may be classified on the basis of physical capacity.

1. Very Large (capacity above 75,000 tpa)
2. Large (capacity between 30,000 and 75,000 tpa)
3. Medium (capacity between 12,500 and 30,000 tpa)
4. Small (capacity between 5,000 and 12,500 tpa)
5. Very Small (capacity below 5,000 tpa)

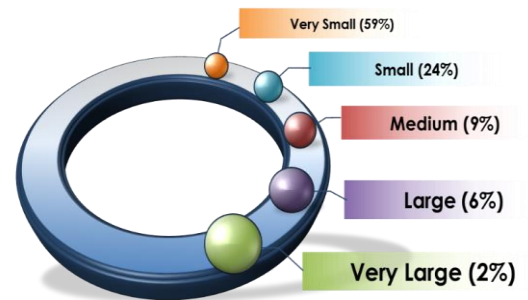


Figure 11: Capacity wise forging Industry

Based on this classification 87 % of the total number of units falls under the small and very small category, while only about 5 per cent are large and very large units. The balance of about 8 % constitutes the medium sized units.

Over the years, the Indian forging industry has evolved from being a labour-intensive industry to capital-intensive manufacturing sector.

The forging industry of India provides direct employment to about 95,000 people. The small and very small units are mainly dependant on manual labour, however medium and large units are more mechanized. Quality standards in the industry have improved significantly and the sector is now well known globally for its high quality. Current share of auto sector is about 58% of total forging production while the rest is with the non-auto sector. Changes in Indian automobile industry directly impact Indian forging industry, because the forging components form the backbone of the Indian automobile industry.

Since the automobile industry is the main customer for forgings the industry's continuous efforts in upgrading technologies and diversifying product range has enabled it to expand its base of customers to foreign markets. The Indian forgings industry has made rapid strides and

currently, not only meets almost all the domestic demand, but has also emerged as a large exporter of forgings.

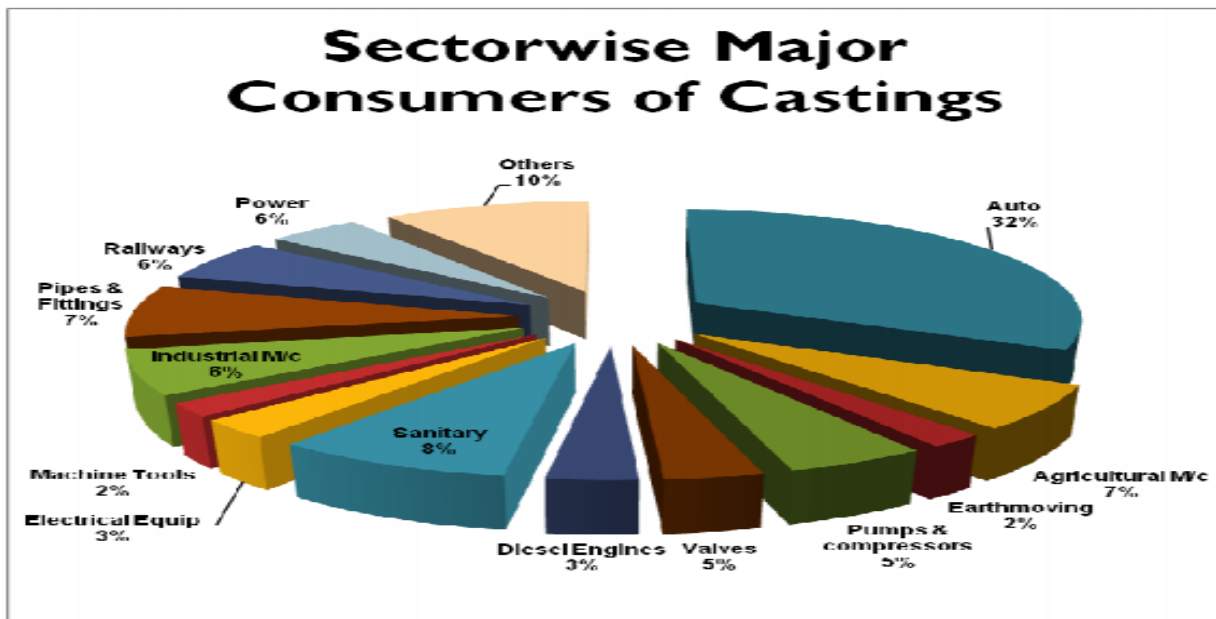
The industry is increasingly addressing opportunities arising out of the growing trend among global automotive OEM's (Original Equipment Manufacturers) to outsource components from manufacturers in low-cost countries. As a result, the industry has been making significant contributions to country's growing exports.

The forging industry needs to leverage the market opportunity through focused approach on increasing productivity, upgrade of technology rather than mere capacity expansion. The industry has to constantly look for opportunities to increase productivity. The future of the industry does not look as dismal as it was 2-3 years back.

3.2 Foundry Industry

Small and medium scale foundry industry is a vital part in the Indian industries and would keep on playing an important part in the Indian economy later on. It has been watched that a many of the small scale industry in this area today, are not intrigued with innovative upgrades and their quality, effectiveness and because of this benefit have really declined throughout the years. Globally, numerous new organizations are coming into the field and the competition is currently expanding rivalry from bigger units. To stay in the market the units thus, need to embrace more up to date and innovative ways to deal with update their technological capacities and hence stay focused. The small scale units, in any case, have constrained limit and assets to put resources into the innovative capacity improvement. The contextual analyses in the small scale areas easily demonstrate the advantages of vitality effective process.

Figure 12: Sector-wise consumption of Casting



The Indian foundry industry manufactures metal cast components for applications in Auto, Tractor, Railways, Machine tools, Sanitary, Pipe Fittings, Defence, Aerospace, Earth Moving, Textile, Cement, Electrical, Power machinery, Pumps / Valves, Wind turbine generators etc. However, Grey iron castings have the major share i.e. approx. 68% of total castings produced.

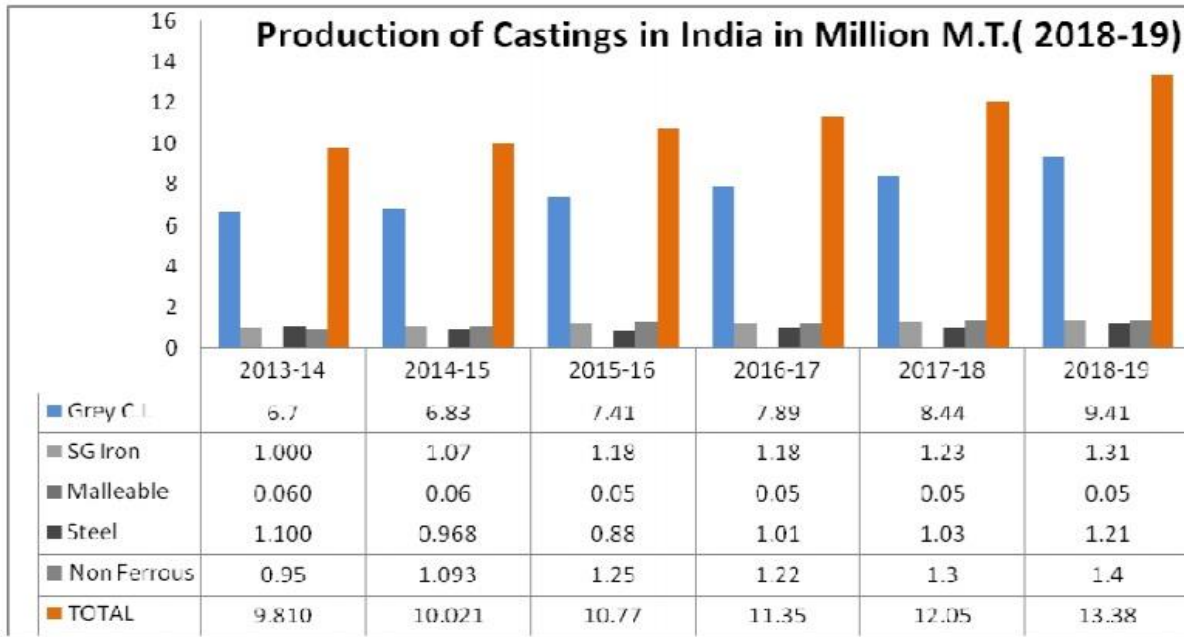
There are approx. 5000 units out of which 90% can be classified as MSMEs.

India is the world's third-largest casting producer after China and the U.S. While China accounts for 40% of the world's 105 million tones casting production, the U.S. and India each do between 11 and 12 million tones per year.

3.2.1 Role in Manufacturing Sector:

The new manufacturing policy envisages the increase in the share of manufacturing in the GDP to 25% from current 15% & to create 100 Million additional jobs in next 10 years. Since all engineering & other sectors use metal castings in their manufacturing, the role of foundry industry to support manufacturing is very vital. It is not possible to achieve the above goal without the sustainable corresponding growth of the foundry sector

Figure 13: Production in Million Tones



3.2.2 Key growth drivers of the market:

Foundries across India are presently upgrading facilities and technologies in a bid to improve their productivity and increase their capacity. To cater to the growing demand, this industry is embarking on major expansions and technological initiatives, with investments of over INR 10 Bn, since 2011. Majority of the foundry units in India fall under the MSME sector, which has registered consistent growth over the years. There are around 51 MSME units spread across

the country. About 55.3% of the MSMEs are based out of rural areas, indicating the deployment of a significant rural workforce in the MSME sector. Re-implementation of Public Procurement Policy, Pradhan Mantri MUDRA Yojana, Make in India, Startup India, and Skill India initiatives are helping in the growth of the MSME sector in the country.

3.3 Major Metallurgical Industries In The North East

The biggest gas-based steel plant in northeast India (Rs. 250 Cr., 1,50,000 TPA) has started commercial production in Tripura. The plant manufactures cold rolled sheets, galvanised corrugated and plain sheets and cold rolled closed annealed sheets needed by the roofing, automobile industry and for making cupboards, panels, grain storage bins and silos and barrels. The project would not only help to tap the unexplored business potential of the north-eastern region and adjacent countries but also provide employment in the state, would ensure rapid socio-economic development of the state. Bangladesh government will soon give transit facility through its ports. Obviously, the target market would be Bangladesh competing with China and Korea. It employs around 300 youngsters." State-owned upstream oil major ONGC is supplying gas to the steel plant. (Ref.: <https://www.oneindia.com> reported by Pinaki Das, ANI)

M/s. K.D. Iron and Steel Co. in Assam has become the largest steel manufacturing unit in North-Eastern India. The Group has a sizable presence in wide gamut of industries which includes Cement, Steel, and Metallurgical Coke products. With vast experience & expertise in building material industry the group has launched the Autoclaved Aerated Concrete (ACC) Blocks for building construction.

The above references are indicative to prove that there is scope for downstream and ancillary metal industries in the region.

4 BUSINESS OPPORTUNITIES FOR SMALL-SCALE FOUNDRIES

4.1 Potential foundry Clusters in India

A peculiarity of the foundry and forging industry in India is its geographical clustering. Typically, each cluster is known for catering to some specific end-use markets. For example, the Coimbatore cluster is famous for pump-sets castings, the Kolhapur and the Belgaum clusters for automotive castings and auto parts, etc.

4.1.1 Foundry industry today

Foundry industry products are used in all applications from sanitation to Aerospace. Global casting production reached a value of 110 million tonnes in 2017, of which China occupies lion share with a total of 49.4 million tonnes in 2017. Casting production in India reached a value of 11 Mn tonnes in 2018, and is expected to expand at a compound annual growth rate (CAGR) of ~12.7% from 2018 until 2023.

In India, Foundry industry started around 1940 in Howrah and then later expanded to other states. At present, the Indian foundry industry manufacturers metal cast components for applications in Auto, Tractor, Railways, Machine tools, Sanitary, Pipe Fittings, Defence, Aerospace, Earth Moving, Textile, Cement, Electrical, Power machinery, Pumps / Valves, Wind turbine generators etc. Foundry Industry has a turnover of approx. USD 19 billion with exports approx. USD 3.06 billion.

4.1.2 End-user segment growth insights:

Automotive: The foundry market is linked directly with the development of the overall automotive sector. Growth of the automobile industry is expected to generate huge demand for castings producers. Based on volume, India is currently the fourth largest automobile industry, globally. Rapid growth of the automotive sector has also led to the steady development of other subsidiary industries like the auto component industry, indicating huge demand for castings.

Pipes and fittings: The pipe sector in India is poised for steady growth due to substantial investments and capacity additions. Companies produce a wide range of steel, cement and PVC pipes, which are used in various industries. Demand for castings is expected to expand with the growth of the pipes and fittings market in India.

Power: Consistent power supply and availability of quality electrical equipment are necessary for the growth of the Indian economy from a global perspective. As of December 2018, India had a power generating capacity of ~349.28 GW. The Government of India has targeted an addition of ~88.5 GW under the 12th Five-Year Plan (2012–2017), and another ~100 GW under the 13th Five-Year Plan (2017–2022). The foundry industry is expected to benefit from such power generation installations.

4.1.3 Government initiatives:

A Vision Plan 2020 has been initiated by The Institute of Indian Foundrymen (IIF) to recommend the needed initiatives for rapid growth, and emerge as a leading supplier of quality castings in the global market by 2020. An implementing agency for the India Foundry Mission (IFM) will have full authority to represent it, demonstrate the pilots and implement recommendations, and monitor market growth.

4.1.4 Key deterrents to the growth of the market

Since most of the castings manufacturing units fall under small and medium enterprises (SMEs), they cannot use advanced technological equipment or automation due to high costs, thus limiting their marketing strength. It is challenging for them to sustain their position in the global marketplace. The inability to meet the domestic demand for castings and to supply quality products to the global market acts as a huge barrier for the industry to grow further.

4.1.5 Technologies employed

I) Melting furnace

A majority of the foundry units melt raw materials using cupola furnace. Majority of units are using divided blast cupola for melting, with a few exceptions that are still running single blast cupola. About 75% of cupolas are over a decade old, the blower motor are re-winded multiple times. The specific energy consumption of cupola for melting varies in range of 80 – 150 kg coke per tonne for molten metal. In terms of coke to metal ratio, it translates into 1:12 to 1:7 and talking in terms of percentage of coke the figures are 15%. All the figures are on charging coke basis (i.e. total coke used during a batch except bed coke).

II) Moulding and core preparation

Mould preparation is an important process in casting industry. Cores are placed inside the moulds to create void spaces. Cores are baked in ovens which are usually electrical fired. Moulds are either prepared manually or using pneumatic moulding machines (ARPA lines). About 10 units use “high pressure moulding lines” (HPML).

III) Sand Preparation:

Sand preparation is done using sand mixers and sand sievers. Sand mixers have typical batch size of 100 to 500 kg. The connected load of these mixers is in the range of 10 to 30 kW. Few plants have sand handling plant along with sand cooler of capacity 5 to 20 tonnes per hour, the connected load of such plant is about 75 to 100 kW.

4.1.6 Foundry Processes at Cluster Level

The main common processes practiced in the foundry unit are mentioned below.

I) Pattern making: It is a model or the replica of the object to be casted. Most of the units get patterns from their clients. Few units make patterns while casting their own designs/products.

II) Hand mould and core making: This is a process by which a mould is manually formed. It is a vessel, the reverse image of the final component, into which the molten metal is poured. Moulds and cores are usually made of sand bonded with clay or other materials such as silicates, resins and isocyanates. Sand Preparation is the key to quality castings. Sand is packed around the pattern within a moulding box to form a mould section. The complete mould may consist of an assembly of two or more sections or parts.

III) Metal preparation: This is the process of segregation and preparation of alloys and scrap prior to the melting process. Depending on the type of foundry, the metal will include pig iron, metal ingots, and scrap. Sorting out undesirable or unsatisfactory metal will be an

important process. Metal containing contaminants such as lead based paint are excluded. For safety reasons metal being added to a hot furnace must be dry.

IV) Metal melting: In this process metals are melted, to a controlled temperature and composition, usually by a cupola furnace using coke.

V) Casting: In this process molten metal is poured by a ladle into the prepared mould for solidification.

VI) Removal of castings: The cool casting is removed by knocking it away from the mould by hand or using vibrators or pneumatic tools. The process of removing the casting from the mould, is known as knockout or shakeout.

VII)Fettling and finishing: This is the process of removing excess material from the casting to meet specified dimensions. Fettling and finishing involves a number of different processes depending on the type of foundry. h) Heat treatment: In some units, the metallic structure and physical properties of the component are enhanced by the use of controlled temperatures.

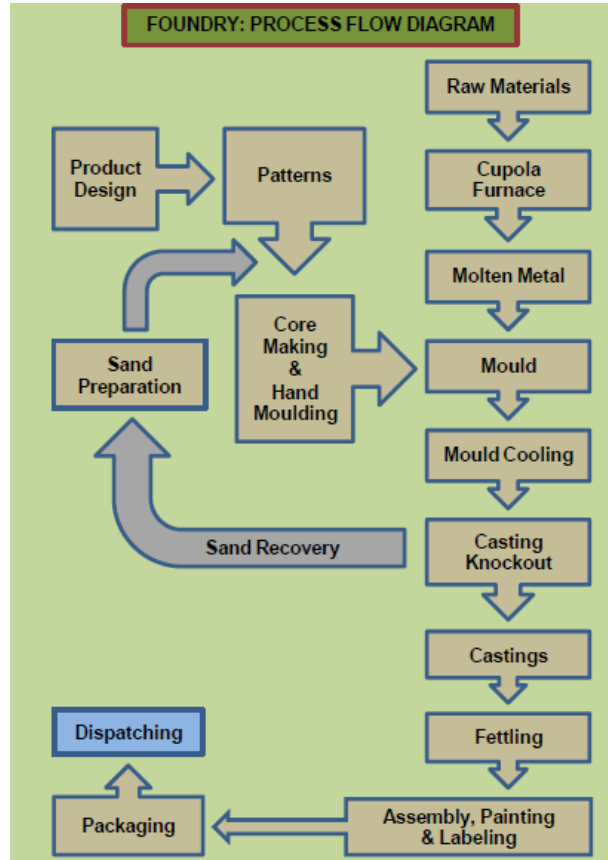


Figure 14: Foundry process flow

VIII) Assembly process: After finishing, parts of the products are assembled usually within the shop floor.

IX) Material handling and packaging: This is the process of handling materials throughout the casting process and the presentation of components for dispatch to meet the customer specifications.

X) Storage: Most of the units need sufficient space for storing finished items.

XI) Delivery: Most of the time, delivery happens in the evening and during night.

XII)Plant maintenance: This is one of the regular tasks carried out by most of the units so as to keep it in a safe operable condition.

XIII) Waste disposal: This is the process of removal, segregation and safe storage and disposal of unusable materials and by-products. Old sand and other debris are the significant non-recoverable waste produced in most metal casting processes.

Most of the foundry units carry out some of the above and many of these processes.

4.2 Key Challenges, scope and Recommendations:

4.2.1 Key Challenges to Foundry Industry

It is evident from the studies, that when unit of the foundry is considered, the integrated approach to both environment friendliness and system efficiency should be considered. Implementation of any system will result in increased production cost without increasing the productivity. But the integrated approach discussed in studies will largely cut the increased production cost due to Cleaner Production (CP) approach. Control of pollution parameters and the standard requirements should not be taken in isolation but should be taken in totality with social need, market growth and economic suitability of the industry and indigenously best available technology to achieve the objectives.

The price of coke has risen over the recent year and is presently about INR 30,000 for each ton. The major part of energy is used in the melting process. It was found that, conventional type cupola furnace used by nearly 90% of the foundry units, about 10% industry use electric induction furnace for melting. Low ash coke is in used by most of foundries. Thus MSME foundries in these areas have the conventional sand casting production which consumes high resources such as energy.

The pollution measuring machine was set up in order to take reading. Iron is used as raw material. The gas rate of SPM 1829.9 $\mu\text{g}/\text{m}^3$ and followed by the NO₂ 171.4 $\mu\text{g}/\text{m}^3$ and SO₂ 42.5 $\mu\text{g}/\text{m}^3$. Most of the foundries in Gujarat had not adopted DBC technology till now. They are using local cupolas which are having less efficiency due to high coke consumption.

Most MSME foundry units have not used pollution control systems to meet the emission standards. Since most companies are not reusing or recycling their sand, major equipment used in foundry units are local made melting furnaces, Sand mullers, Knock-out machine they are using coke as well as electricity in a foundry melting, hence Improvement potential areas are air emissions, efficient use of raw materials and energy, waste reduction along with any recycling and re-use options. Air pollution as well as disposal of foundry wastes is major issues in the cluster.

Energy efficiency is one more factor to consider this can be solved by installing the dived blast cupola design instead of normal cupola furnace. This will improve overall efficiency of furnace and reduce harmful emission.

4.2.2 Recommendations

Among many objectives of the Cleaner Production (CP) for sustainable development (SD) is to use all the recourses efficiently as much as possible and thus to use best available and suitable technologies and processes without drastic change as it requires skill as well as money

considering holistic approach. With this regards CP implementations may be applied in continual manner such as short terms, medium terms and long term measures. With the aid of these studies following measures may be helpful and can be applicable in present conditions to achieve the benefits of Cleaner production (CP) in terms of Sustainable Development (SD).

1. Short terms measures can be categorized in which no substantial investments such as

- Housekeeping such as maintenance of compressor, scrap storage, placing lid on induction furnace etc
- Inspection in terms of energy audit and management.
- Training awareness programmes for both foundry owner as well as workers too.

2. Medium terms involve selection of Best available techniques (BAT) depending upon suitability in present conditions in terms of technology and human point of view such as:

- Variable frequency drive screw compressor.
- Energy efficient motors.
- Purchase of good quality coal.
- Efficient energy distribution system.
- Increasing shaft height of cupola furnace
- Conversion of conventional cupola to Divided Blast Cupola (DBC)
- Use of capacitors to get the benefits of Power factor (PF) from Electricity boards.

3. Long terms measures required environmental perspectives in terms of sustainable development for foundries along with economic benefits for a justified period of times such as In this studies only two devices are used and found to be effective others devices and processes can be used as below:

- DBC in place of Cupola.
- Induction furnaces • Adequate sand reclamations system
- Use of dry dust collectors methods like fabric filters
- Reclaim sand used in molding.
- Dust emission control technologies such bughouses, and electrostatic precipitators (ESPs).
- Wet scrubbers. Scrubbers can also used to control mists, acidic gases, as well as amines.
- Pressure sand filter.
- Air Exhausters.

4.2.3 Future Scope

Framework developed in this investigation can assist foundry industry for implementing cleaner production system with high productivity, resulting in higher quality and less pollution for sustainable growth with fewer modifications. This work can be extended to other casting techniques (continues casting, die casting etc.) and all ferrous and non ferrous small and medium scale foundry. It can potentially lead to a new approach for Indian foundry industry to compete with globalization for sustainable development through cleaner production. It is

hoped that some useful and affordable CP systems may emerge from these studies in future. Following are the specific area which needs devoted and disciplined study, this are as below.

- Exhaust capture efficiency is possible by use of various systems, such as draughts, hoods and partial covering of the furnace.
- During observation it was also noted that ordinary coal was used by the firms so in that coal there is a less amount of oxygen and high carbon so high quality of coal may be used to have a complete consumption. 149 It is essential to study various kinds of coal and its suitability and economics.
- To promote this Industry, a holistic approach is necessary to cope with the situation. Policies must be promoted and proper feasible training programme could be developed to improve and promote the best available technology. This could help in survival with prosperity of these industries.
- The existing study is done in the area of Gujarat state. The foundry units in India are located in 20 different geographical Hub so there is need to study every hub and need to develop some guides within the constraints of sustainability.

In summary, the CP approach will definitely directly contribute to the sustainable development of the industry and country.

5 BUSINESS OPPORTUNITIES FOR SMALL – SCALE FORGING

5.1 Potential forging Clusters in India

A peculiarity of forging industry in India is its geographical clustering. Typically, each cluster is known for catering to some specific end-use markets. For example, the Jalandhar cluster is famous for tools and Auto-parts, the Pune forging is for Bearings and auto parts and the Nagaur clusters for Hand tool, etc.

5.1.1 Forging Industry Today

The forging industry of today looks forward to the year 2020 with an awareness of the business and technical challenges that will shape its future. The major forces shaping the business community of the future are:

- Increasing globalization of markets.
- Demand for a greater return on investment and increased capital productivity.
- Customer expectations for increasingly higher levels of quality at a lower price.
- Changing skill requirements of industry employees.

In order to meet the competitive challenges of the future and achieve its vision, the forging industry must fortify itself in several critical areas: technology development and application; energy and the environment; cooperative efforts; competitiveness; education; markets; and human resources.

Specific areas in which technological issues need to be addressed include materials, die design and modeling, lubrication, process modeling and optimization software, process controls and sensors, real-time preventative maintenance, and primary and secondary processing equipment. The forging industry of the future will be energy efficient and will protect the environment. Environmentally acceptable, functionally effective, and affordable technologies are needed that integrate pollution prevention into the entire metal forging processing system design. Cooperative research will play a major role in returning the U.S. forging industry to world leadership. Forging companies must leverage their limited resources by teaming with customers, suppliers, government, academia, and other forgers to locate the significant technologies that are being practiced or are under development.

5.1.2 The Importance of The Forging Industry

Forging has unique value among manufacturing processes. The industry is a key link between critical manufacturing segments--metal suppliers (both ferrous and nonferrous) and end user industries. Forgings are intermediate products used widely by original equipment manufacturers in the production of durable goods. They range in size from less than an ounce to more than 150 tons and are found in the machines, vehicles and equipment used to generate our industrial economy. Forgings are found in 20% of the products representing the Gross Domestic Product of the United States. The products of the forging industry are essential to the U.S. industrial economy, to its society, and to its national security.

Forging imparts advantages that few processes can duplicate. The industry's future is based on improving upon these advantages. The following are features of forging that make the process and industry so important to designers and users (specifiers) of components:

- Forgings can be manufactured from readily available bar stock,
- Almost all metals and alloys can be forged,
- There are few restrictions on part size,
- Forgings can produce high tolerance features,
- The products are fully recyclable,
- Forgings impart high strength and reliability to components
- Forgings typically have relatively low life cycle costs.

5.1.3 Forging Process at Cluster Level

During the forging process, a metal workpiece is plastically deformed by pressing, squeezing, or hammering forces--usually at temperatures ranging from ambient to 1,500°C--so that it approaches its maximum theoretical density and the upper limits of the material's potential strength. The properties of the worked metal can be greatly enhanced by selecting the proper types and sequence of operations. The controlled process of deformation that takes place imparts exceptional metallurgical soundness and mechanical properties to the forging--structural integrity, impact strength, fracture toughness, fatigue life, and uniformity.

The manufacture of forged products can be carried out by several basic forging methods. The choice of method is determined by the quantity of parts to be produced, the characteristics of the material, and the configuration to be formed.

Impression-die forging, often referred to as closed-die forging, accounts for the bulk of commercial forging production. As the name implies, two or more dies containing impressions of the part shape are brought together causing the workpiece to plastically deform with the metal flow restricted by the die contours.

Most impression-die forging is performed at elevated temperatures and is known as hot forging. The optimum hot forging temperature depends on the material being forged. Also in the impression-die forging category are cold forging and warm forging processes.

Cold forgings are forged at ambient temperature. Cold forged parts are generally symmetrical and typically weigh less than 25 pounds, and because of their extreme dimensional precision and fine surface finish they often need little or no further machining. Production rates are very high with long die life. In warm forging the workpiece is heated above room temperature but well below hot forging temperatures.

Open-die forging differs from impression-die in that the metal workpiece is not confined laterally by impression dies. The process is typically associated with large parts, although parts weights can range from a few pounds to 150 tons. The open-die forging process progressively works the starting stock into the desired shape, most commonly between flat-faced dies. As the stock is not contained in a closed die, a highly skilled forge operator is required in locating and positioning the workpiece on the die. Open die forgings require subsequent machining in almost all cases.

Ring rolling is a very cost effective and property effective process in which seamless rolled rings are forged in numerous cross-sectional shapes, ranging from several inches to over 20 feet in diameter. Rings can range in weight from one pound to more than 50,000 pounds, and are typically used in gears, bearings, couplings, rotor spacers, and components for pressure vessels and valves.

5.2 Key Challenges, scope and Recommendations:

5.2.1 Key Challenges to Foundry Industry

In order to meet the competitive challenges of the future and achieve its vision, the forging industry must fortify itself in several critical areas. The key challenges that must be addressed by the industry fall into the following categories:

- Technology development and application.
- Energy and the environment.
- Cooperative efforts.
- Competitiveness.
- Education.
- Markets.
- Human resources.

5.2.2 RECOMMENDATIONS

The industry needs to develop and put in place programs and systems to help find the strategically significant technologies--already in practice, that have been developed, or are being developed--and find ways to deploy those technologies to the industry..

The industry must lead the drive for technological advances that benefit many facets of the forging process, and continue to enhance the industry's competitiveness and profitability. Specific areas in which technological issues need to be addressed include materials, die design and modeling, lubrication, process modeling and optimization software, process controls and sensors, real-time preventative maintenance, and primary and secondary processing equipment. Other research and development needs for the forging industry are outlined in Appendix A.

The industry needs to develop and put in place programs and systems to help find the strategically significant technologies--already in practice, that have been developed, or are being developed--and find ways to deploy those technologies to the industry. Cooperative industry efforts on the forge process will make the forging industry world leaders in bulk deformation.

The forging industry must lead the drive for technological advances that benefit many facets of the forging process, and continue to enhance the industry's competitiveness and profitability. Specific areas in which technological issues need to be addressed include materials, die design and modeling, lubrication, process modeling and optimization software, process controls and sensors, real-time preventative maintenance, and primary and secondary processing equipment.

Other research and development needs for the forging industry are outlined below:

Production Efficiency

- Neural networks for process control and optimization.
- Modeling and verification of complex problems in metal forging.
- Rapid prototyping: tools and manufacturing.
- Advanced die materials and surface modifications or coatings.
- Advanced contact and non-contact sensors.
- Imaging system for commercial quality control and inspection of parts.
- Knowledge-based system for troubleshooting industrial equipment.
- Develop design relevant material properties.
- Training and education.

Energy Efficiency

- Reduction in heating cycles.
- Energy efficient gas fueled burners for furnaces.
- Fuel/combustion system optimization.
- Advanced cogeneration/waste heat utilization systems.
- Induction heating system with reshapable coils.
- Model for increasing metal plasticity at lower forging temperatures.

Recycling

- Energy/environmental life cycle assessment.
- Develop economic methods to convert scale to usable products.
- ISO 14000 compliance.

Environmental Protection

- Waste stream identification.
- Air emissions measurement, reduction, and control.
- Water processing and reuses.
- Environmental modeling of the forging process.

5.3 Future Scope

The forging industry of the future will be energy efficient and will protect the environment. In the 21st Century, the forging plant will be a zero environmental liability, making it a valued and responsible neighbor in its community and a respected source of high-paying jobs for workers in the surrounding area.

To attain the vision, cooperative efforts within the forging industry must maximize the financial resources for research projects and technology development that focus on making the process an environmental asset.

Technologies are needed that integrate pollution prevention into the entire metal forging processing system design. These technologies must be environmentally acceptable, functionally effective, and affordable. The following programs will address these issues and significantly impact the forging industry:

- Eliminate aerosol emission within the plant through the use of advanced die systems. The development of cost-effective new production methods (such as net shape forging) will eliminate the need for post-forging removal of surface material.
- Establish a program that develops and deploys environmentally benign lubricants, or eliminates the requirement for die lubrication altogether. Develop new water-based synthetic die lubricants that eliminate graphite from the forging process.
- Reduce energy consumption through advanced waste heat recovery systems that maximize furnace or induction heater efficiency. One such step is to develop closed-loop controls that minimize the heat wasted in the forging process when problems occur in forging systems.
- Increased use of induction heating and advances in combustion technology will significantly improve energy efficiency in forging facilities and reduce the environmental impact of today's fossil-fuel fired process heating systems--completely eliminating harmful products of gas combustion.
- All fluids necessary to plant operation will be recycled, and ultimately replaced with environmentally beneficial materials.
- New ways to treat waste are needed to prevent damage to the environment. Improvements are needed in methods and technology to minimize forging scale and

recycle other process materials and gasses that otherwise represents an environmental liability.

- Renewable energy, advanced technologies for energy and resource efficiency, cogeneration, and other waste reduction process improvements and other cost-effective environmental protection improvements must be developed.

6 POSSIBILITIES FOR CLUSTER DEVELOPMENT APPROACHES RELEVANT TO METAL WORKING SMEs

Industry clusters are regional concentrations of related industries. The importance of encouraging and supporting industry clusters to promote job creation and economic growth need no emphasis. A cluster-based approach starts with the industries that are already present in the region and regional stakeholders pursue initiatives to make those industries better. An approach for creating entirely new clusters in a region is a strategy to improve overall business environment conditions, by upgrading skills, access to finance and infrastructure, by streamlining government rules and regulations, by supporting local demand, and by being open to foreign investment and competition.

Developing industry clusters has become a key goal for regional economic development as clusters have been shown to strengthen competitiveness by increasing productivity, stimulating innovative new partnerships, even among competitors, and presenting opportunities for entrepreneurial activity.

But, before committing to any industry or cluster-based development strategy, one would have to do more homework to determine any potential snags in the availability of resources and inputs, just as one would also evaluate the depth and breadth of a region's labour u before landing on a set of target industries. Therefore, clusters for metal MSMEs need to be investigated further before implementing cluster-based economic development strategies. However, *prima facie* a couple of new metal based clusters in Assam and Tripura appears to be feasible.

7 NORTH EASTERN STATES – POISED FOR GROWTH

Northeast India comprises of seven separate but adjoining states, as well as standalone Sikkim. The northeast region remains one of the least visited but fastest developing part of India and attracts investments since the 1st North East Business Summit held in Nov. 2000 at New Delhi (12 such events have taken place, since the 1st Summit). North-east India has been recognised not only as tourist destination but also as an ideal investment destination with unlimited opportunities.

Today, Northeast India is standing at the verge of a trillion-dollar business opportunity. NER's economic linkages can be accelerated by a number of measures across different areas, of which trade logistics, e-commerce supply chains, transportation and border infrastructure deserve better attention.

Much of NER's value chain potentials with Bangladesh, ASEAN countries and rest of India in agriculture, horticulture, floriculture, processed food, engineering, automobiles, garments, pharmaceuticals, etc., have remained unlocked. There are vast opportunities in trade with live-stock, horticulture, fishery, agro-processing sectors or natural resource areas. Value chains across NER may eventually go up once supporting supply chains are in place. For example, NER needs specialised cold-chains. To promote trade, all airports and land ports in NER must have enough cold-chains. NER states shall encourage the start-ups which are exporting processed food, organic fruits and vegetable, high-end fashion products through borders. New value chain opportunities in view of the Regional Comprehensive Economic Partnership (RCEP) or India-Bangladesh Comprehensive Economic Partnership Agreement (IBCEPA) are also expected to emerge.

NER, therefore, must modernise cross-border supply chains to unlock value and create business opportunities. This has to be done jointly by state and union governments. First, the rise of synchronised commerce needs integrated supply chains. The expansion of e-commerce supply chains and start-ups pave the way for further visibility globally. Second, NER states may undertake drastic reforms in labour and land regulations. Third, with disappearing border barriers, expansion of existing units (benefit of scale economy) makes sense when RCEP and/or IBCBTA come in effect. This requires that the North East Industrial Development Scheme (NEIDS), 2017 is redesigned to facilitate new investments in the region.

Compared to what was a decade back, inter-country bus, air or rail services from Northeast India are in better shape today. Truly, it is the airlines that connect NER with the rest of India. Guwahati is now directly connected by air with most of major Indian cities and Dhaka, Paro and Bangkok for passenger and Hong Kong for freight. However, NER's other airports are behind of Guwahati in connecting with abroad. Air service between Imphal and Mandalay is needed to support the growing health and wellness tourism in NER. Maiden flights from Imphal to Mandalay and Agartala to Dhaka are likely to start soon. International flights from Bagdogra will certainly boost tourism in North Bengal, Sikkim and Bhutan, and, at the same time, we liberalise restrictions of foreigners entering Sikkim.

Sikkim government may consider introducing online permit or on-arrival permit at the entry points. Pakyong airport in Sikkim and Tezu airport in Arunachal Pradesh, both inaugurated a few months back, are yet to be fully utilised due to technical constraints. What next is Imphal, Guwahati and Bagdogra airports should be expanded to accommodate international flights. Other NER airports such as Agartala, Aizawl, Shillong also need capacity addition and more domestic and international flights.

Railway connectivity in Northeast has progressed well, no doubt. Capitals of Northeastern states are getting connected by rail with the rest of India. Agartala and Silchar are now having broad-gauge railway lines and are connected with other parts of India. Railway development has made positive impacts on common people, who are now more integrated with the rest of India. Indian Railways has already started train services between the Dharmanagar, Agartala and Sabroom in Tripura. The railway link to Sabroom is vital for the development of the state of Tripura, and linking it with Chittagong Port will open new vistas for the entire NER. The railway line will reach Imphal by 2020. It has to be extended to Moreh and then to Tamu and Kalay in Myanmar.

Assam government has also mooted a proposal to reopen the pre-partition railway links with Bangladesh, for example, Chittagong to Makum, Cox Bazar to Ledo and Golakganj to Moirabari. The Rail-cum-Road Bridge at Bogibeel is a breakthrough, which connects North Bank of Brahmaputra with South Bank at Dibrugarh in upper Assam. But, the supply does not match the demand in railways. Electrification of railway tracks and introduction of high-speed trains are the next step forward. Drastic reforms are must in Northeast Frontier (NF) Railway headquarter, the custodian of railways in the Northeast.

Railway connectivity with Bangladesh will be a game changer. Today, Agartala has direct rail, road and air connectivity with the rest of India, and Bangladesh has been providing transit to all modes of transportation except railways. Once Agartala and Akhaura railway line is completed, the journey time between Agartala and Kolkata will reduce to 10 hours from 31 hours. Akhaura being located on Dhaka-Chittagong rail route, NER will start using Chittagong as the region's main port which was the situation before 1947. India and Bangladesh currently have four operational rail links between West Bengal and western Bangladesh-Petrapole-Benapole, Gede-Darshana, Radhikapur-Biral and Singhabad-Rohanpur, of which Radhikapur-Biral and Singhabad-Rohanpur are also notified for use of Nepalese transit traffic.

Road transport is the dominant mode of transportation in the NER. In the last 3 to 4 years, several road connectivity projects have been taken up in NER under the Bharatmala. Under Bharatmala Pariyojana, about 5300 km long road would be developed for border road and international corridors. The road from Dimapur – Kohima – Imphal is relatively good with four-way lane. By 2023, almost 80 to 90 per cent of the road connectivity in the NER under Bharatmala Pariyojana would be completed. With the ongoing expansion of project between Imphal and Moreh and proposed alternative route of four-way lane till Moreh, the connectivity within NER and with the neighbouring countries would improve. What NER needs, perhaps in an accelerated manner, is seamless road connectivity between Guwahati and border towns such as Moreh in Manipur or Dawki in Meghalaya. At the moment, the journey from Imphal to Guwahati takes about 12 hours, with many sections of the road being in bad condition. Similarly, the Imphal-Silchar road should be widened and made all-weather.

National Highways and Infrastructure Development Corporation (NHIDCL) has been awarded to complete the construction and maintenance of the National Highways in NER. NHIDCL is also working to improve the roads between Imphal to Kohima and Imphal to Jiribam. The World Bank and Japan International Cooperation Agency (JICA) are also engaged in logistics sector in NER. However, there are many challenges such as land acquisition and encroachment, unlawful activities of insurgent groups, particularly between Imphal and Jiribam and between Imphal and Dimapur, etc. Active participation of state governments in the central projects is needed for timely completion of the projects.

On international projects, the road connecting Samdrup Jongkhar (Bhutan) and Guwahati shall be taken up for upgradation. The Trilateral Highway (TH) between India, Myanmar and Thailand is coming up very fast. At the moment, the Kalewa-Yargi section in Myanmar (122 km) is under construction, which is likely to be completed by 2021. However, the TH can be made operational if the three countries implement a Motor Vehicle Agreement (MVA) or Cross-Border Transport Agreement (CBTA) and rehabilitate the old bridges along the TH.

Connectivity through waterways has also witnessed some major changes in recent years. Cargo transportation through National Waterway (NW) 2 has been rising. Export to Bangladesh using IWT has also gone up in recent years. Dhubri (in Assam) is now well connected with Narayanganj (in Bangladesh) through IWT and there has been regular sailing of cargo vessels. Neighbouring Bhutan has been using this IWT route for trade with Bangladesh. Improvements are underway in both Bangladesh and India to improve several IWT terminals, including Ashuganj river terminal, which is one of the most strategic locations in Bangladesh. Ashuganj has road links and custom facilities for transit cargo to NER via Akhaura-Agartala land border and also links to Chittagong port terminal. The Protocol on Inland Water Transit and Trade (PIWTT) between India and Bangladesh also includes additional ports of call, and specifically grants India access to Chittagong and Mongla ports for shipping goods to NER, while the Coastal Shipping Agreement between the two countries provides for direct connectivity between seaports of eastern part of India and Bangladesh. Bangladesh has already allowed the use of Chittagong port for the NER. Taken together the various initiatives around IWT provide for a much more flexible system for transport and logistics that can only benefit the NER.

Heritage tourism along the waterways between the NER and Bangladesh can attract millions of tourists from the region and abroad. Cruise tourism is another opportunity. Fresh investments are needed to convert river terminals along the river Brahmaputra into full-fledged river ports. However, to promote safe navigation using electronic charts, night navigation aids and Differential Global Positioning Systems (DGPS) stations along the rivers are needed and needs to be maintained well. A major task is to develop IWT terminals with appropriate cargo handling equipment and to establish Road-Rail link including a roll-on roll-off (RO-RO) facility. Jogighopa in Assam is being developed as multimodal IWT terminal. Promoting the use of waterways can lead to greater economic activities along the river banks by communities, which in turn will have a positive impact on the local economy and livelihoods.

NER requires logistics parks all across the major trading points. This indeed generates huge business opportunity since NER is a consumption-driven region. DP World is setting up a logistics park in Punjab and some other parts in India. The Asian Development Bank (ADB) is also setting up such facilities in Assam. Indian and global logistics operators shall be invited to develop specialised logistics centres in NER.

NER states may consider setting up Special Economic Zones (SEZ) for timber, food processing, etc. Building smart cities in Moreh and Dawki will enhance economic activities in the region. Industries with potential to serve neighbouring markets and ASEAN need to be identified and promoted in NER, and harmonisation of customs procedures and other trade facilitation measures would help facilitate Northeast's trade. At the same time, the North East Council (NEC) must be revamped to undertake the connectivity-led activities for which NEC can provide the leadership.

8 SWOT ANALYSIS (STRENGTH,WEAKNESSES, OPPORTUNITY AND THREATS)

8.1 Industrial Development in NE States (general)

Strength:

- Most of the raw materials are available at adjacent states.
- Dealer network is good for supply of pig iron, steel scrap and coke, etc.
- Workers would be able to produce precision and quality work with traditional technology.
- Strong requirement and demand in the domestic market for casting products in India.
- Research and academic activities carried out by various institutes have generated.
- A good amount of knowledge base to support the future challenges.
- Most of the entrepreneurs are highly experienced in the foundry line.
- Availability of testing labs in nearby states (Howrah). Formal linkages with the engineering colleges for refining of technologies.
- Research and academic environment generating vast knowledge base.

Weaknesses:

- Irregular fluctuation and increase in the cost of raw materials.
- Inability to procure raw material at competitive price.
- Shortage of capital for small firms.
- No skill up-gradation training for the workers.
- Non-existence of any certificate/diploma course in modern foundry operations.
- People prefer to work in other sectors.
- Losing ground in the national as well as international market (china etc).
- Lack of awareness on export opportunities.
- Lack of external connectivity for exports
- Reluctance in competitive participation in global market.
- Most of the foundries are supplying only to the domestic market.
- Lack of adequate infrastructural and technological development.
- Absence of mind set to adapt the changing circumstances.
- Poor knowledge base on occupational health hazards.
- Absence of innovative approach to improve the existing processes.
- Lack of collective action for bulk purchase of raw material like pig iron, aluminium, coke and furnace oil for reduction of cost.

Opportunity:

- Recent expansion in the automobile market foresees a remarkable increase in casting consumption in this sector during the years to come.
- Scope for common brand marketing.

- As a result of recent trend in interdisciplinary research, enough opportunities have emerged before the metal casting cluster to flourish with the state of the art technology.
- There is an increasing trend by the foreign consumers to import quality casting products due to closure of foundry unites in those countries.
- Enough scope for export to European and East Asian countries.
- Growing environmental concerns in foundries of western countries provides opportunities for sourcing of castings from developing countries like China and India.
- Encouraging the Government polytechnic to conduct more Diploma courses in Metallurgy so that foundry sector can get more people to work in this specialized area.
- Re-implementation of Public Procurement Policy, Pradhan Mantri MUDRA Yojana, Make in India, Startup India, and Skill India initiatives are helping in the growth of the MSME sector in the country.

Threats:

- Competition is going to increase in the changed scenario of global market.
- Other Asian competitors in particular China are emerging as potential supplier in global market due to better technology, infrastructural and other facilities like advancements in terms of quality, delivery schedule and effective price.
- Due to liberalized economic policy, there is a high possibility of imported motor and pump-sets from cheaper manufacturing base like China.
- Competition from other developing clusters in India like Howrah, Ahmadabad, Hyderabad, etc.
- The new environment policy emboldened by the Supreme Court of India for necessary energy savings, clean technology or eco-friendly process will impact the cost of castings.
- Availability of skill workers is slowly reducing.

9 POSSIBILITIES FOR CLUSTER DEVELOPMENT APPROACHES

Industry clusters are regional concentrations of related industries. The importance of encouraging and supporting industry clusters to promote job creation and economic growth need no emphasis. A cluster-based approach starts with the industries that are already present in the region and regional stakeholders pursue initiatives to make those industries better. An approach for creating entirely new clusters in a region is a strategy to improve overall business environment conditions, by upgrading skills, access to finance and infrastructure, by streamlining government rules and regulations, by supporting local demand, and by being open to foreign investment and competition.

Developing industry clusters has become a key goal for regional economic development as clusters have been shown to strengthen competitiveness by increasing productivity, stimulating innovative new partnerships, even among competitors, and presenting opportunities for entrepreneurial activity.

But, before committing to any industry or cluster-based development strategy, one would have to do more homework to determine any potential snags in the availability of resources and inputs, just as one would also evaluate the depth and breadth of a region's labour u before

landing on a set of target industries. Therefore, clusters for metal MSMEs need to be investigated further before implementing cluster-based economic development strategies. However, *prima facie* a couple of new metal based clusters in Assam and Tripura appears to be feasible.

9.1 Proposed Cluster

- ❖ Project Area: 250 Acres
- ❖ Total number of units: approx. 100 Units
- ❖ Total envisaged castings output:
 - Phase I: 1st year of commercial operations: 75k tonnes per annum
 - By the end of 5th year of commercial operations: 1.5 lakh tonnes per annum
- ❖ Total envisaged investment by foundry units: approx. Rs 600 Crores
- ❖ Employment potential:
 - Direct employment: 20000 approx
 - Indirect employment: 60000 approx
- ❖ Envisaged exports: 1.5 lakh tonnes of casting output, valued at Rs 600-800 crore
- ❖ Common infrastructure: roads, water supply, drainage, sewerage, power supply, CETP, waste management etc. at a cost of Rs 50 crore
- ❖ Common facilities: tool-room, R&D centre cum testing lab, marketing cum management up gradation centre & ITI at a cost of Rs 20 crore (approx.)
- ❖ Project benefits:
 - Investments as well as creation of direct employment and indirect employment.
 - Boost to the Economy of the state, especially in the metallurgical sector.
 - Social-economic upliftment of the region.
 - Opportunities to set up foundries of international standards to attract foreign direct investment.
 - Attract User Industries like Automobiles, pumps, OEMs, Railway units, Electrical appliances etc.
 - Backward integration with pig iron industry
- ❖ External infrastructure: Establishment of road connectivity to Chittagong port to enable the exports to East Asian Countries.

9.1.1 Short term strategy:

- Fostering common vision amongst the entrepreneurs
- Exposure visits / seminars for awareness creation on best foundry practices;
- safety systems; need for technology up gradation; certification
- Propagation of Energy savings measures
- Common purchase of inputs
- Credit linkages between tiny units and bankers

9.1.2 Long term Strategy:

- Development of alternative products like steel grinding media balls / oil expellers/sugar plant equipment, Etc.
- Common marketing
- Usage of BDS for productivity improvement
- Certification of units

9.1.3 Technology to be adopted:

For cupola based foundries, replacement of conventionally designed cupolas with an energy efficient divided blast cupola (DBC) is the major option. The existing modified divided blast cupolas have coke consumption of about 110 – 130 kg per tonne of liquid metal. With proposed energy efficient DBC the coke consumption is expected to be about 80 kg per tonne of liquid melt. The investment for a new DBC is expected to pay back within one year on account of coke saving alone. The saving can be achieved around 25-30%.

9.2 Major Stakeholders

Major stakeholders for the cluster would be Indian Foundry Association and concerned state foundry association.

The District Industries Centres should provide incentives to MSMEs like Interest Subsidy Scheme. Under this scheme, MSMEs can avail 3% interest subsidy (subject to a maximum of Rs 10 lakhs) on term loans loan on technology.

The MSME Development Institute (DI), Kolkata may be able to provide assistance for the promotion and Development of Micro, Small and Medium Scale Industries. They also implement various central and state government schemes for MSMEs including Credit Linked Capital Subsidy Scheme (CLCSS) and Technology Upgradation Scheme (TEQUP) for technology and quality upgradation.

9.3 Support Organisations

Augmentation of facilitation services being offered by industries promotion agencies/ financial institutions including role of entrepreneurship development institutes operating in the North-East have been explored. To explore/ exploit convergence of special schemes being implemented for the NE states by the North Eastern Council (NEC), North Eastern Development Finance Corporation Ltd. (NEDFL) and Ministry of Development of North Eastern Region (DoNER) and Indian Chamber of Commerce and Industry.

Table 2: List of Government Organizations

Name of the State	Govt. Departments	Corporations, Boards and other related organisations
Arunachal Pradesh	Commissioner (Industry) Block No.23,	Arunachal Pradesh Industrial Development & Financial Corporation Ltd. C - Sector, Itanagar - 791111,

	Arunachal Pradesh Civil Secretariat, Itanagar - 791111.	Arunachal Pradesh Chief Executive Officer APKVI Board, Naharlagun, Itanagar General Managers of DICs CII, Arunachal Pradesh State Office Ratnapeeth, 59, MG Road, Uzanbazar Guwahati-781 021
Assam	Commissioner of Industries & Commerce, Assam Udyog Bhawan Bamunimaidam, Guwahati-781021	Assam Industrial Development Corporation Limited The Managing Director Assam Small Industries Development Corporation Ltd., M.R.D. Road, Bamunimaidam Guwahati-781021, Assam Assam Trade Promotion Organisation Assam Skill Development Mission Directorate of Employment and Craftsmen Training Assam Financial Corporation Vittiya Bhavan M.S.Road, Paltanbazar, Guwahati-Assam-781 008 M/s. K.D. Iron and Steel Co., 6th Floor, Sri Kamakhya Tower, Christian Basti, G.S.Road, Guwahati – 781005
Manipur	Principal Secretary (Textiles, Commerce & Industries) Govt. of Manipur Manipur Secretariat, South Block Imphal – 795001	Manipur Industrial Dev. Corporation Ltd., Takyel Rd, Khuraijam Leikai, Imphal, Manipur 795004 MSME-DI, Imphal General Managers of DICs
Meghalaya	Department of Commerce and Industries Director of Trade,	Meghalaya Institute of Entrepreneurship (MIE) General Managers of DICs KVIB

	Commerce & Industries, Imphal	Deputy Director CII, Meghalaya Meghalaya State Office, Ratnapeeth, 59, MG Road, Uzanbazar Guwahati-781 021
Mizoram	The Special Secretary, Department of Commerce & Industries	Special Secretary, Labour, Employment, Skill Development & Entrepreneurship, Mizoram General Managers of DICs KVIB
Nagaland	Director, Dept. of Industries & Commerce	Director, Employment, Skill Development, Entrepreneurship Kohima Nagaland Nagaland Industrial Development Corporation Ltd., Kohima Road, Bank Colony, Dimapur, Nagaland - 797117 General Managers of DICs KVIB Deputy Director CII, Nagaland State Office Jail Colony Kohima-797001
Tripura	Department of Industries and Commerce Government of Tripura Shilpa Udyog Bhawan, Near Ginger Hotel, Khejur Bagan P.O.:- Kunjaban, Agartala, West Tripura - 799006	Tripura Industrial Development Corporation (TIDC) General Managers of DICs West, Dhalai, Gomati and Unokoti KVIB Deputy Director CII, Tripura New Industries Building, (1st floor) P.O. Kunjaban, Agartala-799
Sikkim	Dept. of Commerce & Industries Udyog Bhawan, Below Sikkim Press, Upper Tadong, Tadong, Gangtok, Sikkim	General Manager, District Industries Centre- South & West General Manager, District Industries Centre- East & North KVIB

	737102	Sikkim Industrial Development & Investment Corporation Ltd. (SIDICO) SIDICO Udyog Bhawan, Tadong , East Sikkim 737102
		Director CII, Sikkim State Office City Centre, Office Block F No - 0313 Matigara Siliguri - Distt - Darjeeling-734403 West Bengal

10 POTENTIAL CANDIDATE INDUSTRIES (FOUNDRY, FORGINGS AND METAL CRAFTS)

Table 3: Potential industries

#	Name of the Product	Approx. Project Cost
1.	Agriculture Implements	85.35
2.	Metal Handicraft Items	7.60
3.	Aluminium Pressure Die Casting (upto 0.75 kg)	55.85
4.	Copper Powder	107.10
5.	Galvanized M.S.Wire	86.17
6.	Heat Treatment Servicing Unit	8.00
7.	Investment Casting	192.28
8.	Manufacturing of S.G. Iron Casting	44.26
9.	Non-Ferrous Castings	83.12
10.	Aluminium Utensils	42.19

10.1 Agriculture Implements

10.1.1 Introduction

The establishment of an industrial unit for manufacture of Tractor drawn Agricultural Implements like Tillers/cultivators & Disc harrows etc. These implements are mainly employed for the preparation of soil bed for sowing & burial of organic substances as well as loosening & aerating the soil in the agricultural fields.

10.1.2 Market Potential

The proposed products –Tillers & Disc harrows are primarily the tractors drawn agricultural implements that are mainly employed for preparation of soil bed for sowing & burial of organic substances as well as loosening & aerating the soil in the agricultural fields. These are heavy duty & economical implements employed by the farmers all over the world for soil bed preparation. Since India is high in the Agriculture base there is a big demand of these implements in the entire country including Jammu & Kashmir particularly in the plain areas

like districts Kathua, Jammu & Samba. Presently there is no organized manufacturer of these products in the state & there is a tremendous gap in demand & supply since most of the products are being supplied by the units in neighboring states-Punjab & Haryana. Therefore there is a very good market potential for the production of the Agricultural implements.

10.1.3 Project Cost & Financial Analysis

Table 3: Total Capital Investment & financial Analysis

S.No.	Items	Units	Values
1.	Production Capacity (Per Annum)	Nos.	1250
2.	Land and Building	Sq. mtr	607
3.	Machinery and Equipments	Rs. In Lakhs	17.30
4.	Working Capital	Rs. In Lakhs	24.03
5.	Total Capital Investment	Rs. In Lakhs	85.35
6.	Rate of Return (%)	%	35.66
7.	B.E.P. (%)	%	37.01

10.2 Metal Handicraft Items

10.2.1 Introduction

The non-ferrous metal industries are century old traditional craft in many of the pocketed areas of Assam, West Bengal, Orissa and Andhra Pradesh. Many fancy articles, tools, statues, flower pots, ash tray, agarbatti stand etc. are manufactured. Bellmetal utensils are normally manufactured by melting brass metal and tin in small crucible to attain optimum melting temperature and to have better fluidity. These moulded metal is poured into the mould made with sand and binder in double box moulding. The products are then made smooth and furnishing by scrappers mounted on hand operated fixtures. Brass, copper utensils are still popular in different ceremonial occasions.

10.2.2 Market Potential

The demand based on the type of handicrafts is difficult to analyze, owing to constantly evolving trends. This has compelled the handicraft producers to keep themselves updated about the ongoing trends, so that they can match the consumer expectations. At present, the growth of the furniture and furnishings segment in the global handicrafts market is increasing at a rapid pace. The market has also been observed to shift from ethnic designs to more contemporary styles. Also, the combination of ethnic and contemporary designs in handicraft products is trending these days. The quality of handicraft products has also improved over the years, due to their increasing adoption among the high class society.

10.2.3 Project Cost & Financial Analysis

Table 4: Total Capital Investment & financial Analysis

S.No.	Items	Units	Values
1.	Production Capacity (Per Annum)	Nos.	908
2.	Land and Building	Sq. mtr	1500
3.	Machinery and Equipments	Rs. In Lakhs	4.00
4.	Working Capital	Rs. In Lakhs	3.60
5.	Total Capital Investment	Rs. In Lakhs	7.60
6.	Rate of Return (%)	%	38%
7.	B.E.P. (%)	%	23%

10.3 Aluminium Pressure Die Casting (upto 0.75 kg)

10.3.1 Introduction

Though tremendous technological advancements in the metal casting industry have taken place in recent years, the foundry industry faces increasing demands to achieve higher productivity at minimum cost, even while producing high quality cast components of intricate shapes. By proper selection of a casting technique with careful foundry and metallurgical controls, castings of high quality are being commercially manufactured. Amongst a large number of foundry techniques one is low and high pressure die-casting. It has been developed and industrially employed to produce castings of near-net shape components. The near net shape cast parts are famous for their fine details, good surface conditions, complex shapes and economy. Under the present scenario of industrial development, metal casting has moved from an art and craft industry to the industry based on science and technology. Die casting provides the foundry man with one of the fastest means of producing castings with a much higher degree of accuracy than that normally obtained by conventional sand casting. In fact, this method is unexcelled for mass production work as numerous castings can be produced very rapidly at low cost. The castings can be made to very close tolerances and with a fine surface finish.

10.3.2 Market Potential

The popularity of pressure die cast aluminium alloy components arises from the following advantages it offers as compared to other methods of castings: – High Productivity – Good as cast surface finish and appearance. – Compact casting–sound strength. – Do not require further machining. – Can be cast within close dimensional tolerance. – Very thin section, can be cast with ease. – Metal wastage in the casting is low. – Rejection due to casting defects is low. Demand mainly arises from the sources like Defence, Telephone industry, Automobile components and fittings, Electrical appliances, Electronic components, Builders hardwares

and fittings etc. Demand in these areas again depends upon the primary market, replacement market and substitution market.

10.3.3 Project Cost & Financial Analysis

Table5: Total Capital Investment & financial Analysis

S.No.	Items	Units	Values
1.	Production Capacity (Per Annum)	MT/Annum	114
2.	Land and Building	Sq. feet	300
3.	Machinery and Equipments	Rs. In Lakhs	24.89
4.	Working Capital (3Months)	Rs. In Lakhs	30.96
5.	Total Capital Investment	Rs. In Lakhs	55.85
6.	Rate of Return (%)	%	19.61
7.	B.E.P. (%)	%	61.18

10.4 Copper Powder

10.4.1 Introduction

Copper Powder is the basic raw material for many of the sintered products. These products find their uses in aircrafts, space crafts, parts for guns, porous metal bearings, filter gas diffusers, welding rods, bimetallic strips and electrical parts. The usage of copper powder has increased manifold by virtue of its physical properties, long life high scrap value and wide range of uses. Next to iron and steel, it is widely used in the market.

10.4.2 Market Potential

The indigenous production of copper powder is only around 7000 tonnes per annum as against an estimated demand of about 15000 tonnes per annum. This itself shows the huge demand for the product in India. Since there are only a few small scale manufacturing units scattered over the country, the market potential for the product is very large.

10.4.3 Project Cost & Financial Analysis

Table 6: Total Capital Investment & financial Analysis

S.No.	Items	Units	Values
1.	Production Capacity (Per Annum)	MT/Annum	120
2.	Land and Building	Sq. feet	250
3.	Machinery and Equipments	Rs. In Lakhs	11.70
4.	Working Capital (3Months)	Rs. In Lakhs	95.40
5.	Total Capital Investment	Rs. In Lakhs	107.10
6.	Rate of Return (%)	%	71
7.	B.E.P. (%)	%	33

10.5 Galvanised M.S. Wire

Galvanized M.S. Wire has versatile use in producing different Engineering items such as Building Hardwares, barbed wires, Screens rivets etc. Special quality of wire is also required for producing special purpose fasteners, reinforcement wire etc.

The Galvanized M.S. Wire is a Mild Wire which is coated with a steel layer of Zinc. The coating of Zinc provides cathodic protection to underneath Steel surface. The Galvanised M.S. Wire offers better surface protection at lower cost in humid atmosphere.

10.5.1 Market Potential

The Galvanized M.S. Wire has very good demand for its versatile use in different applications. There is a large demand for this item from the down stream industries.

With the availability of appropriate technology, the activity is highly feasible in the small scale sector and marketing is generally not a problem.

10.5.1 Project Cost & Financial Analysis

Table 7: Total Capital Investment & financial Analysis

S.No.	Items	Units	Values
1.	Production Capacity (Per Annum)	MT/Annum	1160
2.	Land and Building	Sq. feet	500
3.	Machinery and Equipments	Rs. In Lakhs	24.90
4.	Working Capital (3Months)	Rs. In Lakhs	61.27
5.	Total Capital Investment	Rs. In Lakhs	86.17
6.	Rate of Return (%)	%	34.8
7.	B.E.P. (%)	%	44.5

10.6 Heat Treatment Servicing Unit

10.6.1 Introduction

Heat Treatment is a term used for hardening and tempering of Metal components/Mechanical products of Ferrous and Non-Ferrous origin to increase the life or mechanical properties. Steel in general, supplied in annealed conditions having hardness between 140 to 280 BHN depending on the percentage of alloying elements which facilitate further mechanical operations. 15%–20% of the steel produced is tool steel which will be the raw material for manufacturing of gears, fixtures, shafts, cutting tools, blades and many more products. If these products are used in soft conditions, it will be worn out in a short period. Hence such products are to be hardened and tempered. Heat Treatment is a general term which consists of processes like Hardening, Tempering, Annealing and Case Hardening etc.

10.6.2 Market Potential

Demand in the market mainly arises from:

- Defence
- Railways
- Automobile
- Ball & Roller Bearings
- General Engineering
- Fasteners and Hardware
- Machine Tools

The demand in the above areas again depends upon the primary market, i.e., replacement market and substitution market. Most of the general engineering units in SSI Sector offload the Heat Treatment jobs to servicing units because they may not have enough capital for an independent Heat Treatment section.

10.6.3 Project Cost & Financial Analysis

Table 8: Total Capital Investment & financial Analysis

S.No.	Items	Units	Values
1.	Production Capacity (Per Annum)	MT/Annum	65
2.	Land and Building	Sq. feet	400
3.	Machinery and Equipments	Rs. In Lakhs	6.03
4.	Working Capital (3Months)	Rs. In Lakhs	1.86
5.	Total Capital Investment	Rs. In Lakhs	8.00
6.	Rate of Return (%)	%	56
7.	B.E.P. (%)	%	51

10.7 Investment Casting

10.7.1 Introduction

Investment Casting is a metal casting process which employs an expendable pattern and one piece non metallic mould. This process is also known as Precision Casting because it eliminates the parting line and reduces the machining cost. Sometimes, this process is also known as lost wax method. Although all metals, namely ferrous as well as non-ferrous can be casted by this process, it is most suitable for expensive, hard and high strength metals and alloys, which are difficult to machine. This also includes Stainless and Tool Steels.

Steel, in general, finds extensive application in each and every sphere of life ranging from domestic use to industrial use. In this project, the casting has been worked out on the basis of Stainless Steel Scrap, which finds tremendous application in Chemical, Pharmaceutical, Dairy, Power Generation, Aircraft Industries such as Screws, Fuel Lines, Engine Parts, Heat

Exchangers, Turbine Buckets and Valves. Most of it conforms to austentic, ferritic and martensitic grade followed by Heat Treatment.

10.7.2 Market Potential

The units engaged in the manufacturing of Chemical, Pharmaceutical, Power Generation, Aircraft Industries and Dairy Equipment require a number of special castings such as Stainless Steel Castings in different sizes and shapes. In addition, the requirement of tool steels has gone on increasing with the pace of industrial development. The number of units engaged in the Steel Castings by Investment process are negligible. A few which are producing their castings by conventional type of casting process are not of the standards and specifications with respect to chemical composition of steel. In view of the above, there is immense scope for setting up of such units in the Small Scale Sector with induction melting and quality control facilities due to latest industrial policy declared by the Government, so as to cater to the needs of various industries established in the country and overseas.

10.7.3 Project Cost & Financial Analysis

Table 9: Total Capital Investment & financial Analysis

S.No.	Items	Units	Values
1.	Production Capacity (Per Annum)	MT/Annum	810
2.	Land and Building	Sq. feet	1500
3.	Machinery and Equipments	Rs. In Lakhs	66.28
4.	Working Capital (3Months)	Rs. In Lakhs	122.59
5.	Total Capital Investment	Rs. In Lakhs	192.98
6.	Rate of Return (%)	%	29
7.	B.E.P. (%)	%	52

10.8 Manufacturing of S.G. Iron Castings

10.8.1 Introduction

The present project profile envisages the production of S.G. Iron Castings of various shapes and sizes having weight between 50 gm. to 12 kg. in Medium frequency induction furnace. S.G. Iron Castings are extensively used because of their high strength, ductility, shock as well as wear resistance properties and easy machinability.

10.8.2 Market Potential

S.G. Iron possesses greater tensile strength, machinability than ordinary cast iron and also has a considerable measure of ductility, resistance to impact comparable to that of steel and low cost involved that justifies it as the metal of future. Due to economic reforms based upon principle of liberalization, globalization, privatization and changes at international economy including the emergence of WTO global and domestic challenges, the demand for components of S.G. Iron particularly in automobile sector is likely to increase manifold not only for domestic consumption but also for export purpose. Since small-scale sector accounts

for 40% of gross value of output in the manufacturing sector and 35% of total exports from the country, this industry has great scope.

10.8.1 Project Cost & Financial Analysis

Table 10: Total Capital Investment & financial Analysis

S.No.	Items	Units	Values
1.	Production Capacity (Per Annum)	MT/Annum	300
2.	Land and Building	Sq. feet	1500
3.	Machinery and Equipments	Rs. In Lakhs	25.05
4.	Working Capital (3Months)	Rs. In Lakhs	14.01
5.	Total Capital Investment	Rs. In Lakhs	44.26
6.	Rate of Return (%)	%	37.80
7.	B.E.P. (%)	%	58.82

10.9 Non-ferrous Castings

10.9.1 Introduction

The castings of metals and alloys of copper, zinc, tin, aluminium, lead etc. come under the group of non-ferrous castings. Some of the prominent alloy castings are Brass, Bronze, Aluminium Bronze, Gun Metal etc. These castings are used for various purposes like bearing, bushes, automobile parts, textile parts, corrosion resistance parts, marine parts, impellers, clamps and connectors, over-head conductors etc. Some of the main products manufactured are:

1. Gun metal valves
2. Gun metal bushes
3. Water meter body
4. Aluminium clamps and connectors
5. Impellers
6. Bell metal castings
7. Leaded Brass Bearings
8. Water tight and pressure tight castings

10.9.2 Market Potential

Non-ferrous castings are fast consuming items and the area of application for these items are vast. Due to certain inherent advantages of mechanical and chemical properties, the use of non-ferrous castings is increasing day by day. The consumption of these items is by Automobile Industries, machine manufacturing Industries, Textile Industries, Electrical Industries and so on. The consumption of Gun metal bushes alone is very large which are required in original equipments as well as for replacement market.

10.9.3 Project Cost & Financial Analysis

Table 11: Total Capital Investment & financial Analysis

S.No.	Items	Units	Values
1.	Production Capacity (Per Annum)	MT/Annum	216
2.	Land and Building	Sq. feet	300
3.	Machinery and Equipments	Rs. In Lakhs	28.88
4.	Working Capital (3Months)	Rs. In Lakhs	54.24
5.	Total Capital Investment	Rs. In Lakhs	83.12
6.	Rate of Return (%)	%	27.78
7.	B.E.P. (%)	%	52.9

10.10 Aluminium Utensils

10.10.1 Introduction

Food preparation in kitchen involves tasks like cutting food items to size, heating food on an open fire or on a stove, baking, grinding, mixing, blending, and measuring, boiling, stirring, frying; etc. and utensils are made for each task. Also different containers are also required for storing the processed and cooked food. Besides the utensils are also required for meal serving and eating.

Utensils may be classified as cooking utensils that are put on fire i.e. cooking containers, or Kitchen processing utensil and Dining utensils consisting of containers and cutlery items and finally the food item storage containers. Liquids like water and beverages require a separate design class of utensils.

10.10.2 Market Potential

Aluminum is quick to heat up food and has lower cost, thereby making it affordable to consumers. Besides aluminum is preferred metal in cooking utensils. Lower cost makes it popular for all types of utensils including utensils used for dining and other uses, in low income strata of population. Products from over 100 brands are available from India. Branded products are increasingly finding favor with Indian consumers in all segments of the market. Overall demand is growing between 20-30% depending on the sub-category. Despite competition, new design products are finding favors due to convenience and utility.

10.10.3 Project Cost & Financial Analysis

Table 12: Total Capital Investment & financial Analysis

S.No.	Items	Units	Values
1.	Production Capacity (Per Annum)	MT/Annum	270
2.	Land and Building	Sq. feet	600
3.	Machinery and Equipments	Rs. In Lakhs	9.01
4.	Working Capital (3Months)	Rs. In Lakhs	33.18
5.	Total Capital Investment	Rs. In Lakhs	42.19
6.	Rate of Return (%)	%	160.75
7.	B.E.P. (%)	%	13.04

11 SUGGESTIONS AND RECOMMENDATIONS

1. Creating awareness on the industrial potentialities in the area of foundry/ forgings and metal crafts manufacturing/ service enterprises through seminars/ get-together and group programmes
2. Establishment of at least a couple of training centres at two locations, one at Guwahati and the other at Imphal.
3. Introduction of add –on- courses at the polytechnics and ITIs in all the states
4. Opportunity Guidance classes and awareness creating programmes for the potential and prospective entrepreneurs by inviting experts in the field
5. Dissemination of information on the scope of metals based enterprises
6. North Eastern Council and The Ministry of Development of North Eastern Region to be involved for adequate funding support
7. Preparation and publication of a Region-specific compendium containing project profiles/ technical know-how suitable for entrepreneurs belonging to NE States and Sikkim
8. Establishing tie-ups with existing foundry clusters elsewhere in the country