General Engineering Sector Focused Technology Center Visakhapatnam

Cluster Diagnostic Report

Technology Center System Program (TCSP)

Office of DC MSME, Ministry of MSME

30th December, 2019

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List of Abbreviations

AI	Artificial Intelligence
AMTZ	Andhra Pradesh MEDTECH Zone Ltd
APIIC	Andhra Pradesh Industrial Infrastructure Corporation Ltd
APSFC	Andhra Pradesh State Financial Corporation Ltd
APSEZ	Andhra Pradesh Special Economic Zone
BOT	Build Operate Transfer
BDS	Business Development Services
CACR	Compound Annual Growth Rate
CAD	Computer Aided Design
CAM	Computer Aided Manufacturing
CAE	Computer Aided Engineering
CDP	Cluster Development Program
CFC	Common Facility Centre
CIM	Computer Integrated Manufacturing
CITD	Central Institute of Tool Design
CMM	Co-ordinate Measuring Machine
CNC	Computer Numeric Control
DIC	District Industries Center
DPR	Detailed Project Report
DPIIT	Department for Promotion of Industry and Internal Trade
EBW	Electron Beam Welding
EDM	Electrical Discharge Machining
EOT	Electric Overhead Travelling
ERP	Enterprise Resource Planning
EEPC	Engineering Export Promotion Council
FSW	Friction Stir Welding
GDDP	Gross District Domestic Product
GMP	Good Manufacturing Practices
GPM	General Purpose Machines
HCV	Heavy Commercial Vehicles
IALA	Industrial Area Local Authority, Vishakhapatnam
ISO	International Standard Organization
MES	Manufacturing Execution System
MIG	Metal Inert Gas
NABL	National Accreditation Board for Testing and Calibration Laboratories
NSIC	National Small Industries Corporation
OEM	Original Equipment Manufacturer
PIWA	Parawada Industrial Welfare Association
RINL	Rashtriya Ispat Nigam Limited
SMFC	Sheet Metal and Fabrication Cluster
SPM	Special Purpose Machines
TC	Technology Centre
TCM	Technology Cluster Manager
TCSP	Technology Centre Systems Program
TIG	Tungsten Inert Gas
VASSIWA	Visakha Autonagar Small Scale Industrialist Welfare Association
VCIC	Visakhapatnam-Chennai Industrial Corridor
VSEZ	Visakhapatnam Special Economic Zone

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1. Executive Summary

The increased focus on manufacturing in India has boosted the Indian Machine Tool Industry & Tool Rooms and has helped in positioning it on the world tooling market. The market size for the Indian machine tooling industry was estimated to be around INR 14691 Cr as of 2018[1] of which 47% was accounted by domestic consumption. In terms of the global market, India is placed 17th in terms of production and 12th in terms of consumption of tools and faces stiff competition from other countries like The USA, China and Germany. In order to keep up with the domestic and global market in terms of optimized costs, reduced scrap and improved efficiency & productivity of the machines, the Indian market needs to focus on automation of processes in manufacturing and engineering. Through the Technology Center at Visakhapatnam, the focus is on catering to these requirements with a specialized focus on the Sheet metal, fabrication, machining and other manufacturing units.

To prepare this cluster diagnostic report, an extensive exercise was conducted to understand the challenges being faced by the cluster. Also, the existing, as well as proposed services being offered by the Technology Center in Vishakhapatnam, were reviewed. This report is a result of a detailed assessment conducted with an objective to understand the requirements of the cluster. Cluster requirements for production, training and consulting were mapped with TC's existing and proposed infrastructure to recommend necessary interventions.

Apart from getting a detailed understanding of the service offerings of the technology center, an excessive focus was given to understand the three prioritized clusters of Sheet Metal and fabrication, Machining, and Composite Material (Including foundry and forging) in and around Vishakhapatnam. The idea of this exercise was to map the existing and proposed TC services with the cluster requirements and accordingly recommend solutions for the transformation of TC's business avenues. Some of the key observations from the study are as below:

- Limited availability of private/government tool rooms in the region forces the units to connect with tooling service providers in other parts of the country like Pune, Hyderabad, Mumbai etc.
- There are limited recognized and authorized testing facilities in the region. The units require testing facilities to conduct tests for which they are dependent on non-NABL accredited testing labs in the region
- There is limited availability of state of the art institutions that provide training for tool and die making and manufacturing. Further there are very few institutes focussing on trainings related to CNC, CMM operators.
- Inadequate marketing and industry linkages Interactions

Recommendations have been provided in domains like reducing the skill gap of the workers, resolving the technological backwardness and nullifying the information asymmetry. Some of the key recommendations are:

- New training courses like Titanium welding, Introduction to Foundry and Forging etc. specific to different clusters have been identified that can be introduced by the technology center
- Technology center can take up NABL accreditation for its testing labs and can offer various testing services for the MSME units
- Conceptualization of Entrepreneur facilitation cell (EFC) in the Technology Center to support MSMEs in availing different government schemes
- Modification of planned machines in the production facility to cater to the needs of the local industry

[1] IMTMA Production, Export & Import Report, Details of Machine Tools 2017-18

2. Introduction

The engineering sector is significant and diverse with various important segments. India's engineering sector has observed a notable growth in the last few years due to increased investments in infrastructure and industrial production. The Indian engineering sector has already marked its influence globally with deep knowledge of distribution, transformation operations, and cost-effective technologies through the export of transport equipment, light engineering products such as castings, fasteners, and forgings, capital goods to various countries globally.

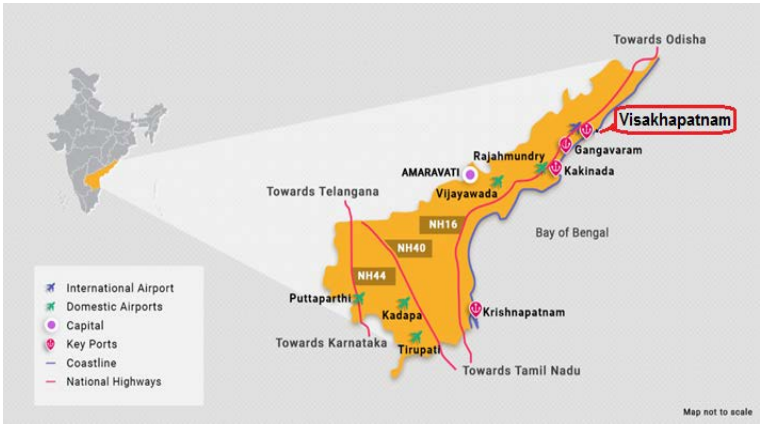
Engineering is by far the major segment in the country, employing nearly four million skilled and semi-skilled employees. The sector has seen exceptional growth, driven by substantial investments in infrastructure development and power projects. From April 2000 to June 2018, the Foreign Direct Investment (FDI) inflow stood around USD 3.45 billion (data released by DIPP, 2018), which has eventually helped India in becoming a part of an exclusive cluster of seventeen countries, which are permanent signatories of the Washington Accord (WA), an elite international agreement on engineering training and mobility of engineers

In order to cater to the growing engineering sector in the country, the Ministry of MSME has initiated a national programme with the support of the World Bank, Technology Center Systems Programme, to upgrade existing technology centers and set up 15 new technology centers. As a part of this program a General Engineering sector-focused Technology Center is being set up in Visakhapatnam to cater to the technological and training needs of the Fabrication, Foundry, Automotive, and Electronic focused clusters in the catchment area. The TC will provide improved access to technology, skill up-gradation and advocacy support to the MSMEs for fulfilling the following aspirations and requirements of the market:

- A strong and sustainable component supply chain, simultaneously developing the local MSME network along with their suppliers
- The national objective to make India and especially the Visakhapatnam area - a fabrication hub through technical excellence by providing necessary infrastructure, facilities and manpower
- The global need to save the energy – material, and power - along with environmental protection of the globe - for the future generations

3. General Engineering Industry in Andhra Pradesh

Andhra Pradesh (AP) is in the Southern region of India and shares boundaries with Chhattisgarh on the North, Odisha on the North East, Telangana, and Karnataka on the west and Tamil Nadu on the South. The state has well-developed social, physical and industrial infrastructure which supports the industry by providing quality power, strong IT backbone and robust port infrastructure. This has helped in making Andhra Pradesh as one of the better performing states with respect to ease of doing business and has attracted several foreign investors in the State. Apart from providing strong physical infrastructure, Andhra Pradesh State Government has also established various institutions like



APIIC, APSEZ etc. for supporting the General Engineering Industry in the region. This enhanced focus on the General Engineering industry has helped in the development and promotion of this industry in costal districts of AP, Visakhapatnam, Vizianagram, Srikakulam, East and West Godavari.

Visakhapatnam district has a total of around 17,560 MSME units that employ around 173,847 people out of which, approximately 9,000 Micro, Small and Medium enterprises cater to the manufacturing, welding and fabrication, Forging, Foundry and composite industries[2].

The general engineering Industry in Visakhapatnam is also benefited by the presence of one of the major and the largest ports of the country. This has helped the local industry in taking benefit of easy accessibility to new markets in South East Asia and beyond. The port also houses a shipyard-The Hindustan Shipyard Limited, which undertakes manufacturing and repairing of ships and submarines. It has manufactured more than 170 vessels and repaired over 2000 ships and submarines. This has helped in the development of a large ancillary market in the region.

4. Approach and Methodology

A multi-step approach was followed to comprehensively cover the issues, demands, and needs of the cluster and map the cluster requirements with TC offerings. As a part of the process, TCM's technical expert, Mr. Bal Gangadhar PRC along with Mr. Dinesh Kumar, Support Consultant, Vishakhapatnam conducted a desk review and undertook in-person industry consultations for the preparation of diagnostic study report (DSR). Cluster Development Expert Mr. K.P. Lal played a pivotal role in shaping the study with his timely advice. While undertaking this study TCM experts first reviewed the existing literature on TC Vishakhapatnam and held extensive consultations with industry representatives to map their requirements vis a vis planned TC offerings and then identify new services that can be offered by TC. The following points were kept in mind while conducting a detailed study.

- The study should look into a longer time horizon of 5 to 10 years
- Skilling the operatives (both existing and new entrants) and supplying the needed components for the industry in general and the SMEs in particular. This is required for making TC self-sustaining and thereby enhancing the potential to offer training and manufacture items at marginally below the market prices. Such a price differential would give the MSMEs – an impetus to grow and become more competitive.
- The laboratories should be equipped and should comply with changing trends of the product, process, and skills that are needed under the ever-changing manufacturing scenario. Further, the pass outs from the TC should be ready for Industry absorption without any additional major training at the Company's end.
- Maintain a minimum number of production machines - both in their versatility and number – to operate as a parts/tooling supplier for meeting the delivery requirements.

Figure 1: Approach and Methodology

Step 1: Desk Review of the Vizag TC's DPR and the General Engineering Industry in Vizag

[2] Detailed project report, Technology Center Vizag

A detailed desk review of the DPR along with cluster needs and the basic requirements of the General Engineering Industry in Vizag was conducted. As a part of this exercise, secondary research was conducted to do preliminary mapping of TC offerings with the requirements of the Industry in Andhra Pradesh, particularly Vizag.

The exercise also tried to identify the current requirements and upcoming trends in the general engineering manufacturing industry. The desk research also focused on identifying the key general engineering clusters in the catchment area of the Technology Center. Three industry clusters that provided complete representation of the region in terms of products and services offered were shortlisted for carrying out the detailed study.

Step 2: Identification of Key Stakeholders

To validate the preliminary findings from the desk review, a sample of key stakeholders from the prioritized clusters that ensured representation from industry associations, MSMEs, governmental bodies and Industry Associations was taken. While preparing the list of key stakeholders, heterogeneity of thought process and complexity of the information being sought were two important parameters considered.

Step 3: Industry Consultations

To understand the business requirements, issues and challenges being faced by the industry in Vizag and to develop an understanding of how TC can work on these issues, a stakeholder consultation with 40+ actors was conducted. Industry associations, manufacturers and suppliers were contacted to get a complete view of the expectations of the industry from the technology center. Apart from this, it was also ensured that the final list of stakeholders had a good mix of those that were contacted during DPR preparation and new stakeholders. This was done to understand how the market has changed over the years and what are the potential areas of changes.

Step 4: Analysis and Recommendations

Inputs and feedback received from all the stakeholders were analyzed carefully by a team of experts. Stakeholder inputs and recommendations were then framed into a set of recommendations which were discussed with the TC representatives.

5. Technology Center Vizag – An Overview

Visakhapatnam Technology Center is one of the new Technology Centers initiated by the Ministry of Micro, Small and Medium Enterprises, Government of India under TCSP (The Technology Center Systems Programme) and would support units in the catchment area that includes Vizianagaram, Srikakulam, East Godavari districts (Andhra Pradesh), Malkangiri, Koraput, Rayagada, Gajjapati and Nowrangpur districts (Odisha), and Sukma, Kondagaon (Chhattisgarh).

The technology Center proposes to provide support from the point of concept creation to the development of prototypes and low volume production to also providing consulting and training support to the workforce and MSME units. The technology center will also play an important role in supporting the state government in developing a strong ecosystem for attracting large auto and electronics manufacturing units in the state.

Visakhapatnam TC aims at offsetting the following challenges
• Lack of Tooling manufacturing facilities • Absence or limited automation in the manufacturing processes • Low machine utilisation in manufacturing units, • Lack of knowledge/ awareness of low-cost automation technologies

Visakhapatnam TC aims at offsetting the following challenges
• Limited standardisation • Limited availability of skilled Manpower and high attrition / job hopping, shortage of trained manpower • Limited / slow adaptability of technology • Dispersed / unorganised approach towards marketing • Low design capabilities

5.1 Training Facility

The Technology Center will provide professional training in various general engineering courses with a focus on fabrication techniques by offering advanced courses that will produce a highly-skilled technical workforce, with greater career prospects. The duration of courses will be both short and long term, ranging from 1 week to 48 months in various specializations like; Tool Room & CNC Manufacturing, CAD/ CAM, Advance Welding, Maintenance Training, Electronics and IT, Industrial and process Automation (Robotics), Training on Testing and calibration, etc. A key focus area of the TC is to skill workers in quality testing of finished products. The batch sizes, the number of batches per annum and respective fees have been decided based on the capacity of existing TCs and NCVT norms.

Laboratories
Welding workshop for 24 including simulator
Welding Qc Lab incl. Radiographic Testing
Solar Energy Lab
Basic Instrumentation Lab
Automation Lab for 20
Metrology Lab Equipment
Chemical and Metallurgical Test labs

Table 1: Laboratories planned as per DPR

A soft skill lab will also be established in the TC that will focus on training in the English language and communication. Soft skill module will be an integral part of all the medium to short term courses. The TC will start training activity from the first year of its operation across all specializations. A detailed list of courses to be offered by the TC is annexed. In order to successfully offer these training services to the MSMEs, TC will also have state of art laboratories.

Currently, the TC is offering training in Auto CAD and CAM. Going forward it intends to start other training programs related to machining and manufacturing. As it initiates operations, TC would face stiff competition from other institutes offering similar services. The below table gives an idea of the fee charged by different institutes. Ind0 German Institute of Advanced Technology (IGIAT) and Siemens Center of Excellence offer some of the courses free of cost to the college students. The fee for the same is being reimbursed by Andhra Pradesh State Government under AP State Skill Development Mission.

	Name of the Course	Duration in hours	Fees Structure (INR)
Technology Center, Vishakhapatnam	Auto CAD	216	2500
	CAM	216	
	CAE	216	
	Advance Certificate in CNC Machining	288	Yet to Finalize the fee structure
	Certification in CNC Milling	288	
	Certificate Course in Turning	288	
	Maintenance	4- 6 months	
	CNC Manufacturing- CAD/CAM		
	Advance Welding		
	Foundry		

	Name of the Course	Duration in hours	Fees Structure (INR)
	Electronics and IT		
	Industrial and Process Automation		
	Training on testing		

Table 2: Technology Centers Courses and Tariff List

	Name of the Course	Duration in hours	Fees Structure* (INR)
Indo German Institute of Advanced Technology	CNC Operator	288	Free for College Students
	Welding Technology	288	
	Building Services	288	
	Site & Survey Supervisor	288	
	Maintenance Technician	288	
	Electrician Technician	288	
	Auto CAD	50	2,600
	PRO E/ CREO	60	4,100
	CATIA	60	4,100
	CNC Programming (Lathe)	60	4,100
	CNC Programming (Milling)	60	4,100
	Basic Robotics	20	2,500
	Advanced Robotics	40	6,000
	Automation - PLC	50	4,100
	WinCC SCADA	30	2,100
	MATLAB	50	4,100

Table 3: IGIAT Courses and tariff list

*They have in-take of 60 students per batch for every 3 months

	Name of the Course	Duration in hours	Fees Structure* (INR)
Siemens Center of Excellence	CAD module	288	Free for College students*
	CAE module	192	
	CAM module	96	
	Automation - Basics pf PLC/ Basics of SCADA & HMI & Networking	120	
	CNC - Turning - NC control Programming/ sinumerik operate	64	
	CNC - Milling - NC control Programming/ sinumerik operate	64	
	Robotics - Basics/Material handling/Arc Welding/Spot Welding	160	

Table 4: Siemens CoE Courses and Tariff List

*They have in-take of 60 students per batch for every 3 months

5.2 Production Facility

Visakhapatnam TC proposes to offer cutting edge production services like - manufacturing of Press Tool Dies, Moulds, Jigs, Fixtures, Gauges, Die Casting Dies, Manufacturing of support parts and

components. Visakhapatnam TC shall also provide technical services such as the design of Tools, Dies, Moulds and Materials Testing, Heat Treatment and Quality Control. The key focus areas of the Technology Center are as follows

- Full / semi-automation, Consultancy support for process improvement in fabrication and other production areas
- Engineering Solutions -Development of Jigs & Fixtures for Machining, Welding, etc
- Support in manufacturing of die casting dies and manufacturing of Forging dies
    - Support in Tool and to MSMEs
    - Provide training/ Skilled manpower for tool and die making and other technical areas
- Testing, calibration, metrology & inspection support
- Reverse Engineering & Import substitution

A detailed list of machinery currently procured for TC is mentioned in the Annexure 3

5.3 Consulting Support

Apart from providing production and training support, the technology center will also support MSMEs in overcoming bottlenecks and inefficiencies in improving their competitiveness and presence in the market. The technology center will also provide handholding support to MSMEs in areas of Product and process development, operations improvement, streamlining and standardization of processes through the adoption of international norms, new technologies and capacity enhancement. The Visakhapatnam TC would have a dedicated professional wing to assist MSMEs by providing consultancy services in the field of Design Support (incl. Product Design), Engineering Solutions (Development of Jigs & Fixtures for Machining, Welding etc., Quality System Support, Project Consultancy (Low-cost Automation Solution support, Productivity Improvement)

TC SWOT ANALYSIS

Strengths	Opportunities
• Latest machinery for providing production and training support • Access to a strong network of 14 General Engineering Technology Centers under the parent Ministry • Availability of state of art laboratories for providing testing services • Government of India support for capital investment	• Expansion plans of major industrial units like HPCL and Hindustan Shipyard. • Non-availability of NABL accredited testing facilities in the region • Absence of Private Tool Rooms in the region. Local units are dependent on tooling facilities in Hyderabad, Mumbai, Pune for tooling related work • State government's focus on attracting manufacturing units in the region. Kia Motors has recently set up a manufacturing in Andhra Pradesh
Weaknesses	**Threats**
• Access to TC is a challenge as it is situated away from the city. Further, as TC does not provide any transportation facilities, the commute would be a challenge for training seekers • High lead time in initiating long term courses in the technology center	• High competition from nearby engineering colleges and training service providers • Economic slowdown affecting the fabrication and foundry industries severely • The future trend of E-Vehicles would require new products and tooling machines beyond the current offerings. This would require a change in overall infrastructure in the TC.

Table 5: SWOT Analysis- Technology Center

6. Overview of General Engineering Clusters – Vishakhapatnam

Visakhapatnam district has a total of around 17,560 MSME units that employ around 173,847 people. Out of which, approximately 9,000 Micro, Small and Medium enterprises cater to manufacturing, welding and fabrication, Forging, Foundry and composite industries[3]. Apart from fabrication, other major industries in the region include electrical, chemical, pharmaceutical, repairing and servicing, textiles and agro-based industries. Some of the large players in the cluster include Hindustan shipyard, Hindustan Zinc Ltd., etc. This has helped in developing Vizag into an industrial hub and has seen a tremendous growth due to its heavy industries (both state owned and private) such as:

- HPCL Oil refinery (Hindustan Petroleum Corporation Limited)
- Visakhapatnam Steel Plant – Rastriya Ispat Nigam Limited (RINL)
- Hindustan Zinc Limited
- Bharat Heavy Plate and Vessels Ltd
- Hindustan Shipyard Limited
- Vishakhapatnam Port
- Coromandel Fertilizers
- NTPC
- ESSAR Palettization Plant (The iron ore now used by this plant comes via 267 km long pipeline from Bailadila, helping reduce transportation costs substantially).

General engineering clusters that were prioritized and studied are job-based clusters where the majority of the enterprises depend upon job work, machining, and fabrication related work. The following three clusters are prioritized based on in-depth study and detailed discussion with Visakhapatnam TC. Other factors that influenced prioritization are the presence of major industries in and around Vizag, industry associations, number of units and socio-economic conditions.

- Sheet Metal and Fabrication Cluster
- Machining Components Cluster
- Composite manufacturing (incl. Forging & Foundry) Cluster

Sheet Metal and Fabrication Cluster:

Sheet metal and fabrication cluster consists of units that offer different services related to

- Heavy Engineering Fabrication: It is the key contributor to the development and establishment of MSMEs in the region. These units are primarily suppliers to the major players that include power, refineries, petrochemicals, and process plant industries including industries like HPCL, Vizag Steel Plant, etc.
- General Construction and Engineering: Major PSU establishments and chemical plants in and around the Visakhapatnam have triggered the growth of a large number of medium and small fabrication units, which present the general image of the fabrication industry in Vizag
- Shipbuilding and Repair Services – Shipbuilding is one of the major jobs generating sector in the region. The majority of job work for the fabrication is related to plant and piping related services.

Machining Component Cluster

The sector consists of nascent units developed to cater to the growing demand for accurately finished components in the local market. Apart from finishing products from raw material, other semi-finished products from forging & foundry and fabrication clusters are subjected to finishing to produce final products. Some of the sectors that utilize machined components include heavy machinery, auto, aerospace, defense, power, refineries, petrochemicals, and process plant industries like HAL, KIA Motors, HPCL, Vizag Steel Plant etc. The uniqueness of this sector is that delivered products may

[3] Detailed Project Report, Technology Center Vizag

require very high accuracy of the finished product, in turn demanding highly accurate machines and high skills. Most of the stakeholders in this cluster are using CNC Machines along with conventional general-purpose machines.

Composite Manufacturing (Including Forge & Foundry)

The sector is the key contributor to the development and establishment of MSMEs in large numbers. Some of the sectors that utilize the output from this sector include auto, heavy machinery, power, refineries, petrochemicals, and process plant industries including industries like HAL, BDL, Defence organizations, HPCL, Steel Plant etc. Some of the units, especially in the castings sector, are delivering to other states and exporting to other countries. Major PSU establishments and chemical plants in and around the Visakhapatnam have triggered the growth of a large number of medium and small MSME units, which present the general image of the Forge and Foundry industries.

Composites have wide usage in Engineering like Plants (tanks, etc.), Auto (vehicles body parts, etc.), Aerospace (rudder etc.) industries and also for general use (base of the roof ventilators etc.), Household settings and decorations (Doors, wedding settings etc.).

6.1 Key Stakeholders and Institutional Framework

Andhra Pradesh government's enhanced focus on improving the industrial ecosystem in the state has helped in the development of a strong stakeholder and institutional framework in Vizag. Constant interaction between these stakeholders has helped in the development of a strong industrial community as well as market for the industries. Key stakeholders for Visakhapatnam TC include: Government bodies, Industry associations, raw material suppliers, financial institutions, testing & certification facilities, machinery Suppliers, skilling and training institutes

Government Institutions: Government Institutions play a vital role and are responsible for promoting the development of the industrial cluster and growth of the MSMEs in the state. These institutions play an important role in influencing policy decisions and are responsible for the execution and implementation of the different central/state schemes and initiatives for all the benefits. Some of the major government institutions in the state are:

- MSME-DI: It is engaged in the development and promotion of Micro, Small & Medium Enterprises in five north coastal districts of AP viz., Visakhapatnam, Srikakulam, Vizianagaram, East and West Godavari. It assists existing and prospective entrepreneurs by providing techno-managerial consultancy services and training in various fields
- District Industries Corporation (DIC): DIC is primarily responsible for the development of Industries in general and small- scale industries in particular and plans for various schemes for industrial development. DIC assists and guides entrepreneurs in setting up industrial units, enable entrepreneurs to get different industrial approvals and clearance from various departments as a single point, provide marketing assistance to the local industrial units and also sanction incentives to industrial units, which are eligible.
- Andhra Pradesh Industrial Infrastructure Corporation (APIIC): APIIC is a wholly owned undertaking of the Government of Andhra Pradesh and was established with the objective of providing industrial infrastructure through the development of industrial areas. APIIC is vested with the objective of providing industrial infrastructure through the development of industrial areas.
- Visakhapatnam Special Economic Zone (VSEZ): Visakhapatnam Special Economic Zone (VSEZ) is one of the central government special economic zones, which is treated as a foreign territory for trade operations, duties and tariffs and allows for full and free return of export proceeds

- National Small Industries Corporation (NSIC): NSIC is a Government of India Enterprise under Ministry of Micro, Small and Medium Enterprises (MSME) and focused to promote, aid and foster the growth of micro, small and medium enterprises and provide integrated support services encompassing Marketing, Technology, Finance, and other services.
- Andhra Pradesh State Finance Corporation (APSFC): APSFC is engaged in promoting small and medium scale (SMEs) industries in Andhra Pradesh under the provisions of the State Financial Corporation Act,1951. APSFC has many friendly schemes to provide term loans, working capital term loans for the entrepreneurs.

Industry Associations: Apart from government institutions, industry associations are other important stakeholders that play an essential role in the development of different clusters. The associations represent the voice of different MSME units and are responsible for shaping the ecosystem required for the growth and development of MSMEs. Some of the important associations in this region are:

- Visakha Autonagar Small Scale Industries welfare Association (VASSIWA)
- Pedagantyada Industrialists Welfare Association (PIWA)
- DICC
- IALA - Autonagar
- Visakha SC/ST Entrepreneur association
- A.P. Chamber of Commerce

They also play an important role in keeping the members informed about policy and procedural changes. Their role is to strengthen the relationship between government and industry and to pursue different economic policies.

Academia: There are more than 60 engineering colleges, technical institutes, and diploma colleges along with incubation centers within the 100 km radius of Pudi. These technical institutes play an important role in catering to the skilled manpower requirements of the clusters.

- Technology Center (TC), PUDI
- Engineering Colleges like Andhra University Engineering College, JNTU engineering College, Dr.Lankapalli Bullayya College of Engineering, Gitam Engineering College, Gayatri Vidya Parishad for Engineering, Vignan Institute of Engineering MVR College of Engineering, etc.,
- Polytechnic Colleges: Government Polytechnic College in Visakhapatnam, Pendurthi and Anakapalli, Sai Ganapathi Polytechnic College, Yalamarty College of Polytechnic, Behara Polytechnic, A.V.N Polytechnic College. Etc.,
- Other Skilling Institutes- AP Skill Development Corporation, Indo-German Institute of Advanced Technology, Siemens, etc

Financial Institutions: Most of the units are financed through term loans and working capital loans from banks and equity contributions by entrepreneurs. Though SBI is the leading bank in Visakhapatnam, all major banks have set up their branches and have their own loan disbursement policy. Andhra Pradesh State Finance Corporation (APSFC) is one of the major financial institutions, which encourage MSMEs for setting the businesses by sanctioning the loan with the lower interest rates.

- APSFC
- SIDBI
- Commercial Banks – PSU Banks, Private Banks

Raw Material Suppliers: For the majority of the job work, the raw material is directly supplied by the clients, however for specialized material, the units import the material from other states like Gujarat, Maharashtra etc. Some units also export the material from China as per their requirement of the specialized material. Some of the other units supplying raw material to the local industry include

- Vizag Steel Plant

- SAIL
- Essar Steel

Machinery Suppliers: MSMEs in these clusters generally require lathe machine, grinding machine, cutting machine, bending machine and welding machine among others. All the machines are general purpose in nature and are provided by several individual suppliers and manufacturers. Most of the units purchase new machines from various locations. The Industries generally have their in-house team for maintenance of the machinery but if they have a critical issue with the machinery, they get the technicians from other cities like Hyderabad, Pune etc.

Testing & Certification Facilities: There are several private testing facilities available in Vishakhapatnam. Despite the presence of these testing labs, only a few MSMEs avail their services. Some of the important testing laboratories in Vizag are:

- Visakha Lab, Indian Oil Corporation Limited has chemical testing facilities
- Material Testing House (India) Limited has Chemical and Mechanical testing facilities
- Avantel Limited has a development Center with state-of-the-art Design, development & test facilities in the discipline of electronics.
- Andhra Pradesh MEDTECH Zone Ltd (AMTZ): AMTZ has the infrastructure facilities for manufacturing, testing, and certification of medical devices.

Cluster SWOT Analysis

Strengths	Opportunities
• Presence of large process based industrial plants like Steel Plant, HPCL, Shipyard, BHEL, Defence establishments like BDL, etc. • Units have very good experience in their core areas of fabrication, Foundry etc. • Presence of active industrial associations **Raw Material** • The raw material is easily available **Infrastructure** • Good Rail, Road, Air and Sea connectivity with major cities	• Large scale expansions and large orders in Shipyard, Defence establishments, HPCL, etc. • Growth of the Aerospace industry in the catchment area in Koraput • New state of Andhra Pradesh is trying to bring more industries into the state for increasing the job opportunities • Increased usage of composite parts in Auto and E-Vehicle parts manufacturing
Weaknesses	**Threats**
Manpower • Limited availability of workforce with fabrication, Foundry and other skills and certifications • Workforce shifting to other countries like Dubai, Oman, etc. **Access to Market** • Weak marketing linkages – absence of organized marketing channels **Technology** • Absence of NABL certified testing labs in the region • Limited awareness about productivity improvements in these manufacturing technologies • Lack of EHS compliances and norms	**Access to Market** • Economic slowdown/ recession in the global market • Absence of new major projects in the area leading to a slackened market for engineering services • Absence of second-generation entrepreneurs leading to the capacity reduction or exiting the business

Table 6: SWOT Analysis: Vishakhapatnam Cluster

6.2 Cluster Need Assessment – Key Issues and Challenges

The focus of the cluster diagnostic report is to identify the major challenges impacting the General Engineering Sector in Vishakhapatnam. As mentioned in the methodology, to translate this focus into

reality, our team conducted one to one discussions and interactions with major stakeholders including MSMEs, technical experts, industry associations, and business development service providers.
Based on the interactions with different stakeholders' efforts have been put to identify the issues being faced by the industrial units in the cluster. The challenges identified within the cluster have been mapped with the potential TC offerings which have helped us to draft the potential areas of improvement that will foster a collaborative relationship between the TC's and industrial units.

Fabrication and Foundry Needs: Larger process industries like HPCL, NTPC, ESSAR, etc. need fabricated equipment like Pressure Vessels, Heat exchangers etc. These industries, auto and earth moving equipment component manufacturers like UNI Parts (supplier for John Deere, Cater Pillar), DOZCO, also needs castings. There are some foundries which also export alloy castings. Plants' equipment needs formed/pressed parts, bent parts, rolled parts to complete the fabrication. The fabrication also needs quality welding and there is a need to expose the workforce with changing trends through repeated training and orientations. Advanced welding like Titanium welding is being done and has become common with most of the equipment.

- These fabrication related jobs are not repetitive therefore MSMEs do not use tooling aids like fixtures.
- However, it has been discussed with some of the fabricators and found that the use of the fixtures and templates will make the production rate faster and more accurate. This concept needs to be propagated to all the other fabricators and to be used by all
- Use of automation and automation equipment/process to improve the rate of production and quality

Though most of the foundries are using permanent mould, wherever necessary, they are facing the following challenges:

- Quality manufacturing of moulds
- Wood pattern making
- No availability of skilled and experienced personnel – not even with a basic understanding of foundry working are available

Quality and Compliance Needs: The fabrication, foundry, and other component manufacturing industries are driven with an increased focus on quality and compliance with reduced rework and scrap. This change in attitude towards compliance and quality was clearly visible during the industry consultations with almost all the players highlighting the needs of introducing training for making the workforce aware of changing standards and opening up of different laboratories for testing the quality of different components.

- Fabrication/welding and subsequent painting are the gap areas as of now in the industry. Since certification for the welders is highlighted as a requirement, it is important to have facilities that provide the same for new trainees and test/certify existing welders on a regular basis
- Newer welding technologies like titanium welding need for specialized welding labs and training.
- Material testing and certification: Material testing is a major requirement and a NABL accredited lab is needed in the Visakhapatnam area for the same. This certification is mandatory for all suppliers and there is a need for an independent and neutral agency that can conduct these tests through certified labs and thereby help the MSMEs in meeting this need.
- There is also a requirement of setting up labs for calibration and recalibration of all the inspection equipment being used in production in the plants on a regular basis as per the ISO norms.

The following table provides needs and challenges in the cluster which have been mapped with the cluster service offerings:

Challenges	Sheet Metal and Fabrication	Machining Component	Composite Manufacturing (Including Forging and Foundry)	New TC's Services planned - offerings to mitigate the challenges and Applicability in the Cluster
Access to the latest and advanced technology	Limited access to automation equipment for supporting the fabrication industry, further there is limited access to advanced welding techniques in the fabrication industry	Limited availability of private/government tool rooms in the region forces the units to connect with tooling service providers in other parts of the country like Pune, Hyderabad, Mumbai, etc. The units face challenges with respect to - Assembly tooling aids - Mould base production - Production of dies and fixtures	Limited availability of private/government facilities focussing on foundry and forging. Further, the component manufacturing units require support in the production and manufacturing of Dies. There is a need for tooling facilities that provide access to large CNC 5 Axis Machines	**Fabrication:** TC will offer services related to advanced welding, Industrial process, and automation, simulation through its different labs TC can also arrange and offer various knowledge-sharing workshops towards new fabrication methods and how they can be adopted at the firm level **Machining and Composite Clusters:** Though TC will be offering advanced tooling technologies, it has been observed that there is a need for the TC to upgrade some machines like CNC 5 axis milling, CNC 3 axis VMC for catering to the requirements of the cluster units
Testing Services and Quality Control	There are limited recognized and authorized testing facilities in the region. The units require testing facilities to conduct the following tests for which they are dependent on non-NABL accredited testing labs in the region. • Mechanical testing • Material Testing • Fluid Testing • Welding testing - NDT	There are limited recognized and authorized testing facilities in the region. The units require testing facilities to conduct the following tests for which they are dependent on non-NABL accredited testing labs in the region. • Material composition testing • Mechanical Testing	There are limited recognized and authorized testing facilities in the region. The units require testing facilities to conduct the following tests for which they are dependent on non-NABL accredited testing labs in the region. • Material composition testing • Polymer testing • Mechanical Testing	TC plans to set up a NABL accredited chemical and metallurgical labs that would offer material testing facilities. Apart from offering this TC also plans to offer training services in Testing. Calibration, recalibration, and vibration testing services are not being planned by the TC
Manpower and Skill Related	Currently, there are only on-job training in fabrication units. Further, the units face a major issue of attrition as skilled labor is moving to other countries like Dubai, Oman etc. for similar work. Apart from ITIs, no other institute is available that	There is limited availability of state of the art institutions that provide provides training on the tool and die making and manufacturing. Further, there are very few institutes focussing on training to CNC, CMM operators.	Availability of limited institutions offering foundry and forging related training courses. Manpower is largely skilled through on the job training. There is a requirement for introducing training courses related to	TC will offer various short term and medium-term training courses to upgrade skill levels for the existing and fresh workforce. The list of training courses is mentioned in Annexure 2 Currently, TC does not offer specific courses on Foundry Technology.

Challenges	Sheet Metal and Fabrication	Machining Component	Composite Manufacturing (Including Forging and Foundry)	New TC's Services planned - offerings to mitigate the challenges and Applicability in the Cluster
	provides training in welding techniques, automation etc.	Further, no institute provides training on testing such as Chemical Testing, metallurgy Testing, Mechanical testing etc.	foundry technology in the cluster	
Poor Access to Information	Limited Awareness about government initiatives and programs of Central, State Government Schemes and Industrial Organizations.	Limited Awareness about government initiatives and programs of Central, State Governments Schemes and Industrial Organizations.	Limited Awareness about government initiatives and programs of Central, State Governments Schemes and Industrial Organizations.	Though this is not the direct focus area of the technology center, TC will support the local government institutions like MSME DI, DIC and other institutes in conducting awareness workshops on different government schemes and initiatives
Access to Market	Inadequate marketing, promotion and industry interactions in and outside the area.	Inadequate marketing, promotion and industry interactions in and outside the area.	Inadequate marketing, promotion and industry linkages in and outside the area.	Marketing access is a major issue faced by the units. Though this is not TCs direct focus area, it will support the cluster MSMEs in availing different government schemes for participating in trade fairs and buyer-supplier meets. Further, it will also contact different PSUs for conducting different Vendor Development Programs, that will support the MSMEs in becoming their vendors
Soft Skills	Training in areas like English speaking, understanding the instructions, inter-personnel communication, updating the records and documentation, etc. are the major missing links in terms of improving employee productivity.	Training in areas like English speaking, understanding the instructions, inter-personnel communication, updating the records and documentation, etc. are the major missing links in terms of improving employee productivity.	Training in areas like English speaking, understanding the instructions, inter-personnel communication, updating the records and documentation, etc. are the major missing links in terms of improving employee productivity.	TC has planned to set up a language lab in the TC that will focus on imparting soft skills training to the workforce

Table 7: Cluster Wise Challenges and Mapping with TC Service Offerings

7. Recommendations

After an enriching experience on the ground and stimulating discussions with different stakeholders like MSMEs, Industry Associations, Government officers and OEMs, TCM found that though TC Vishakhapatnam is catering to majority of the requirements of the cluster, there are certain gaps that need to be filled up for supporting in making the Technology Center a center of excellence.

7.1 Skill Development and Training Facility

The unskilled workforce has been one of the major cluster level challenges that have been witnessed on the ground. Based on the interactions with the stakeholders it has been found that there is a massive need for capacity building workshops in fabrication, machining, foundry and forging. TCM recommends certain new training programmes that can help Vizag TC inculcate standards, quality assessment, value addition and knowledge base amongst MSMEs existing in the cluster. Proposed training programs in the DPR have been modified and new training has been recommended after taking into account the training needs of the industry and focus areas of the Visakhapatnam TC.

Titanium Welding:
A good number of fabricated equipment like heat exchangers are being supplied to process and power industries like HPCL, NPTC, etc. by the fabricating units. In these heat exchangers and other equipment's' fabrication, titanium welding has become common and skill set is scarcely available with most of the MSMEs. Most of the fabricating entrepreneurs have expressed a lack of skilled manpower and sought inclusion of Titanium welding training in the upcoming TC at Visakhapatnam. Along with the other advanced welding technologies, it is proposed to add Titanium welding also in the training programs/labs.

Foundry technology - introduction and practice:
In foundries and alloy metal works that cater to supply of castings to the larger industries like NTPC etc., the operators lack requisite skills and pick up while working in the foundries. This process of gaining skill is taking the time and to cope with this lack of skilled operators, it is proposed to introduce additional training on introduction to foundry technology. This training will have a maximum of theory classes and practical knowledge & experience would be imparted while working as trainee apprentices in MSMEs by tying up with some of the foundries. After having the required theory of foundry technology and practical apprentice training with the guidelines of TC trainers and foundry in-charge managers, the skills are expected to be satisfactory and job-ready.

Apart from the above-mentioned training programs that can be launched as and when the TC becomes operations, there are other training programs that can be introduced in due course of time based on the demand need assessment. Trainings in Advanced Electronics is one such area that was identified during the meetings with the Andhra Pradesh State Skill Development Board and other associations. it is indicated that the skills in the Advanced Electronics including embedded systems are lacking. It was informed that most of students are opting and showing interest for the trainings in the Advanced Electronics after completing the Degree/Diploma, but due to limited availability of good training institutes, they are not able to get proper skilling. Considering this requirement of trainings in the sector, it is proposed to assess the training requirement after one year of the functioning of the TC to introduce a training course in Advanced Electronics including embedded systems. This would also require setting up of an Advanced Electronics and Automation lab for meeting the course requirements.

S.No.	Group	Title of the Training Program	Duration	Pre-Requisite	Applicable Clusters
Phase I: To be introduced within one - two years of operationalization					
1	Manufacturing Related	Titanium Welding	1.5 months (Full time)	ITI/Diploma/Degree/1 year relevant experience	Sheet Metal and Fabrication Cluster
2		Titanium Welding	3 months (part-time)	ITI/Diploma/Degree/1 year relevant experience	Sheet Metal and Fabrication Cluster
3		Fitters Training – Including raw material cutting	2 Months (Full time)	ITI/Diploma/Degree/1 year relevant experience	Sheet Metal and Fabrication Cluster
4		Fitters training – Including the Raw Material Cutting	4 Months (Part-Time)	ITI/Diploma/Degree/1 year relevant experience	Sheet Metal and Fabrication Cluster
5		Foundry technology – introduction and practice	1.5 months (Full)	ITI/Diploma/1 year relevant experience	Composite Material Cluster (Including Foundry and Forging)
6		Foundry technology – introduction and practice	3 months (part-time)	ITI/Diploma/1 year relevant experience	Composite Material Cluster (Including Foundry and Forging)
7	Controls	System Integration hardware and software	2 Months	Diploma Holders/Degree Holders/2 Years Relevant Experience	All OEMS and Plants
8	Maintenance	Electronics troubleshooting and rectification	1 Month	Diploma Holders/Degree Holders/2 Years Relevant Experience	All OEMS and Plants
Phase II: To be assessed after one- two years of operationalization					
9	Electronics	Advanced Electronics including Embedded Systems	4 Months	Degree/Diploma	General

Table 8: New Training Programs planned in the TC

Apart from introducing these new courses in the Technology center, it is important for the technology center to prioritize the training courses, from the list of more than 30 training courses in the DPR, that should be introduced over the next one year till the time TC becomes completely operational. These courses have been prioritized based on the inputs received during the cluster surveys.

Courses Recommended to start on priority in TC

#	Clusters	Specialization	Course name	Duration (months)	Pre-Requisite
1	Sheet Metal Fabrication and Machining	CNC Manufacturing	CNC lathe programming and operation (Full Time)	2	ITI/Diploma/1 year relevant experience
			CNC lathe programming and operation (Part-Time)	4	ITI/Diploma/1 year relevant experience
			CNC Milling Prog and Operation (Full Time)	2	ITI/Diploma/1 year relevant experience
			CNC Milling Prog and Operation (Part-Time)	4	ITI/Diploma/1 year relevant experience

#	Clusters	Specialization	Course name	Duration (months)	Pre-Requisite
			Certificate course in Machinist	24	10th Pass
			Post Diploma in CNC-Prog & Operation	12	ITI/Diploma/Degree 2 year relevant experience
2	Sheet Metal Fabrication	Advance Welding	Advanced titanium welding (Part-time and Full Time)	2 and 4 Months	ITI/Diploma/1 year relevant experience
			Basic Arc and Gas welding (Full Time)	3	10th Pass /(ITI)/6 months experience
			Basic Arc and Gas welding (Part-Time)	6	10th Pass /(ITI)/6 months experience
			TIG welding (Full Time)	1.5	ITI/Diploma/1 year relevant experience
			TIG welding (Part-Time)	3	ITI/Diploma/1 year relevant experience
			MiG welding (Full Time)	1.5	ITI/Diploma/1 year relevant experience
			MiG welding (Part Time)	3	ITI/Diploma/1 year relevant experience
4	Composite incl. Forging and Foundry	Manufacturing	Foundry technology - introduction and practice	1.5 and 3 Months	ITI/Diploma/Degree/ 1-year relevant experience

Table 9: Courses to be Started on Priority over the next one year

The focus of the technology center should be on imparting training in such a way that it becomes a renowned center for improving the overall skills of the workforce. Apart from imparting training, the technology center in Vishakhapatnam should also focus on

- Finishing School: TC Visakhapatnam should join hands with the existing educational institutions in the nearby areas and make the last year of their studies aligned to industry practices for making the pass-outs "industry ready". Most of the institutions have shown interest to get the students to undergo customized training during the change of the semester. The TC should fill in the role of "finishing school" – through enhanced coverage of the syllabus. Since this will help the entire industry – from OEMs to MSMEs – in reducing substantial indirect cost and time. This can be achieved through a focus on following
  - Total Quality Management
  - Total Productivity Management including following pillars - Autonomous Maintenance; Planned Maintenance; Quality Maintenance; Focused Improvement; Early Equipment Management; Training and Education; Safety, Health, Environment; TPM in Administration
  - ISO certifications and its benefits
  - 5S
- Safety Needs and GMP aspects: There should be an increased focus on making the workforce aware of the importance of adhering to safety standards and following good manufacturing practices

- **Maximise the benefits of available human resources**: Generate a new class of "operator" by "up skilling" the operatives. It will tend to attract and better remunerates people by giving the right job based on their skills.

7.2 Production Facility

In terms of production facilities, it has been identified that there is a need for the Technology Center to focus upon the following demands of the Industry

- Assembly tooling aids for MSMEs
- Automation equipment support for fabrication
- Forging and other dies production for SMEs
- Production support to SMEs
- Mould base production facility for supply to the industry including MSMEs.
- Reverse engineering facilities

- **Automation:** Majority of MSMEs in the Visakhapatnam region use manual manufacturing processes, especially in the fabrication field. To bolster the competitiveness and efficiency of these MSMEs, Semi automation/automation needs to be introduced in fabrication equipment used. But, the MSMEs might not have the capacity to purchase latest technologies. Therefore, it is pertinent to introduce semi-automatic production equipment or appropriate tooling in their production.
  - Tooling to position and fix the components for faster welding process
  - Automatic circular seam for rotating a circular job
  - Welding head fitted on a column & beam, suitable for pressure vessel industries
- **Manufacturing support:** Units which manufactures and also exports automotive alloy wheels needs manufacturing support. They also provide a scope for replacement of import of low pressure die casting dies with TC manufacturing for Synergies castings.
- **Reduce all indirect costs on products**: Reduced rejection and reworking by 'doing every time right at first time' by introducing right tooling and appropriate automation.

On the basis of industry consultations, it was identified that MSME units face difficulty for moulds, dies and other tooling due to unavailability of proper tooling facilities in the region. For this purpose, TCM did a detailed study of the existing planned machinery at Vizag DPR and observed that there is a need to upgrade certain machines for meeting the production requirements of the cluster units

Original Machine	New Plan	Comments
• Hydraulic Press (100 T) • Mechanical Press (100 T)	Mechanical press (100 T) to be put on hold	During the discussions, it is found that one Hydraulic Press (100 Ton Capacity) is adequate to take up the current workload for the dies and other production support. There is no immediate requirement of Mechanical Press (100 Ton Capacity) machine and can be procured in a phased manner after 1 year from the start of production in TC as per the requirement.
• Injection Moulding	Injection moulding (200 T) to be put on hold	Based on the MSMEs requirements identified during the interactions, there is no immediate requirement of Injection Molding machine (200 Ton) and can be put on hold
• Water Jet Machine	Increase in size (Cutting capacity upto 400 mm thick or round)	Water jet cutting machine which gives more accuracy on the edges, better dimensional tolerances and usability on a variety of materials, is not commonly available and can be well utilized by the fabrication industry units like Hindustan Ship Yard etc.
• 3D Printer	To be dropped	3D Metal Printer machine can be put on hold as a 3D design, prototyping, and rapid tooling – common facility infrastructure has been installed at Andhra Pradesh Med Tech Zone (AMTZ) in Vizag

Original Machine	New Plan	Comments
Phase II: To be assessed after one- two years of operationalization		
• Pipe Bending Machine	To assess and procurement action to be taken in Phase-II	To support the MSMEs in production and also to take up production orders of Shipyard's fabrication work
• Plate Rolling machine	To assess and procurement action to be taken in Phase-II	To support the MSMEs in production and also to take up production orders of Shipyard's fabrication work

Table 10: Modification in Machines planned in the production facility

Though most of the machines would be purchased during the setting up of TC, there are some other machines that can be looked upon during the second phase of machine procurement. During the stakeholders meeting at VASSIWA association, it is understood that Ship yard has received a new order of (Approx Rs.11,000 Crore) and most of the work will be executed by the MSMEs in the sector. As part of this new order on Shipyard, Fabrication work orders would require pipe bending and sheet rolling work, that would be outsourced to the MSMEs and some of these orders have could also be received by the TC along with the other MSME units. Considering this, it is recommended, to have these production machines in Phase-II in the TC -to take up and support the MSMEs in production. These machines' procurement action will be taken after assessing the production requirement and need in the Phase-II after one – two years of the full functioning of the TC.

Apart from these machines that would impact the MSMEs in all the three clusters, the foundry units in the composite material cluster have also given the feedback that they need the support in simulating the metal flow in the mould which will help them to get a quality product and reducing the cycle time. To support the foundry units, the following simulation service is suggested to be added to the TC facility.

#	Cluster	Service

1	Composites including Forging and Foundry	Simulation service of Metal Flow in Gravity Casting. TC can offer the following services through this simulation service
		• Modelling of component
		  • modelling of Mould with its elements for simulation
		  • Meshing
		  • Pre and post-processing
		  • Analysing the results
		  • Repeat the above till getting satisfactory and approved results
		Notes:
		• TC to check for the required licenses in the existing Simulation/analysis Software packages (ANSYS and others) to carry out the above requirement
		• If appropriate Software is not available, the software requirement is to be included in the Phase-II

Table 11: Additional facilities planned in TC

7.3 Testing Facilities

MSMEs find it difficult to get testing certificates for the products manufactured through foundries, forgings and other processes due to the unavailability of a NABL accredited facility in the region. This forces them to depend on private and unrecognized labs /facilities in the region. It is proposed that the material testing lab planned in the Vizag should be NABL accredited and should have facilities for mechanical and chemical tests. The three major divisions of testing - metrology, metal testing and failure

analysis should also be carried out in the laboratory. The laboratory is expected to cater to the following requirements of the industry

- Ensure regulatory compliance and recognition by all the industries
- Select a suitable process
- Help in quality job work.

Apart from the planned material testing lab, the TC should also focus on setting up two testing labs for meeting the testing needs of the cluster

- **Testing & calibration Services:** MSMEs are required to carry out specified Mechanical and chemical tests on their products before delivery and have to submit a recognised certificate stating the compliance of their products

Calibration and Recalibration Laboratory: Due to the absence of a proper Calibration and Recalibration facility in the region, the units in this area have to send their instruments to far off places – for calibration and certification in order to meet the calibration requirements of different OEMs. Since the calibration exercise has to be carried out periodically, the time period is often set by OEMs as per ISO requirements, thus there is a need to set up a Calibration and Re-calibration laboratory in the region. Through this lab, the focus would be on meeting the following calibration requirements in the region.

- Mechanical (dimensional and pressure)
- Thermal
- Electrotechnical

It is strongly recommended that this lab should be operated on a BOT (Build-Operate-Transfer) basis. Thus the TC need not make any investment - other than housing the Lab. The lab can also be used to train the new entrants – both on its importance and the actual method of calibrating.

Vibration testing and Analysis laboratory: During the interactions, the steel plants have suggested on providing vibration tests - which is also a common requirement with the other process and power plants – to make sure that the components do not leave any residual strain in the operating parts and any failures resulting from vibration will not become disastrous or effect production of the plant. There is no such established facility in and around Vizag. Therefore it is proposed to set up a facility that would be designed to meet the following requirements of the industry

- Vibration testing
- Dynamic balancing machine
- Stress, strain measurements under generated dynamic, cyclic loads
- Noise signals generated under different conditions
- Effect of thermal loads
- Effect of torsional oscillations and shock loads.

The lab should be equipped with the state-of-the-art instrumentation required for measurement, analysis, and control of undesired motion and noise of structures and machinery. This laboratory shall be available on a contract basis (to third parties) – for short courses (designed in the field of noise and vibration control to meet the needs of industry) apart from routine testing and certification. It is proposed to house “life test” and such mandatory requirements in this lab. It is recommended that this lab should also be run on BOT basis for the initial 5 years to reduce the capital outlay during initial stages of TC setup

7.4 Other Cluster Development Activities

7.4.1 Access to Market

To resolve the main issue of limited linkages, TC can support government institutions like MSME DI and DIC in exposing the units to a wider market. TC can provide support in registering with all the national and international EPC and PMC service providers like EIL, Technip, Bechtel and; Auto and other OEMs etc by conducting Vendor Development programs. This will also expose the MSME units to the end-user requirements that can motivate them to upgrade their capabilities accordingly. Wherever possible, TC can act as the aggregator for the OEM and can facilitate orders to MSMEs while taking the overall execution responsibility. TC can also lend a lot of credibility to joint marketing efforts of the MSMEs while being a credible Govt of India facility and having state of the art infrastructure to support high precision jobs outsourced by OEMs.

It is further recommended that TC supports MSME DI and DIC to organize buyer-seller meets for a greater outreach for the MSMEs. These meets can significantly help in the creation of market linkages. These meets can be organized at the regional, state and national level. Organizing exposure visits to MSMEs in the general engineering sector will make the manufacturers aware of the prevailing trends and modern machinery. This exposure can help both TC Vizag and manufacturers to benefit immensely from the existing setup.

7.4.2 Entrepreneurship Facilitation

Entrepreneurs' Facilitation Cell can be established at TC Vizag to bridge the information gap and provide services like

- Basic documentation for UAM, GST
- Import /Export Registration
- Loan processing
- Digital learning
- E-marketing
- Providing information regarding government schemes through mailers and scheme booklets
- Information on how to set up new enterprise,
- Preparation of proposal for large OEMs.

7.4.3 Quality Control

As the majority of the units are without ISO Quality certifications, TC can act as the prime institute to provide consultancy services to increase the awareness about ISO Quality systems and implementing them in the MSME units. TC can undertake activities for increasing awareness about the benefits of implementation of the Quality Systems among the MSME units. This will help the units to qualify and fulfil prerequisites of the registration with the organizations, opening larger markets for them. As a part of this initiative TC can offer services related to Total Quality Management (TQM), Six Sigma Green Belt, 5S, Productivity Management etc.

7.4.4 Productivity Control

Considering current manufacturing processes in the composite and machining clusters, there is a lot of scope to introduce production improvement methods with the use of semi-automation aids. TC can further offer consultancy services to study the existing practices and to suggest appropriate methods for improving the productivity of the workforce. Further, wherever it is not viable to introduce full-automation in the processes, TC can support in the implementation of production aids for the production of Jigs and fixtures. TC can also support the units in the implementation of robotic technology in areas where regular welding is required.

Annexures

Annexure 1: Detailed Cluster Wise Challenges

Challenges	Sheet Metal and Fabrication	Machining Component	Composite Manufacturing (Including Forging and Foundry)
Access to Advanced Technology	During interactions, it has been observed that units are following the same procedures which were followed a decade ago. Mostly the advancements done were only up-gradation to TIG and MIG welding in a limited way as per the demands of the end-user with very limited use of Titanium-based welding	During the interactions, it has been observed that units are using general-purpose cutting tools but not advanced tools. It was also observed that the units are using machines procured a long time ago or 'used machines' This was despite the fact that the units are aware of the latest technologies but not able to procure them due to the high cost of acquisition and operations.	During the interactions, it has been observed that units are using general-purpose cutting tools but not advanced tools. It was also observed that the units are using machines procured a long time ago or 'used machines' There was also limited use of CNC machines and production aids.
Manpower and Skill Related Challenges	There is a high shortage of skilled manpower in welding methods. The situation is further worsened in small scale units who also face a challenge of high workforce attrition and are not able to afford a permanent workforce due to high cost. Limited availability of training institutions further increases the challenge of the availability of skilled manpower. Most of the units hire unskilled manpower with most of the training being imparted during the job.	There is a high shortage of skilled manpower in welding methods. The situation is further worsened in small scale units who also face a challenge of high workforce attrition and are not able to afford a permanent workforce due to large costs that are involved There is limited availability of state of the art institutions that provide provides training tools and die making and manufacturing. Further, there are very few institutes focussing on training related to CNC, CMM operators. Further, no institute provides training on testing such as Chemical Testing, metallurgy Testing, Mechanical testing etc.	There is a high shortage of skilled manpower in welding methods. The situation is further worsened in small scale units who also face a challenge of high workforce attrition and are not able to afford a permanent workforce due to large costs that are involved. Most of the units hire unskilled manpower with most of the training being imparted during the job. Availability of limited institutions offering foundry and forging related training courses. Manpower is largely skilled through on the job training. There is a requirement for introducing training courses related to foundry technology in the cluster
Soft Skills	The workforce requires training in soft skills as currently there are no training efforts towards improving these skills. Training in areas like English speaking, understanding the instructions, inter-personal communication,	The workforce requires training in soft skills as currently there are no training efforts towards improving these skills. Training in areas like English speaking, understanding the instructions, inter-personal	The workforce requires training in soft skills as currently there are no training efforts towards improving these skills. Training in areas like English speaking, understanding the instructions, inter-personal

Challenges	Sheet Metal and Fabrication	Machining Component	Composite Manufacturing (Including Forging and Foundry)
	updating the records and documentation, etc. are the major missing links in terms of improving employee productivity.	communication, updating the records and documentation, etc. are the major missing links in terms of improving employee productivity.	communication, updating the records and documentation, etc. are the major missing links in terms of improving employee productivity.
Productivity Improvement	**Limited use of Automation or Aids:** It has been observed that the methods are the same as used a decade ago. No advanced methods are introduced in the process of manufacturing. Advance technology like Robots is not being used in the field for improving productivity. It is also observed that some of the units are using crude templates which impacts their productivity. Use of Automation or Semi-Automation or Tooling Aids is also minimum which has further impacted the productivity	**Limited use of Automation or Aids:** It has been observed that the methods are the same as used a decade ago. No advanced methods are introduced in the process of manufacturing. Advance technology like Robots is not being used in the field for improving productivity. It is also observed that some of the units are using crude templates which impacts their productivity. Use of Automation or Semi-Automation or Tooling Aids is also minimum which has further impacted the productivity	**Limited use of Automation or Aids:** It has been observed that the methods used in the fabrication are the same as used a decade ago. No advanced methods are introduced in the process of manufacturing. Advance technology like Robots is not being used in the field for improving productivity. It is also observed that some of the units are using crude templates which impacts their productivity. Use of Automation or Semi-Automation or Tooling Aids is also minimum which has further impacted the productivity
Access to Market	**Inadequate linkages:** The majority of the units in the cluster suffer from limited exposure to marketing activities. Most of the units are not registered among the vendor/suppliers list of major nation-wide Engineering PMC companies like EIL, Technip, McDermott etc. Industry-related interactions that can help them in marketing and other promotion-related activities are also not done. **Fewer Efforts in Marketing:** Few efforts are put in reaching out to the other places outside Visakhapatnam and the state of Andhra Pradesh. It is also observed that large orders are being bagged by the major firms located outside Vishakhapatnam that have impacted the backward – downstream units in getting new orders.	**Inadequate linkages:** The majority of the units in the cluster suffer from limited exposure to marketing activities. Most of the units are not registered among the vendor/suppliers list of major nation-wide Engineering PMC companies like EIL, Technip, McDermott etc. Industry-related interactions that can help them in marketing and other promotion-related activities are also not done. **Fewer Efforts in Marketing:** Few efforts are put in reaching out to the other places outside the Visakhapatnam and the state of Andhra Pradesh. It is also observed that large orders are being bagged by the major firms located outside Vishakhapatnam that have impacted the backward – downstream units in getting new orders.	**Inadequate linkages:** The majority of the units in the cluster suffer from limited exposure to marketing activities. Most of the units are not registered among the vendor/suppliers list of major nation-wide Engineering PMC companies like EIL, Technip, McDermott etc. Industry-related interactions that can help them in marketing and other promotion-related activities are also not done. **Fewer Efforts in Marketing:** Few efforts are put in reaching out to the other places outside the Visakhapatnam and the state of Andhra Pradesh. It is also observed that large orders are being bagged by the major firms located outside Vishakhapatnam that have impacted the backward – downstream units in getting new orders.
Poor Access to Information	Though the Government of India and AP State Government have taken several	Through the Government of India and AP State Government have taken several	Through the Government of India and AP State Government have taken several

Challenges	Sheet Metal and Fabrication	Machining Component	Composite Manufacturing (Including Forging and Foundry)
	initiatives to support the entrepreneurs through various schemes, most of the existing entrepreneurs and new aspirant entrepreneurs in the cluster have limited knowledge about them. The units are not fully aware of procedures for availing the incentives different government schemes offer and generally get bogged down by the amount of paperwork and procedures involved during the process	initiatives to support the entrepreneurs through various schemes, most of the existing entrepreneurs and new aspirant entrepreneurs in the cluster have limited knowledge about them. The units are not fully aware of procedures for availing the incentives of different government schemes and generally get bogged down by the amount of paperwork and procedures involved during the process	initiatives to support the entrepreneurs through various schemes, most of the existing entrepreneurs and new aspirant entrepreneurs in the cluster have limited knowledge about them. The units are not fully aware of procedures for availing the incentives of different government schemes and generally get bogged down by the amount of paperwork and procedures involved during the process
Quality Control	**Opting for Quality Standards and Certifications:** It is observed that the majority of the units are without any Quality Certifications with less than 50% of them having these certifications. The challenge is further computed as there are no accredited institutions for testing and certifying the mechanical and chemical properties of the job work. Currently, the units are managing on their own through material supplier certifications which often leads to large errors/rejections in the final product	**Opting for Quality Standards and Certifications:** It is observed that the majority of the units are without any Quality Certifications with less than 50% of them having these certifications. The challenge is further computed as there are no accredited institutions for testing and certifying the mechanical and chemical properties of the job work. Currently, the units are managing on their own through material supplier certifications which often leads to large errors/rejections in the final product	**Opting for Quality Standards and Certifications:** It is observed that the majority of the units are without any Quality Certifications with less than 50% of them having these certifications. The challenge is further computed as there are no accredited institutions for testing and certifying the mechanical and chemical properties of the job work. Currently, the units are managing on their own through material supplier certifications which often leads to large errors/rejections in the final product

Table 12: Detailed Cluster wise challenges

Challenge Severity	**High**	**Medium**	**Low**

Annexure 2: Proposed Training Programs

No	Specialization	Course Name	Duration (Months)
1	Tool Room & CNC Manufacturing, CAD/ CAM	Advanced Diploma in Tool & Die making	48
		Certificate course in Machinist	24
		Post Diploma in Tool Design	12
		Post Diploma in Tool Manufacturing	12
		Post Diploma in CNC-Prog & Op	12
		Master of CAD/ CAM/ CNC	6
2	Maintenance	Machine Maintenance-mech	3
		Maint. Technician	3
		Machine Maintenance-mech (Part Time)	6
		Maint Technician (Part Time)	6
3	CNC Manufacturing ,(CAD/ CAM)	CNC lathe programming and operation (Full Time)	2
		CNC lathe programming and operation (Part Time)	4
		CNC Milling Prog and Operation (Full Time)	2
		CNC Milling Prog and Operation (Part Time)	4
		CAD/CAM/CNC Programming (Full Time)	2
		CAD/CAM/CNC Programming (Part Time)	4
		CAD Modelling with different software (Full Time)	1
		CAD Modelling with different software (Part Time)	2
		Computer Integrated Manufacturing (CIM)	1
4	Advance Welding	Basic Arc and Gas welding (Full Time)	3
		Basic Arc and Gas welding (Part Time)	6
		TIG welding (Full Time)	1.5
		TIG welding (Part Time)	3
		MiG welding (Full Time)	1.5
		MiG welding (Part Time)	3
		Spot Welding (Full Time)	1.5
		Spot Welding (Part Time)	3
		Stainless Steel & Aluminum welding (Full Time)	1.5
		Stainless Steel & Aluminum welding (Part Time)	3
		Welding-NCVT	12
		Robotic Welding system	0.5
5	Electronics and IT	Solar energy system technician	3
		Power plant instrument mechanic	3
6	Industrial and process Automation	Industrial Hydraulics	1
		Industrial pneumatics	1
		PLC Programming	1
		Automation Technician	4
		Process automation design	4
		Diploma in Mechatronics	36
7	Training on Testing	Chemical testing: Analysis of Metal and Non - Metal, Coal, Cement etc.	4
		Mechanical: Physical Properties of metal and Non - Metal product/material	4
		Metallurgical Testing	4
		Electrical	4

Annexure 3: Proposed Production Machines

#	Machine	Size	Quantity
1	CNC Milling-5axis	1.2m*.8m*.8m	1
2	CNC 3axis Vertical Machining Center	2.5m*1.5m*1m	1
3	CNC 3axis Vertical Machining Center	.8m*.6m* .45m	2
4	CNC Lathe	400*1500	1
5	Turn Mill Center	300*600	1
6	Conventional Vertical Milling	1200*300*400	2
7	Conventional Lathe	400*1200	2
8	CNC EDM Wire Cut	500*500*400 mm	1
9	CNC EDM Die Sinking	500*500	1
10	Water Jet Cutting Machine		1
11	3D Scanner		1
12	Radial drill machine	63mm	1
13	Surface Grinding Large	1500x1000	1
14	Surface Grinding Medium	800x400	1
15	Cylindrical Grinding	200mm*750mm	1
16	Tooling & Tooling Systems		
17	Hydraulic press	100 Tonne	1
18	Quality Control and Metrology Lab including CNC CMM	1500*1000	1
19	CAD/CAM Software CATIA, UG etc.		10
20	Vacuum Heat Treatment Furnace system		1
21	Work Stations		10

Annexure 4: List of Stakeholder Contacted

#	Stakeholder	No. of Stakeholders
1	SMEs/ MSMEs	31
2	Industrial Associations	4
3	Government Agencies	4
4	Academia /Technical Institutions	3
	Total	42

#	Stake holder Name	Designation	Name (SME/Bank/Govt. Office/Industry Association)	Engineering Cluster
1	Subash	Managing Partner	M S R Enterprises	Fabrication
2	Sekhar	Project Manager	National Power Engineering Company	Fabrication
3	Srinivas Raju	Managing Director	Sujana Industries	Fabrication
4	Chodavarapu Raju	Partner	USHA Industries	Fabrication
5	Raju	Partner	JN Engineering	Fabrication
6	Subrayaman	Managing Director	DB Solution	Fabrication
7	Dasari Appalanadiu	Managing Director	Mokha Lakshmi Industries	Fabrication
8	Poorna Chandra Rao	Managing Director	Sri Raja Corporation	Fabrication
9	K Srinivas	Managing Partner	Sree vamsi Enterprise	Fabrication
10	D.N.Raju	Director	RVR Projects	Fabrication
11	Ramanujam	Managing Director	Gopal Teknocom	Fabrication

#	Stake holder Name	Designation	Name (SME/Bank/Govt. Office/Industry Association)	Engineering Cluster
12	Krishna Balaji	Managing Director	Lalitha Metals	Fabrication
13	B. Ramakrishna	Managing Director	Lakshmi Ganapathi Engineering Works	Machining
14	Kusuma Santhi	Director	Avishai Engineering Works	Machining
15	K.Venkata Ramana	Director	Quality Tolinc	Machining
16	Srininvas	Project Manager	DDM Engineering	Machining
17	Roopa Devi	Managing Partner	SR Industries	Machining
18	Abishek Gupta	Executive Director	Sahuwala Cylinders	Machining
19	Venkateswara Rao	Managing Partner	Venkateswara Enterprises	Machining
20	T. Mahidhar C	Managing Director	SECON	Machining
21	DCD Maheswara Rao	AGM (Operations)	Flash Forge Pvt Ltd	Machining
22	KVSA Verma	COO	Hobel Bellow Co	Machining
23	DS Varama	HR-Head Operations	ESSAR	Machining
24	Hari Buddhi Raju	Vice-President	UNI-Parts	Machining
25	Kishore	Managing Director	Seera Metal Products	Composite Manufacturing
26	KVN Raju	Managing Director	TTK Fibre Glass Works	Composite Manufacturing
27	Seetharamaih	Managing Director	SreeHari Special Refractories Pvt Ltd	Composite Manufacturing
28	J Govinda Rao		Sri Balaji Composite Doorsanaging Partner	Composite Manufacturing
29	Ravi Kumar	Marketing Manager	Neelakanta Forging	Composite Manufacturing
30	Rajankath	Director	Nichorme Alloy Steel	Composite Manufacturing
31	R Anjeeya Prasad	Managing Director	HastAlloy	Composite Manufacturing
32	Krishna Balaji	President	VASSAWA	General Engineering
33	Shambasiva Rao	Ex-President	AP Chamber of Commerce	General Engineering
34	Sesigiri Rao	Chairperson	IALA	General Engineering
35	KVN Raju	President	AP Composite Chamber	Composite Manufacturing
36	Ramalingeswar Raju	General manager	District Industries Center	
37	Naidu	Dy. Director	MSME-DI	
38	Jayachandra Raju	Estate manager	APIIC	
39	AK Das	GM – Purchase Dept	Steel Plant	
40	Bheema Rao	Principal	ITI College	
41	B.Phanindra Prasad	Principal	Polytechnic College	
42	Srininvas	Manager	AP Skill Development Board	

Annexure 5: Cluster Prioritization Matrix

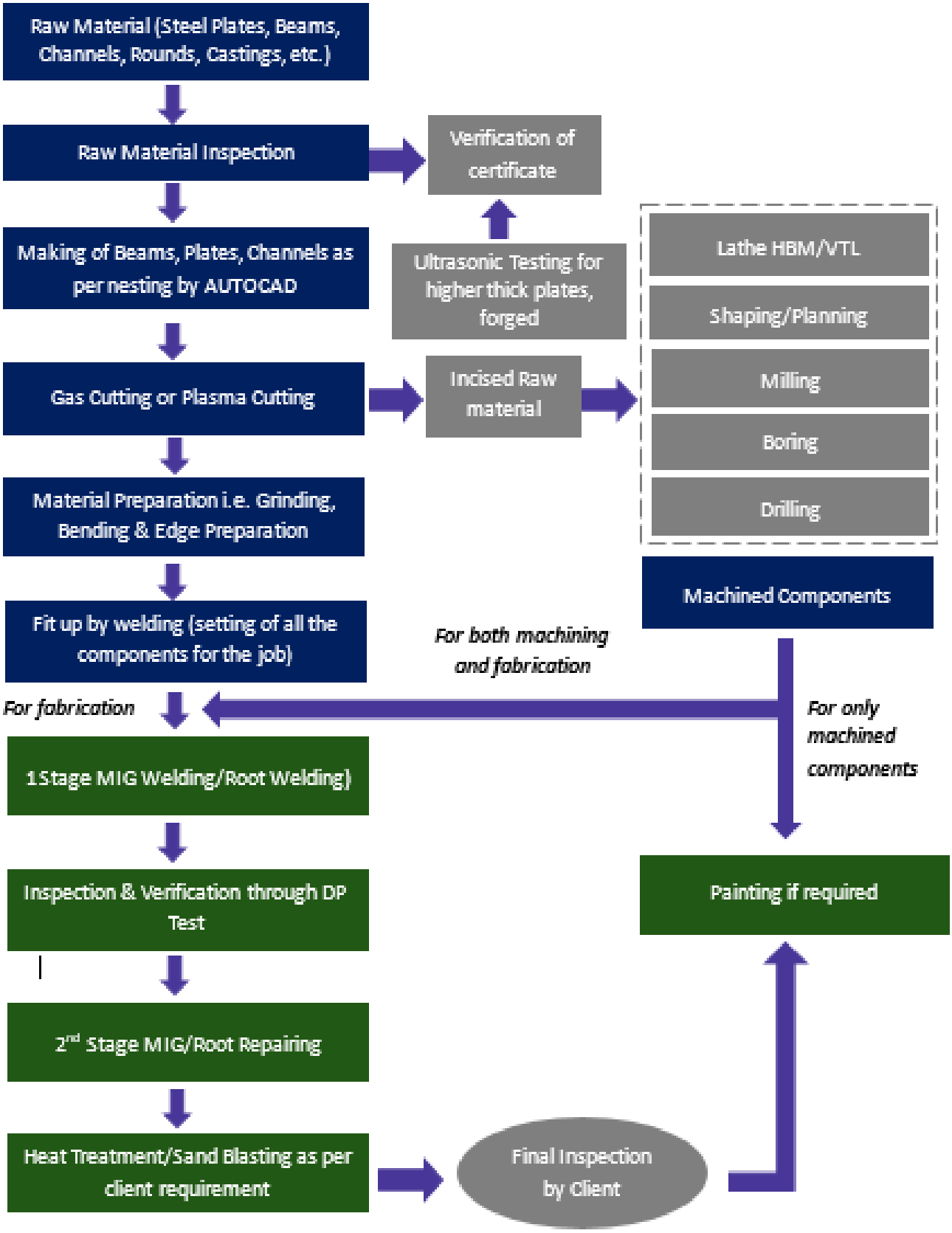
Cluster Prioritization

#	Cluster	Characteristics (sectors/subsectors, type of enterprises, relevant for TC services)	Number Of Enterprises	No of Employment	No of Associations, Name of Main /Active Association	Presence of Engineering, Technical, Skill Development institutions, BDS Providers	Other support Institutions	Previous cluster development intervention (Name of the agency and Year)	Common Facility Centre / SPV if any	Relevance for Agro and Rural Technology	Existing Linkages with TC	Geographical Proximity (appx)	TC's qualitative Feedback	Remarks
1	Steel Metal Fabrication Cluster, Visakhapatnam	machining and fabrication units	1000 Units	20000	**Visakha Autonagar Small Scale Industrialists Welfare Association(VASSIWA), AP Chamber of Commerce & Industry Federation,** Pedagantyada industrialists Welfare Association (PIWA), DICCI, Visakha SC/ST Entrepreneurs Welfare Association, Kadiyam Industrial Cluster Development Association, IALA-Autonagar	Indian Institute of Welding (IIW), Vizag Institute of Technology, GITAM, Govt ITI	CII, KVIC, NSIC, DIC, MSME DI	Not yet, DIC Visakhapatnam got a 5000cr fund for cluster development activities in autonagar area.	No	Yes	No	60 km radius in Vizag city, all units are scattered in all industrial parks of Visakhapatnam district of AP	Prioritized as per TC	A joint meeting has been organized with VASSIWA with President and this cluster has been suggested by them.
2	Sea Food Cluster, Visakhapatnam	Sea Food- dry fish	45	1800	**Visakha Autonagar Small Scale Industrialists Welfare Association(VASSIWA), AP Chamber of Commerce & Industry Federation,** Pedagantyada industrialists Welfare Association (PIWA), DICCI, Visakha SC/ST Entrepreneurs Welfare Association, Kadiyam Industrial Cluster Development Association, IALA-Autonagar	Indian Institute of Welding (IIW), Vizag Institute of Technology, GITAM, Govt ITI	CII, KVIC, NSIC, DIC, MSME DI	No			No	10km from Vizag city		
3	Coffee Cluster	Coffee	33	3300	**Visakha Autonagar Small Scale Industrialists Welfare Association(VASSIWA), AP Chamber of Commerce & Industry Federation,** Pedagantyada industrialists Welfare Association (PIWA), DICCI, Visakha SC/ST Entrepreneurs Welfare Association, Kadiyam Industrial Cluster Development Association, IALA-Autonagar	Indian Institute of Welding (IIW), Vizag Institute of Technology, GITAM, Govt ITI	CII, KVIC, NSIC, DIC, MSME DI	No	No	No	No	30km from Vizag		
4	Pedagantyada General Engg. Cluster, Pedagantyada, Gajuawaka	Foundry, forging, casting	150	3000	**Visakha Autonagar Small Scale Industrialists Welfare Association(VASSIWA), AP Chamber of Commerce & Industry Federation,** Pedagantyada industrialists Welfare Association (PIWA), DICCI, Visakha SC/ST Entrepreneurs Welfare Association, Kadiyam Industrial Cluster Development Association, IALA-Autonagar	Indian Institute of Welding (IIW), Vizag Institute of Technology, GITAM, Govt ITI	CII, KVIC, NSIC, DIC, MSME DI	No	No	Yes	No	30 Km from Vizag city		A meeting held with PIWA, president and sectary were present in the meeting. PIWA association has been suggested to consider this industrial area for cluster development activities.

5	Agananpudi, Anakapally, and Perwada General Engineering Cluster	Machining and fabrication units	200	3000	**Visakha Autonagar Small Scale Industrialists Welfare Association(VASSIWA), AP Chamber of Commerce & Industry Federation,** Pedagantyada industrialists Welfare Association (PIWA), DICCI, Visakha SC/ST Entrepreneurs Welfare Association, Kadiyam Industrial Cluster Development Association, IALA-Autonagar	Indian Institute of Welding (IIW), Vizag Institute of Technology, GITAM, Govt ITI	CII, KVIC, NSIC, DIC, MSME DI, COIR Board	No	No	Yes	No	40km from Vizag city		VASSIWA has suggested us to consider these industrial areas for cluster development activities. These three clusters have a low amount of firms in general engineering machining/fabrication.
6	Visakhapatnam COIR Cluster-Korupurlu, Near S. Rayavaram	coconut products	29	500	**Visakha Autonagar Small Scale Industrialists Welfare Association(VASSIWA), AP Chamber of Commerce & Industry Federation,** Pedagantyada industrialists Welfare Association (PIWA), DICCI, Visakha SC/ST Entrepreneurs Welfare Association, Kadiyam Industrial Cluster Development Association, IALA-Autonagar	Indian Institute of Welding (IIW), Vizag Institute of Technology, GITAM, Govt ITI	CII, KVIC, NSIC, DIC, MSME DI, COIR Board	No	No	Yes	No	30km from Vizag		
7	Gambheeran General Engineering Cluster	Machining and fabrication units	50	300	**Visakha Autonagar Small Scale Industrialists Welfare Association(VASSIWA), AP Chamber of Commerce & Industry Federation,** Pedagantyada industrialists Welfare Association (PIWA), DICCI, Visakha SC/ST Entrepreneurs Welfare Association, Kadiyam Industrial Cluster Development Association, IALA-Autonagar	Indian Institute of Welding (IIW), Vizag Institute of Technology, GITAM, Govt ITI	CII, KVIC, NSIC, DIC, MSME DI, COIR Board	No	No	Yes	No	30 Km from Vizag city		We had a meeting with industrialists and found that a very small amount of firms involved in general engineering equipment.
8	Machining Component Manufacturing (Conventional & CNC) Cluster, Visakhapatnam	Machining and fabrication units	500	3000	**Visakha Autonagar Small Scale Industrialists Welfare Association(VASSIWA), AP Chamber of Commerce & Industry Federation,** Pedagantyada industrialists Welfare Association (PIWA), DICCI, Visakha SC/ST Entrepreneurs Welfare Association, Kadiyam Industrial Cluster Development Association, IALA-Autonagar	Indian Institute of Welding (IIW), Vizag Institute of Technology, GITAM, Govt ITI	CII, KVIC, NSIC, DIC, MSME DI, COIR Board	No	No	Yes	No	60 km radius in Vizag city, all units are scattered in all industrial parks of Visakhapatnam district of AP	Prioritized as per TC	
9	Composite Manufacturing Cluster, Visakhapatnam	Foundry, forging, casting	700	4000	**Visakha Autonagar Small Scale Industrialists Welfare Association(VASSIWA), AP Chamber of Commerce & Industry Federation,** Pedagantyada industrialists Welfare Association (PIWA), DICCI, Visakha SC/ST Entrepreneurs Welfare Association, Kadiyam Industrial Cluster Development Association, IALA-Autonagar	Indian Institute of Welding (IIW), Vizag Institute of Technology, GITAM, Govt ITI	CII, KVIC, NSIC, DIC, MSME DI, COIR Board	No	No	Yes	No	60 km radius in Vizag city, all units are scattered in all industrial parks of Visakhapatnam district of AP	Prioritized as per TC	

Annexure 6: Manufacturing Process

Different stages in the Fabrication and Machining Process



Machining Process

Machining is any process in which a cutting tool is used to remove small chips of material from the workpiece (the workpiece is often called the "work"). To perform the operation, relative motion is required between the tool and the work. This relative motion is achieved in most machining operation by means of a primary motion, called "cutting speed" and a secondary motion called "feed". Machining is a part of the manufacturing of many metal products and including materials such as wood, plastic, ceramic, and composites. Much of the modern-day machining is carried out by computer numerical control (CNC), using the computer to control the movement and operation of the mills, lathes, and other cutting machines.

The Basic three main machining processes are classified as turning, drilling and milling. Other operations like shaping, planning, boring, broaching and sawing, etc. may fall into miscellaneous categories. Also, grinding and similar abrasive operations are also included within the category of machining

In turning, a cutting tool with a single cutting edge is used to remove material from a rotating workpiece to generate a cylindrical shape. The primary motion is provided by rotating the workpiece, and the feed motion is achieved by moving the cutting tool slowly in a direction parallel to the axis of rotation of the workpiece.

Drilling is used to creating a round hole. It is accomplished by a rotating tool that typically has two or four helical cutting edges. The tool is fed in a direction parallel to its axis of rotation into the workpiece to form the round hole.

In boring, a tool with a single bent pointed tip is advanced into a roughly made hole in a spinning workpiece to slightly enlarge the hole and improve its accuracy. It is a fine finishing operation used in the final stages of product manufacture.

Reaming is one of the sizing operations that removes a small amount of metal from a hole already drilled.

In milling, a rotating tool with multiple cutting edges is moved slowly relative to the material to generate a plane or straight surface. The direction of the feed motion is perpendicular to the tool's axis of rotation. The speed motion is provided by the rotating milling cutter

Other conventional machining operations include shaping, planning, broaching and sawing.

Roughing cuts are used to remove large amount of material from the starting work part as rapidly as possible. Finishing cuts are used to complete the part and achieve the final dimension, tolerances, and surface finish.

A cutting fluid is often applied to the machining operation to cool and lubricate the cutting tool.

Today other forms of metal cutting are becoming increasingly popular. An example of this is water jet cutting. Water jet cutting involves pressurized water in excess of 620 MPa (90 000 psi) and is able to cut metal and have a finished product.

More recent, advanced machining techniques include precision CNC machining, electrical discharge machining (EDM), electro-chemical erosion, laser cutting, and plasma cutting, or water jet cutting to shape metal workpieces

Machining requires attention to many details for a workpiece to meet the specifications set out in the engineering drawings or blueprints. Besides, the obvious problems related to correct dimensions, there is the problem of achieving the correct finish or surface smoothness on the workpiece. The inferior finish found on the machined surface of a workpiece may be caused by incorrect clamping, a dull tool, or inappropriate presentation of a tool. Frequently, this poor surface finish, known as chatter, is evident by an undulating or irregular finish, and the appearance of waves on the machined surfaces of the workpiece

FORGING:
Forging is a forming manufacturing process involving the shaping of metal using localized forces. The localized forces are delivered with a power hammer or a die. Forged parts can range in weight from less than a kilogram to hundreds of metric tons.

Forged parts are widely used in processes and machines wherever a component requires high strength. Forging is classified according to the temperature at which it is performed: cold forging (a type of cold working), warm forging, or hot forging (a type of hot working). Different types of forging are: Drop forging, Open-die drop forging Closed-die forging or Impression-die forging

Forging dies are usually made of high-alloy or tool steel. Dies must be impact and wear-resistant, maintain strength at high temperatures, and have the ability to withstand cycles of rapid heating and cooling.

Foundry Casting
It is a manufacturing process in which a liquid material is usually poured into a hollow cavity of the desired shape made in a mould and then allowed to solidify. The solidified part is called a casting, which is taken out of the mould to complete the process. Casting materials are usually metals. Heavy equipment like machine tool beds, ships' propellers, etc. can be cast easily in the required size, rather than fabricating by joining several small pieces.

Fettling is the process of cutting, grinding, shaving or sanding away these unwanted bits like caused by seams and imperfections in the moulds is called "fettling". In modern times robotic processes have been developed to perform some of the more repetitive parts of the fettling process.

Casting process simulation uses numerical methods to calculate cast component quality considering mould filling, solidification, and cooling provides a quantitative prediction of casting mechanical properties, thermal stresses and distortion. Simulation accurately describes a cast component's quality up-front before production starts.

Permanent mould casting is a metal casting process that employs reusable moulds ("permanent moulds"), usually made from metal. Typical products are components such as gears, splines, wheels, gear housings, pipe fittings, fuel injection housings, and automotive engine pistons. Various types of castings are – Slush casting, Centrifugal casting or roto casting, low pressure, and high pressure Die castings, Vacuum, Blow moulding, Compression Moulding, Injection moulding, Spin casting etc.

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