73RD INDIAN FOUNDRY CONGRESS & IFEX 2025

9th to 11th February, 2025 • Biswa Bangla Mela Prangan, Kolkata

SOUVENIR

Foundry Solutions, *Personalized*

40+ ye

The Casting Loop: En

ars, 500+ customers
d-to-End Foundry Solutions, *Personalized.*

The MPM Edge :

Customer First approach : *"On-site", "on-line", "on-call"*

Headquartered centrally at Nagpur, with a network of warehouses at strategic locations near foundry hubs, and a versatile team of technical applications experts, MPM is well positioned to cater to our customers across the country within 24 hours of a call.

Facilities:

- 4 manufacturing plants
- 7 warehouses across India

Quality Assurance:

State of the art laboratories powered by data driven, digitally delivered insights

Technical Services :

Technically competent team with 100+ years of combined experience in the foundry ecosystem

Leading Digitalization and Sustainability

At MPM, we are committed to become a Digital first, data driven organization, while working towards sustainability and environment

GSI /Energy Analytics :

Adopting digitalization, our machines and laboratory are online, helping us optimize our processes and take proactive decisions

Sustainability Focus:

MPM group companies have embarked on the journey to become to become solar power driven to improve the environmental impact of our operations

Beyond Borders:

Driving innovations through international collaborations and leading universities focused on the foundry ecosystem

We invite you to associate with the MPM Brand Experience!

MPM PRIVATE LIMITED

M-22, MIDC, Hingna Industrial Estate,
Nagpur - 440 016 Maharashtra, India.
Tel: +91 (7104) 232401 / 232402/237065

info@mpmindia.com
www.mpmindia.com

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RBAC

R B Agarwalla & Company
Access covers since 1958

CELEBRATING 65 YEARS

Why RBAC?

RBAC is a specialist in all Municipal castings products. R.B Agarwalla & Company excels in providing complete range of manhole covers and frames with optimum design that makes our products strongest, lightest and safest in usage.

Our capabilities include:

- **Deep Product & Domain knowledge:** More than 15000 active products for more than 80 different countries worldwide. Deep domain and product knowledge
- **Manufacturing flexibility:** one of very few to offer the entire spectrum of green sand molding techniques: Hand, Low-pressure machine molding, High-pressure machine molding and Air impulse machine molding
- Quality assurance with complete process and product control of **Critical to Quality** parameters
- **Aesthetics:** RBAC products are aesthetically beautiful providing crisp and clear surface and markings
- **Unlimited options:**
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  - High-performance coatings like epoxy, powder coating, CED, Fusion Bonded epoxy etc
  - Hot dip galvanized or high wear resistance (salt spray tested) top coats
- Fully committed to satisfying our customers

Deep Product Knowledge

Unmatched Manufacturing Flexibility

Stringent Quality Control

Aesthetically Beautiful

Largest Manufacturing Capacity in India

Committed to Customer Satisfaction

73rd INDIAN FOUNDRY CONGRESS & IFEX 2025

9 to 11 February, 2025, Biswa Bangla Mela Prangan, Kolkata, West Bengal, India

THE INSTITUTE OF INDIAN FOUNDRYMEN

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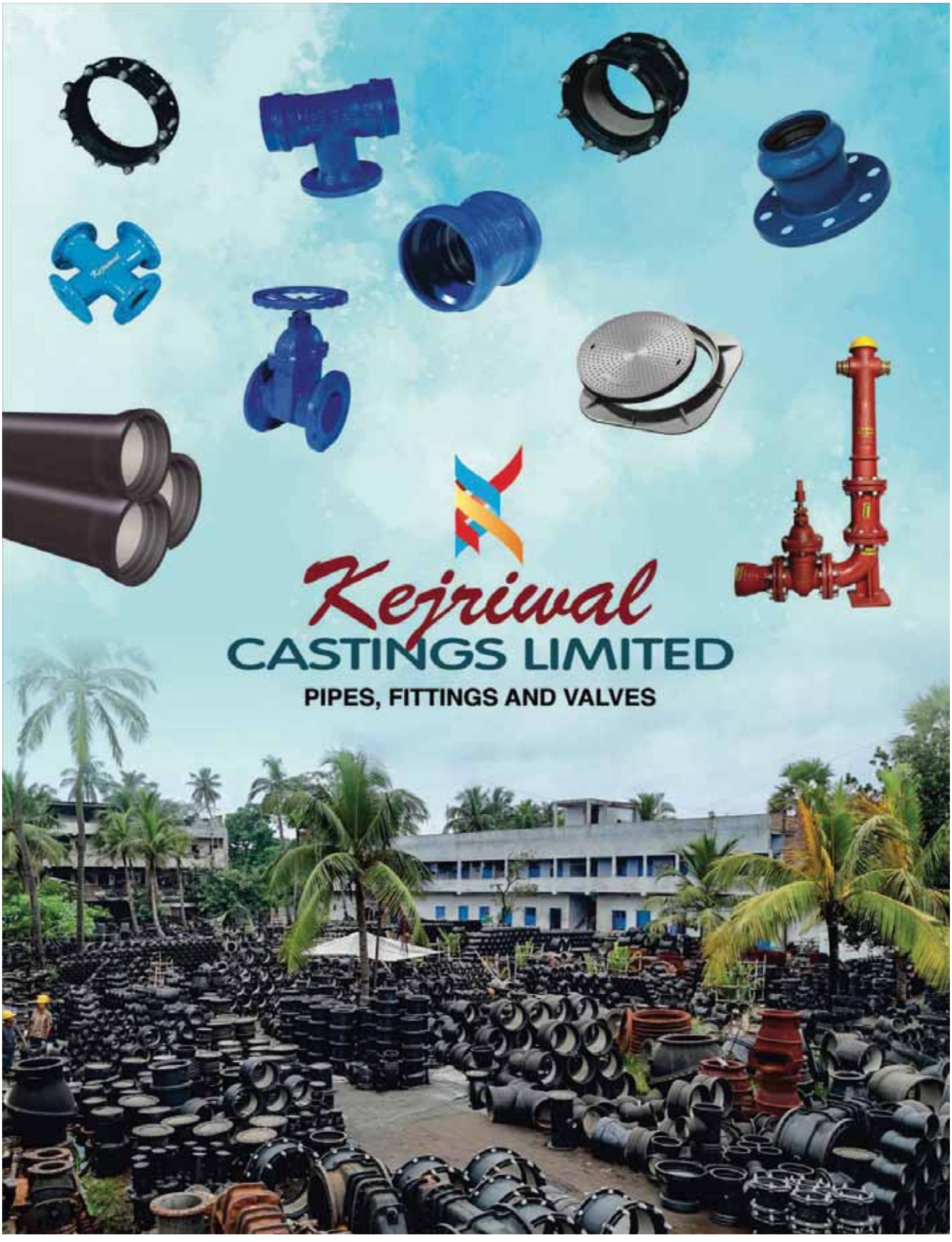
www.indianfoundry.org

THE INSTITUTE OF INDIAN FOUNDRYMEN

An ISO 9001:2015 Certified Organisation

West Bengal Industrial Development Corporation


Kejriwal
CASTINGS LIMITED
PIPES, FITTINGS AND VALVES

CONTENTS OF SOUVENIR

73rd INDIAN FOUNDRY CONGRESS

ORGANISING COMMITTEE

Navneet Agarwal
President

Vijay S Beriwal
Chairman, IFC

Pradeep Kr Madhogaria
Co-Chairman, IFC

Goutam Dutta
Vice-Chairman, IFC

Ravindra P Sehgal
Chairman, IFEX

Anil Vaswani
Co-Chairman, IFEX

Dr Shamim Haidar
Vice-Chairman, IFEX

Rajan Vaswani
Mentor

Ranjan Guha
Hon Secretary

Naman Shah
Hon Joint Secretary

Abhay Goel
Hon Treasurer

Abhishek Satnaliwala
Hon Joint Treasurer

NATIONAL OFFICE BEARERS

Navneet Agarwal
President

Sushil Sharma
Vice President

Pradeep Kr Madhogaria
Hon Secretary

Dinesh Gupta
Hon Treasurer

D S Chandrashekar
Imm Past President

Indian Foundry Association

- Established in 1952 - one of the oldest non-profit all-India Industry Associations, Golden Jubilee celebrated in 2001
- Affiliated to Indian Chamber of Commerce, Kolkata
- Represented in Steel Consumers' Council, Ministry of Steel, Govt of India
- Administration by Honorary Executive Council backed by professional Secretariat
- Work in close cooperation and coordination with EEPC, IIF and other Foundry Associations of Agra, Coimbatore, Batala, Agra, Rajkot

Role of IFA

- Promote, develop and help in up-gradation of Foundry Industry and fraternity in general
- Advising members on all industry related matters like excise, technical, taxation and labour laws
- Assistance in Marketing
- Procurement of materials like pig iron, hard coke, limestone, etc in a timely and cost efficient manner for benefit of members
- Guiding members about adherence to eco-friendly measures by way of installation of anti-pollution equipment culminating in setting-up of 2 demo plants in consultation and cooperation of TERI & NML

Objectives and Vision of IFA

- To become the focal and rallying point to the entire Foundry Industry.

IFA Members at The Press Club for Press Conference

FCDA

Foundry Cluster Development Association (FCDA) is involved in implementing Foundry Park Project on Ranihati-Amta Road, Howrah. Among other infrastructural assets, it has a Common Facility Centre consisting of

A) Vivekananda Private ITI

Which has obtained approval of National Council of Vocational Training, Govt of India (NCVT) for conducting the following courses:

FITTER

The NCVT-approved ITI Fitter course lasts two years (National Council for Vocational Training). Under the ITI Fitter subject list, candidates will learn about fittings such as pipe fittings, machine fittings, and structure fittings in this course

ELECTRICIAN

ITI electrician course prepares the students to work on a variety of electrical equipment and do different types of electrical wiring. The course gives exposure to both theoretical and practical knowledge of all household appliances, electrical machines, lighting wiring, etc. Successful students can apply directly for workman permit (License) from Electrical License office kolkata, West Bengal

FOUNDRYMAN

Foundryman is a trade in ITI in which students study sand testing, woodworking, safety precautions, hand tools, unit sand, pit furnace, moulding process, core, gating system, metalworking, induction furnace, such casting process, settling of casting, furnace, moulding process, core, gating system, metalworking, induction furnace, such casting process, settling of casting, binders, iron ore, common cast iron, wrought iron, foundry

Course Fees of around Rs 25,000 per year on an average

B) Tool Room/Testing Laboratory (Vivekananda Technical Institute)

Equipped with latest equipment like CNC machine; Induction Furnace, Test Lab (NABL Accredited) etc. It houses NABL approved sand laboratory.

Sector	Machine/Instrument Name
Sand Laboratory	1. Digital Green Compressive Strength Machine 2. Digital Permeability Tester 3. AFS sieve Shaker machine 4. Sand muller 5. Sand Mixer 6. Total Clay content tester 7. Rapid Moisture Tester 8. Sand Rammer 9. Mould Hardness Tester 10. Core Hardness Tester
Chemical Laboratory	1. Universal Testing Machine (UTM) 2. Impact Testing Machine 3. Brinell Hardness Testing Machine
Machine Shop	1. Optical Emission Spectrometer 2. Hot Air Oven 3. Muffle Furnace 4. Strohlein apparatus 5. Digital Balance

Accreditation

Laboratory (Chemical, Physical, Sand) - *NABL approved*

Foundry Cluster Development Association (FCDA)

Corporate Office: 4, India Exchange Place (7th Floor), Kolkata - 700001
Phone: 22306790/22318524 Email: foundrypark@fcda.in
Park Site: Hawlibagan, Ranihati-Amta Road, Howrah- 711322
Mobile: 8017000041 Email: princivti@fcda.in

MESSAGES

Message

डी॰ तारा, आई.ए.एस.
अपर सचिव
D. Thara, I.A.S.
Additional Secretary

भारत सरकार
आवासन और शहरी कार्य मंत्रालय
GOVERNMENT OF INDIA
MINISTRY OF HOUSING AND URBAN AFFAIRS

MESSAGE

I am pleased to know that the Institute of Indian Foundrymen (IIF) is organizing the 73rd Indian Foundry Congress (IFC) and the Indian Foundry Exhibition – IFEX 2025 at Biswa Bangla Mela Prangan, Kolkata between 9th to 11th February, 2025.

I am also happy to note that there will be a special symposium on "HAR GHAR JAL" during the 73rd IFC. This mission, launched by the Government of India in 2019, aims to provide functional household tap connections to every rural household to ensure access to safe drinking water, reducing the risk of water-borne diseases and improves overall health and hygiene of millions of people in rural India.

This massive mission of the Government will also bring opportunities for the Foundry Industry. There will be surge in demand for sanitary and hardware items made by casting process. I am sure the deliberations during the symposium on "HAR GHAR JAL" will be enriching for the participants and will enable the industry to be ready and tap the opportunities.

I extend my best wishes to all the exhibitors, organizers and all the participants for very useful participation in the IFEX 2025.

(D. THARA)

Office: 144-C, Nirman Bhawan, New Delhi-110011, Phone: 011-23061444, 23061991
Email: tharad@ias.nic.in, Website: www.mohua.gov.in

Message

आर.के. राय, आईईडीएस
अपर विकास आयुक्त
R.K. Rai, IEDS
Additional Development Commissioner

सत्यमेव जयते

भारत सरकार
सूक्ष्म, लघु एवं मध्यम उद्यम मंत्रालय
GOVERNMENT OF INDIA
OFFICE OF THE DEVELOPMENT COMMISSIONER
MINISTRY OF MICRO, SMALL & MEDIUM ENTERPRISES

Date:24.12.2024

MESSAGE

I am pleased to note that the Institute of Indian Foundrymen (IIF) is organizing the 73rd Edition of Indian Foundry Congress and the Indian Foundry Exhibition – IFEX 2025 at Biswa Bangla Mela Prangan, Kolkata on February 9-11, 2025.

I am happy to share that the Ministry of MSME has approved IFEX 2025 for extending financial assistance to the MSEs under the PMS scheme of the Ministry, in order to support them to take part in this internationally renowned foundry exhibition and showcase their capabilities.

Ministry of MSME is implementing various schemes and programs to promote the growth and development of MSME Sector including foundry Industry in India for Technology Upgradation, Skill Development, Marketing Support, Research & Development Support by promoting Industry-Academia partnerships to foster innovation and technology transfer.

I extend my best wishes to all the exhibitors, organizers for success in their endeavor and all the participants for very useful participation in the IFEX 2025.

24/1/2025

R.K. Rai
(Additional Development Commissioner)

Room No. 723-A, 'A' Wing, 7th Floor, Nirman Bhawan, New Delhi-110 010
Ph.: 011-23062561 Email : rk.rai@gov.in

Message

ডাঃ শশী পাঁজা
ভারপ্রাপ্ত মন্ত্রী
শিল্প, বাণিজ্য ও উদ্যোগ বিভাগ
এবং
নারী ও শিশু উন্নয়ন এবং সমাজকল্যাণ বিভাগ
পশ্চিমবঙ্গ সরকার

Dr. Shashi Panja
Minister-in-Charge
Department of Industry, Commerce & Enterprises
and
Women & Child Development and Social Welfare
Government of West Bengal

MIC/IC&E/7/25

Date : 17.01.2025

I am happy to know that the Institute of Indian Foundrymen is organizing its annual mega flagship initiative the **73rd Indian Foundry Congress along with International Foundry and Equipment Exhibition-IFEX 2025 & Cast India Expo, under the theme "Casting for a Better Future - Innovate, Collaborate, Perpetuate" at Biswa Bangla Milan Mela Prangan, Kolkata, from 9th to 11th February 2025.**

The three-day Exhibition-cum-Convention would attract industrialists from Foundry and allied industries across India and beyond to Bengal which would translate into business collaboration, techno commercial knowledge dissemination and job creation for the local foundries and their suppliers.

Significantly, the Institute has completed 75 Years of journey this year, which would be celebrated in a spectacular manner with global footfall and networking amongst foundrymen of different countries and giving an opportunity to the Casting Manufacturers, Equipment Makers and Material Suppliers of Bengal to interact with their counterparts across the globe.

I would like to take this opportunity to wish the Institute and all foundrymen grand success on this wonderful occasion.

Shashi Panja

Dr. Shashi Panja

"**Shilpa Sadan**", 4, Abanindranath Tagore Sarani (Camac Street), 6th Floor, Kolkata - 700 016
Ph. : 4005 0111, e-mail : micicewb@wb.gov.in

Message

Message from President, IIF

Dear Fellow Foundrymen,

It is my great pleasure and honour to extend a warm welcome to all dignitaries, delegates, exhibitors, authors, speakers, sponsors, service providers, visitors, members, and foundrymen participating in the 73rd Indian Foundry Congress, IFEX 2025, and Cast India Expo, scheduled for February 9-11, 2025, at Biswa Bangla Mela Prangan, Kolkata, West Bengal.

Under the theme "Casting for a Better Future: Innovate, Collaborate, Perpetuate," this premier event will foster insightful discussions and exchanges on cutting-edge innovations and collaborations that drive sustainability and growth at local, national, and global levels.

Set against the backdrop of rapid advancements in casting processes, industrial equipment, foundry materials, automation, Industry 4.0, simulation software, and 3D printing, this Congress will showcase near-zero-defect casting solutions through technical sessions and exhibitions. Some of the prominent symposium being planned for the first time in IFC are Har Ghar Jaal – focussing on the massive initiative of the GOI to provide clean drinking potable water to every household in India. Another is focussing on Environment & Sustainability with cast studies in the foundry. This IFC will continue it dwell deep into Robotics and Automation to make it easier for the foundry fraternity to adopt solutions as per their needs.

As always there will be Techmart for various companies to showcase their technical prowess and innovation in products and services.

You will be able to witness a walk down the Wall of Fame, showcasing the best all IIF across all regions and chapter.

Spouses have always been a solid support, without whom none of us will be able to do what we do. Special programs for the spouses have been planned on location and off location to meet, learn and be entertained.

While your minds will enjoy the sessions in the day, your sensory organs will be overwhelmed in the evenings. The team has planned for a glittering awards ceremony, an exciting entertainment with several musical and dance shows that will help you unwind and enjoy with your colleagues. Do not forget to experience the renowned hospitality of the East.

Hosting this grand event in Bengal—the cradle of the Indian Foundry Industry—is truly symbolic. The Institute of Indian Foundrymen (IIF), founded in 1950, was established by a group of passionate metal casters who sought to revolutionize foundry practices. As IIF enters its 75th year, we celebrate this milestone with grandeur across the nation, including a special celebration in Kolkata on the eve of the IFC.

The overwhelming response in exhibition space bookings and delegate registrations is a testament to the enthusiasm and scale of this event, promising to be the largest IFC ever held in Eastern India.

I would like to thank each and every member of the Organizing Committee and the entire Eastern region who have been working tirelessly and burning the mid night oil to ensure a seamless experience for all Delegates - from transportation and world-class accommodations to thought-provoking technical sessions, business meetings, and networking opportunities.

Your presence and support are key to making this event a grand success!

Looking forward to welcoming you all!

Thank you.

Jai Hind!

Navneet Agarwal

President, IIF 2024-25

Message

Message from Chairman, IIF-Eastern Region

The Eastern Region of The Institute of Indian Foundrymen (IIF) hosting the 73rd Indian Foundry Congress (IFC) concurrently with International Foundry Exhibition (IFEX) 2025 at Biswa Bangla Milan Mela Prangan, Kolkata from 9th to 11th February, 2025 and is honoured to invite you to its annual flagship event on the theme of " Casting for a better future- Innovate, Collaborate, Perpetuate."

The Indian Foundry industry has witnessed steady growth in recent years supported by increasing demand in various sectors such as Automotive, Engineering, Energy and Infrastructure.

In Eastern India, particularly in Bengal, the Foundry industry has witnessed significant development with Kolkata & Howrah as a major hub characterized by growing market size, expansion of existing players and potential for further growth.

So, dear fellow Foundrymen, welcome to Kolkata, the City of Joy, the Gateway of Eastern India, which is about to witness the most significant gathering of Foundry fraternity from around the world to focus on the latest trend in markets and technologies for the foundry industry and to explore the newer changes and future opportunities.

The 73rd IFC and IFEX 2025 Organising Committee along with various Sub Committees, Executives and dedicated IIF staff are putting their finest efforts to assure you best of services, networking and business.

Let us join together to participate in the greatest Foundry show of the East ever!

Best Regards.
Gautam Dutta

Message

Message from Chairman & Co-Chairman, 73rd IFC Organising Committee

It is with immense pleasure that I welcome you all to 73rd Indian Foundry Congress. This eagerly anticipated event after Eight long years brings together an exceptional gathering of Industrialists, Academia, Professionals, Researchers and Innovators united by a shared vision to advance our Industry and shape the future.

This year's theme "Better Future / Innovation / Collaboration / Perpetuate " underscores the importance of addressing emerging challenges and harnessing opportunities in our rapidly evolving Foundry World. Over the cause of the Congress and Planned symposium, we will engage in thought provoking discussions, share ground breaking ideas and explore the latest developments through keynote speeches, panel discussions and interactive Q+A session which all are meticulously designed considering todays' challenges.

The Exhibition, an Integral part of the Congress, offers a unique platform for showcasing pioneering technologies, products and solutions that are setting new benchmarks in the Industry.

Organizing the event of this scale has been a truly collaborative effort and I extend my heartfelt thank from bottom of my heart to our Sponsors, Partners, Speakers and Organizing Team for their very hard work and dedication.

I am sure that this congress inspires new ideas, fosters meaningful connections and ignites a collective drive to achieve excellence. Let us come together to participate and shape a brighter future.

Vijay S Beriwal
Chairman

Pradeep Kumar Madhogaria
Co-Chairman

Message

Message from Chairman, Souvenir Committee

With immense gratitude and pride, I extend my heartfelt appreciation to each of you as we gather for IFEX 2025 and the **73rd Indian Foundry Congress (IFC)**. These platforms have been instrumental in driving innovation, fostering collaboration, and strengthening the Indian foundry industry.

At A**llied Iron Products Pvt Ltd,** our journey over the past 25 years has been one of resilience, growth, and commitment to excellence. From humble beginnings, we have expanded our presence globally, delivering **high-quality Cast Iron and Ductile Iron products** to key markets, including the **UAE, Oman, Qatar, Africa, and Europe**. Our focus on **precision, durability, and sustainability has earned the trust of clients worldwide.**

IFC & IFEX have played a crucial role in this journey, providing a **knowledgesharing and Problem-solving ecosystem** where industry leaders, innovators, and stakeholders come together to help each other and shape the future. The insights gained, the relationships built, and the technologies explored here continue to push our industry forward.

This souvenir is a small token of appreciation, symbolizing the shared spirit of progress that binds us all. As we forge ahead, let us **embrace new opportunities, adopt advanced technologies, and strengthen our collaborations** to elevate India's foundry sector to even greater heights.

Wishing you a successful and enriching experience at IFEX 2025!

Sincerely,

Niitesh Jain
Chairman

Message

Message from Chairman, IFEX 2025

Foundry fraternity and friends,

Kolkata will witness the major congregation of the Indian Foundrymen in February 2025 and besides hearing talks on wide-ranging topics related to the Foundries, they shall also be witnessing the largest Foundry Exhibition of the East which is indeed emerging as the growth hub for castings with focus on Railways, Defense, Water distribution across India and Municipal castings for exports and domestic consumption.

India is the second largest producer of castings with a compounded annual growth rate of over 10 percent. However, this growth must come with technological upgradation and modern technologies with more efficient plants and machinery.

The convergence of industrialists, academia, machinery and equipment suppliers, Foundry chemicals suppliers besides the various other service providers makes this one of the largest "Make in India-think tank" assemblies which, I am sure, will give rise to a spurt in the Foundry growth across India.

The unique part of this event happening in the eastern part of India is that it comes in a big way after eight years with the 2020-21show being affected by the COVID. We had started with the idea of booking one Hall A with about 4500 sq meters but over the last few months, the response was so overwhelming that we had to close the bookings with a total space of over 8500 sq meters being occupied in the two halls. This shows the enthusiasm and the excitement in the Foundry Industry and the growth prospects and also on the confidence in the East which is certainly attracting a lot of new entrepreneurs to set up the Foundries and other related industries.

To add to the knowledge and understanding of the AI applications, the automation and the Robotics is making its entry in the East for the first time and we do have the conference sessions on this besides the actual Live Demo area in the Exhibition where robotswill demonstrate the ease of working in focussed areas of the Foundry operations.

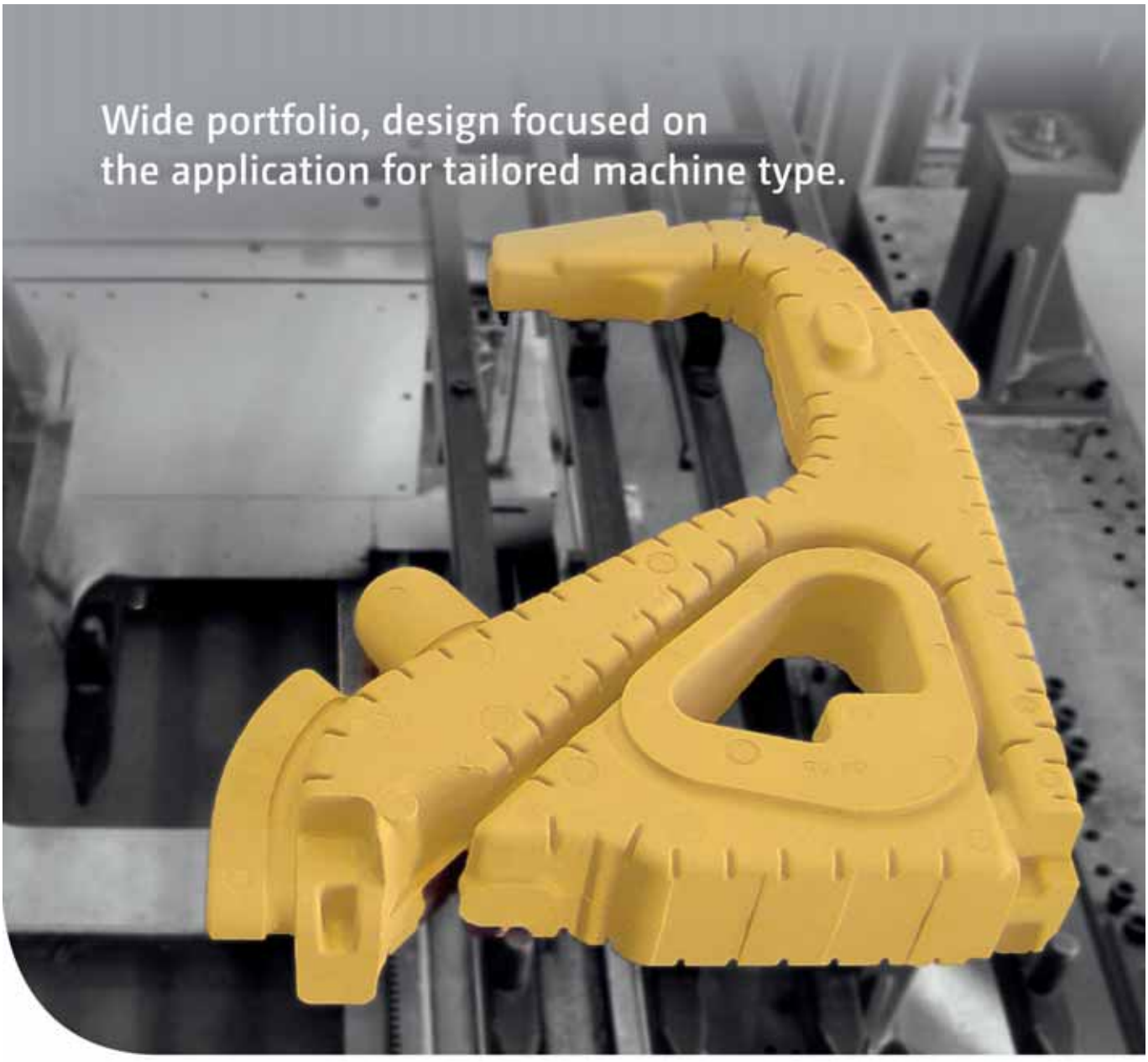
The excitement is building up and I am sure all the delegates and visitors will gain vast knowledge by witnessing the Exhibition and interacting with the over 250 exhibitors in this mega event that is turning out to be a grand show.

Witness, Learn, Network and Enjoy - that is the mantra of IFEX 2025 !!

Ravi Sehgal,

Past President, IIF

Chairman- IFEX 2025



All supporting business activities of Laempe Mössner Sinto GmbH in India will be handled by OUR subsidiary **Laempe India Private Limited**

LAEMPE
INDIA PRIVATE LIMITED

Office No.1018, 10th Flor, Gera's Imperium Alpha Survey No.64, Hissa No.1 to 6,
EON IT Park Road, Kharadi, PUNE – 411014, Maharashtra, India
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ARTICLES

STANDARDS ADVISORY COMMITTEE AND ITS ROLE IN BIS ACTIVITIES AND FORMULATION OF STANDARDS FOR THE FOUNDRY INDUSTRY

STANDARDS ADVISORY COMMITTEE,
THE INSTITUTE OF INDIAN FOUNDRYMEN

The Bureau of Indian Standards (BIS) is the national standards body of India that develops, implements, and certifies standards for various products, services, and systems with the following objectives:

1. **Promote consumer protection:** Through standardization and certification, BIS aims to protect consumers' interests by ensuring that products and services meet minimum safety and quality requirements.
2. **Facilitate trade and commerce:** BIS standards and certification schemes help to facilitate trade and commerce by providing a common language and framework for businesses to operate.
3. **Enhance competitiveness:** By adopting international standards and best practices, BIS helps Indian industries to enhance their competitiveness in the global market.

The Standards Advisory Committee (SAC) of The Institute of Indian Foundrymen (IIF) is the nodal point of connect between the BIS and the foundry industry. SAC under the Chairmanship of Mr. Dinesh Gupta, National Hon. Treasurer-IIF (2024-25) played a crucial role in the development and implementation of standards pertaining to the foundry industry in India and took active participative role in various BIS Activities. As a result of such key interventions, IIF is now holding strong presence and footprints in BIS through the SAC.

The following are the broad areas of activities of the SAC:

- The SAC advises the BIS on priorities for standardization, taking into account national interests, Foundry Industry needs, and consumer requirements.
- The SAC ensures that the views and interests of various stakeholders, including industry, consumers etc. are represented in the standardization process.
- The SAC provides technical expertise and guidance to BIS on various aspects of standardization, including technical content, testing, and certification and reviews the draft standards prepared by BIS.
- The SAC engages with industry stakeholders, including manufacturers, suppliers, and consumers, to understand their needs and concerns related to standardization.
- The SAC provides feedback to BIS on the implementation of standards, including any challenges or issues faced by industry stakeholders.
- The SAC promotes awareness and adoption of standards among industry stakeholders, to ensure that standards are widely accepted and implemented.

SAC represents the IIF in the following metallurgical departments of the BIS:

1. Research Evaluation Committee (15th Feb 2024)

2. MTD C- Divisional Council (6th Dec 2023)

3. Three important Sectional Committees of MTD Division Council :-

   - MTD 6 - Pig iron and Cast Iron Sectional Committee
   - MTD 14 - Foundry and Steel Casting Sectional Committee
   - MTD 21- Non-Destructive Testing Sectional Committee

4. Member of Standardization Cell, BIS

SAC's role in implementation of Quality Control Orders (QCOs) pertaining to the foundry industry

1. DPIIT under Ministry of Commerce & Industry, Govt. of India has issued Cast Iron Products (Quality Control) Order, 2023 on dt. 24th August 2023.

2. The QCO mandated the following Cast Iron Products to comply to the respective Indian Standards

   a. IS 1726:1991 Cast iron manhole covers and frames

   b. IS 1729:2002 Cast iron/ductile iron drainage pipes and pipe fittings for over ground non-pressure pipeline socket and spigot series

   c. IS 1879:2010 Malleable cast iron pipe fittings

   d. IS 13349:1992 Cast iron single faced thimble mounted sluice gates

   e. IS 210:2009 Grey iron castings

   f. IS 1537:1976 Vertically cast –iron pressure pipes for water, gas and sewage

3. SAC immediately felt the need to sensitize the foundry industry about this mandatory BIS licensing of the foundry units manufacturing the above articles and joined hands with BIS and led the initiative by organizing various webinars, seminars and Manak Manthan programmes at various locations. More than 15 such events were held across the country

4. SAC had been successful in getting financial assistance from BIS for organizing such events

5. During these events, SAC noted the voice of the industry raised by various industry representatives about the knowhow and preparedness of the industry to get complaint to the QCO and approached DPIIT requesting the extension of the QCO to give sufficient time to the industry to get the license

6. The DPIIT appreciated the ongoing initiative of SAC in organizing sensitization seminars across the country to educate the industry about the licensing process, requirements, importance and encouraging them to become compliant and assured support.

7. After rigorous persuasion with DPIIT, DPIIT extended the date of implementation of the above said QCO by 6 months

8. SAC also provided free-of-cost consultancy services to various IIF members on BIS licensing process

SAC's role in IIF's ISO 9001 certification process

- IIF is on the journey to standardizing its operations compliant to the ISO 9001 Quality System Standards.
- SAC is playing a crucial role in this journey for designing and monitoring the systems, defining key performance indicators and driving the Institute's objectives

SAC is committed to promote standardization as a means to improve the quality of castings produced in India, facilitate trade, and enhance the competitiveness of Indian foundry industry.

ADUKIA INDUSTRIES

AIC CASTING | NN ISPAT | RAIC | AIC IRON

Our company boasts a production capacity of **1 million metric tonnes** annually, offering a diverse range of products:

INDUSTRIAL CASTINGS

MOTOR BODIES, GEARBOXES, STATOR HOUSINGS, SLAG POTS, CI PANS.

MUNICIPAL CASTINGS

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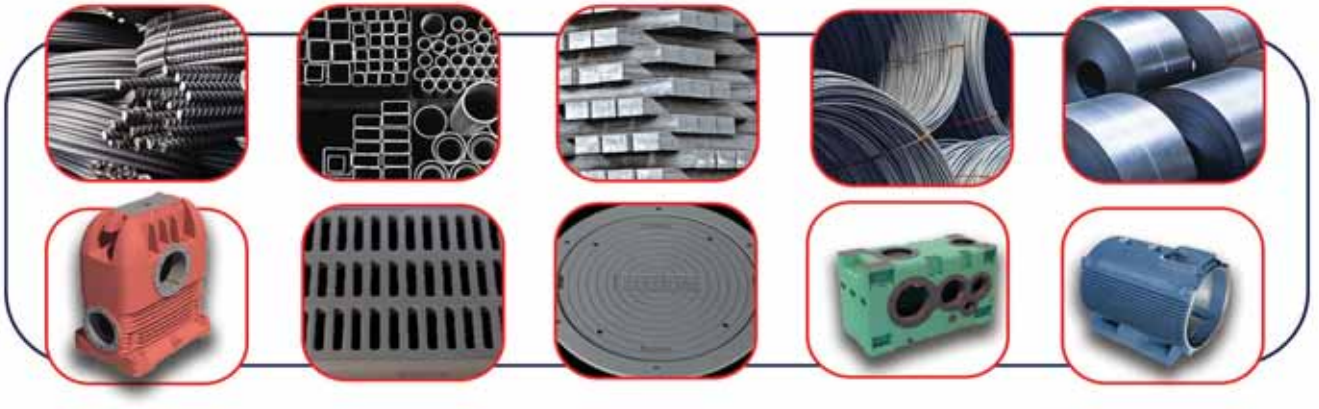

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PROFILE OF THE INDIAN FOUNDRY INDUSTRY

Compiled By:
FOUNDRY INFORMATICS CENTRE (FIC)
IIF, NEW DELHI

Foundry Industry at a glance

i) **Global Scenario:** As per the World Casting Census published in Jan 2023 by Modern Castings, USA, global casting production increased to more than 113.14 million metric tonnes. China, India & USA hold the top three positions.

ii) **India is 2nd largest producer:** With the casting production of approx. 15.16 Million MT per annum in 2023-24 (up from previous year approx 7%), India continues to be the second largest producer of castings in the world

iii) **Types of casting:** Grey Iron Casting, Non-ferrous Casting, Ductile Iron Casting, Steel Casting, Malleable Casting

iv) **Production:** 15.16 Million MT per annum in 2023-24 (up from previous year 7%)

v) **Total number of units (approx):** 5000

vi) **Employment:** 2.0 million (Direct 0.5 million & Indirect 1.5 million)

vii) **Revenue:** USD 21.0 billion

viii) **Exports:** USD 4.11 billion (2023-24)

ix) **End users:** Automotive (32%), Industrial Machinery (7%), Pipes & fittings (9%), Agriculture machinery (8%), Railways (6%), Pumps & Compressors (5%), Valves (4%), Electrical Equipment (3%), Power (5%), Sanitary (8%) etc.

x) **Major Foundry Clusters:** Batala, Jalandhar, Ludhiana, Agra, Pune, Kolhapur, Sholapur, Rajkot, Mumbai, Belgaum, Coimbatore, Chennai, Shivamoga, Hyderabad, Howrah, Indore, Ahmedabad, Faridabad etc.

xi) **Opportunities for growth:** Government of India's impetus on Infrastructure development; Defence/ Space Sectors; Modernisation of the Railways; Renewable Energy Sector, Capital Goods, Power, Cement and Textile markets-castings and Expanding export market. Also demand for light weight and high technology cast components would be required for sectors like Electric Vehicles, High Speed Trains, Defence, Nuclear Power Plants etc as they require critical cast components to withstand pressures, heat and safety.

In detail

The Indian foundry industry manufactures metal cast components for applications in Auto, Tractor, Railways, Machine tools, Sanitary, Pipe Fittings, Defence, Aerospace, Earth Moving, Textile, Cement, Electrical, Power machinery, Pumps/ Valves, Wind turbine generators etc. Foundry Industry has a turnover of approx USD 21.0 Billion with export approx. USD 4.11 billion.

The industry is expected to reach USD 31.77 billion by 2029, growing at a CAGR of 10.30% from 2024 to 2029.

However, grey iron castings have the major share i.e. approx 68% of total castings produced.

There are approx. 5000 units out of which 90% can be classified as MSMEs. Approx 1500 units are having International Quality Accreditation. Several large foundries are modern & globally competitive. Many foundries use cupolas using LAM Coke. However, these are gradually shifting to Induction Melting. There is growing awareness about environment & many foundries are switching over to induction furnaces & some units in Agra are changing over to cokeless cupolas.

General Economic Scenario

Government focuses on "MAKE IN INDIA", "EASE OF DOING BUSINESS", infrastructure and easing FDI norms to promote investments in manufacturing and new initiatives and co-operations in skill development.

Forecasts of growth by leading Institutions

India to become fastest growing economy >7.5% YoY as per forecasts of leading International Institutions.

Major Foundry Clusters

The major foundry clusters are located in Batala, Jalandhar, Ludhiana, Agra, Pune, Kolhapur, Sholapur, Rajkot, Mumbai, Ahmedabad, Belgaum, Coimbatore, Chennai, Hyderabad, Howrah, Kolkata, Indore, Chennai, Ahmedabad, Faridabad, Gurgaon etc.

Each cluster is known for its products typically for catering to some specific end-use markets. For example, the Coimbatore cluster is famous for pump-sets castings, the Kolhapur and the Belgaum clusters for automotive castings and the Rajkot cluster for diesel engine castings, Howrah cluster for sanitary castings etc.

Manpower

The foundry sector is highly labour-intensive and currently generates employment for 2.0 million directly and indirectly mainly from socially & economically weaker sections of society. It has potential to generate additional employment of 2.0 million in next 10 years.

Role in Manufacturing Sector

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

Foundries focus on technology

- Automation
- 3D Printing
- Robotics/ IT application
- Foundry simulation software
- Reclamation/ recycling of waste raw material
- Common facility centre
- Value addition and Up-scaling the operations

Sectors driving growth:

a) Auto and auto components
b) Tractors
c) Construction equipment
d) Machine tools
e) Capital goods
f) Defence & Railways –Emerging opportunities

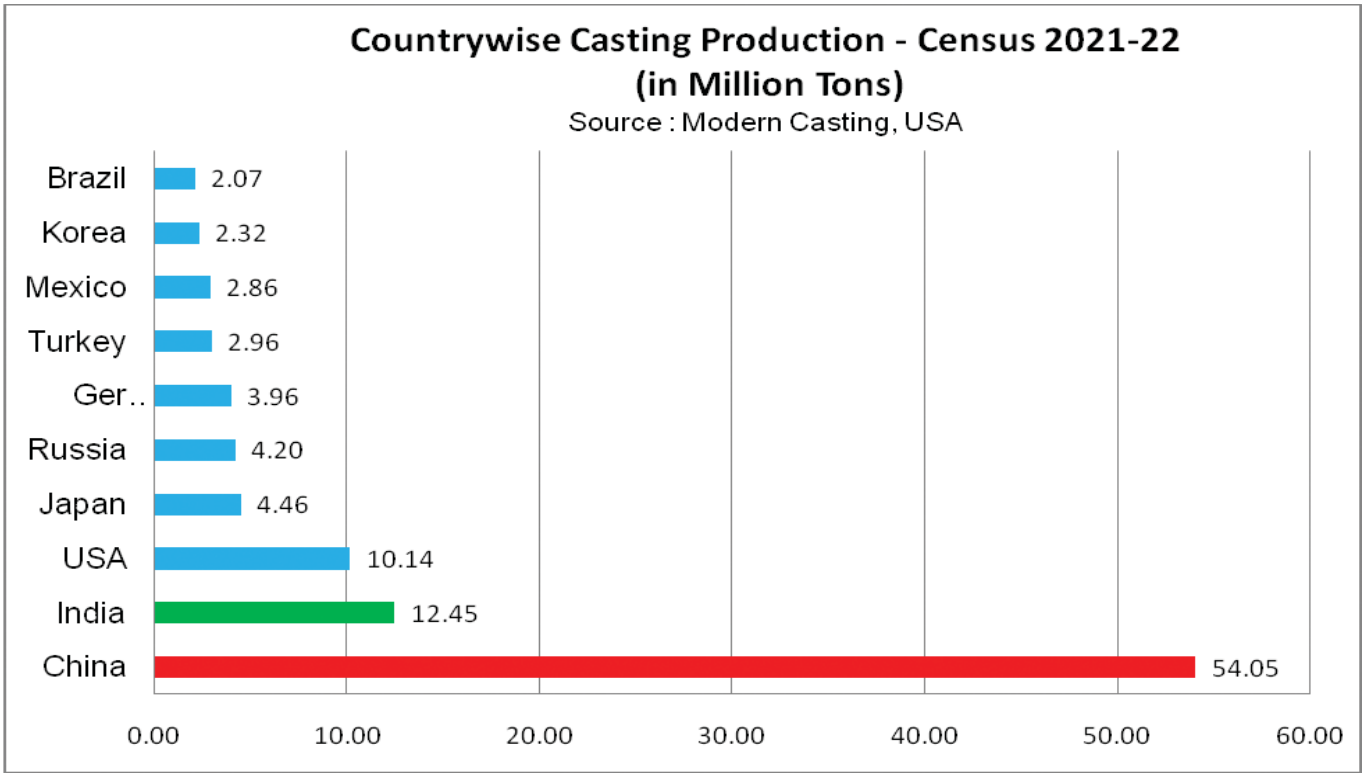
Key challenges

Lack of skilled manpower: Insufficient trained personnel to operate advanced machinery and technology.

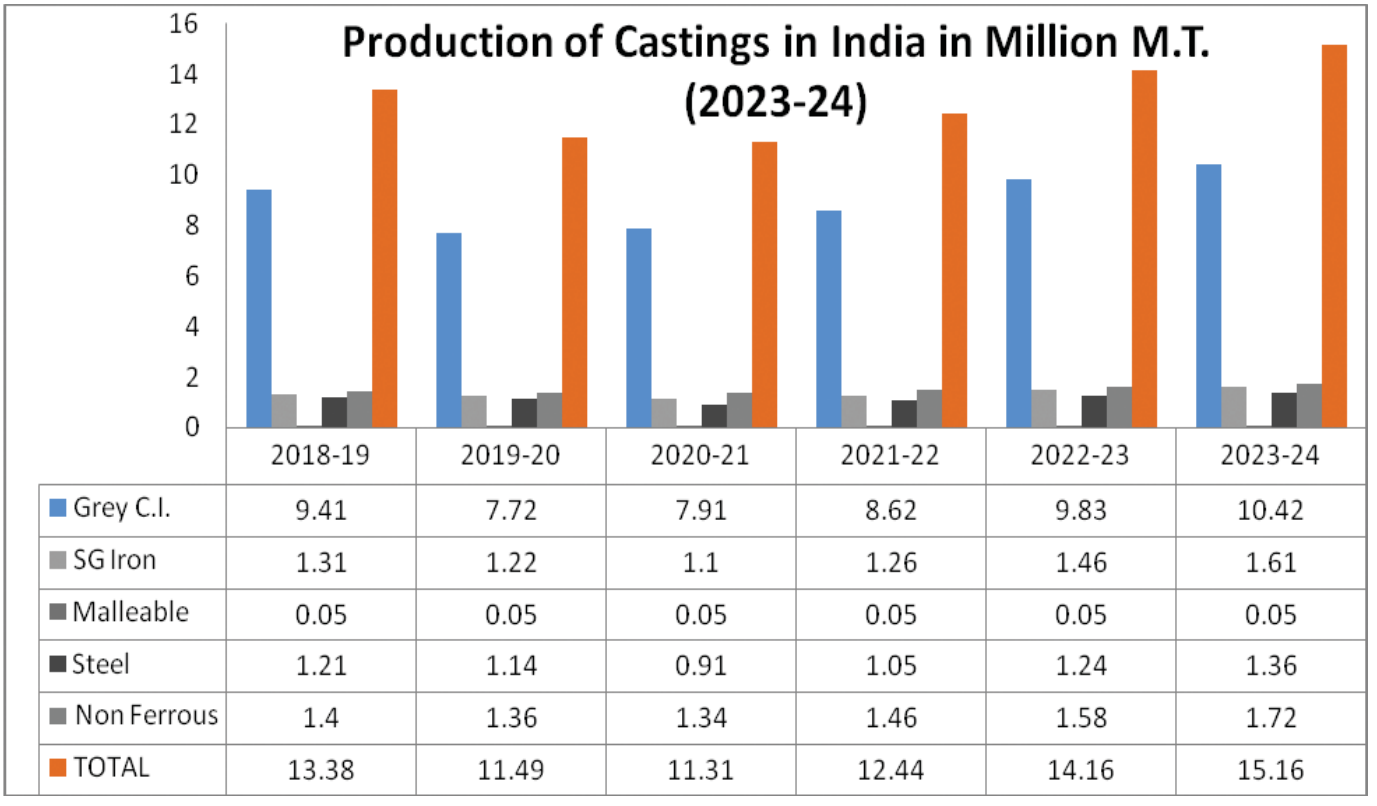
Stringent government regulations: Environmental and labour laws impacting the industry's operations and profitability.

Dependence on imported raw materials: Fluctuations in global raw material prices affecting production costs.

World Casting Census 2021-22



Production of castings in India during last six years (in million tonnes)



	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
Grey C.I.	9.41	7.72	7.91	8.62	9.83	10.42
SG Iron	1.31	1.22	1.1	1.26	1.46	1.61
Malleable	0.05	0.05	0.05	0.05	0.05	0.05
Steel	1.21	1.14	0.91	1.05	1.24	1.36
Non Ferrous	1.4	1.36	1.34	1.46	1.58	1.72
TOTAL	13.38	11.49	11.31	12.44	14.16	15.16

Exports Import

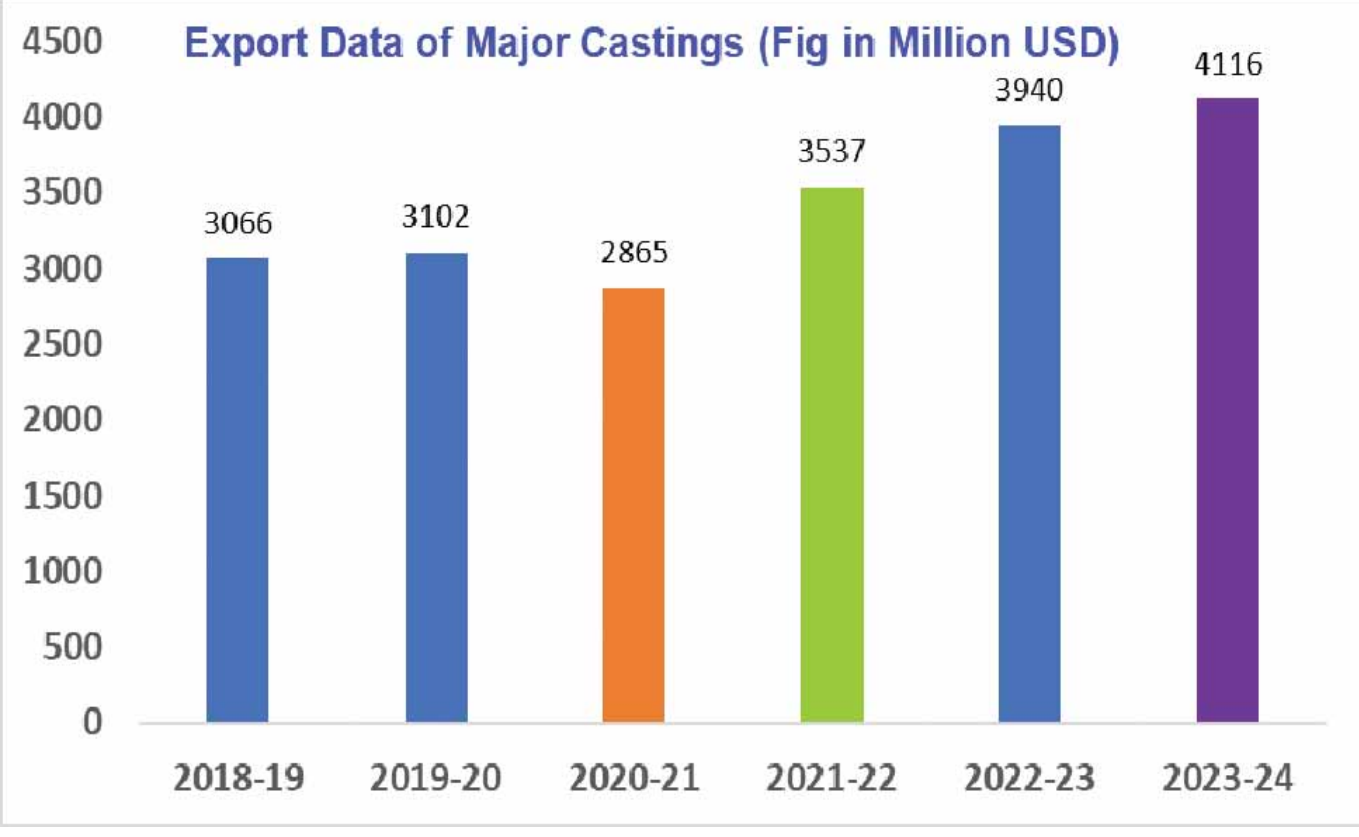
An analysis of the export quantity in the last few years shows how India's merchandise exports have shifted away from traditional commodity baskets like textiles, gems & Jewellery etc., to more on engineering goods.

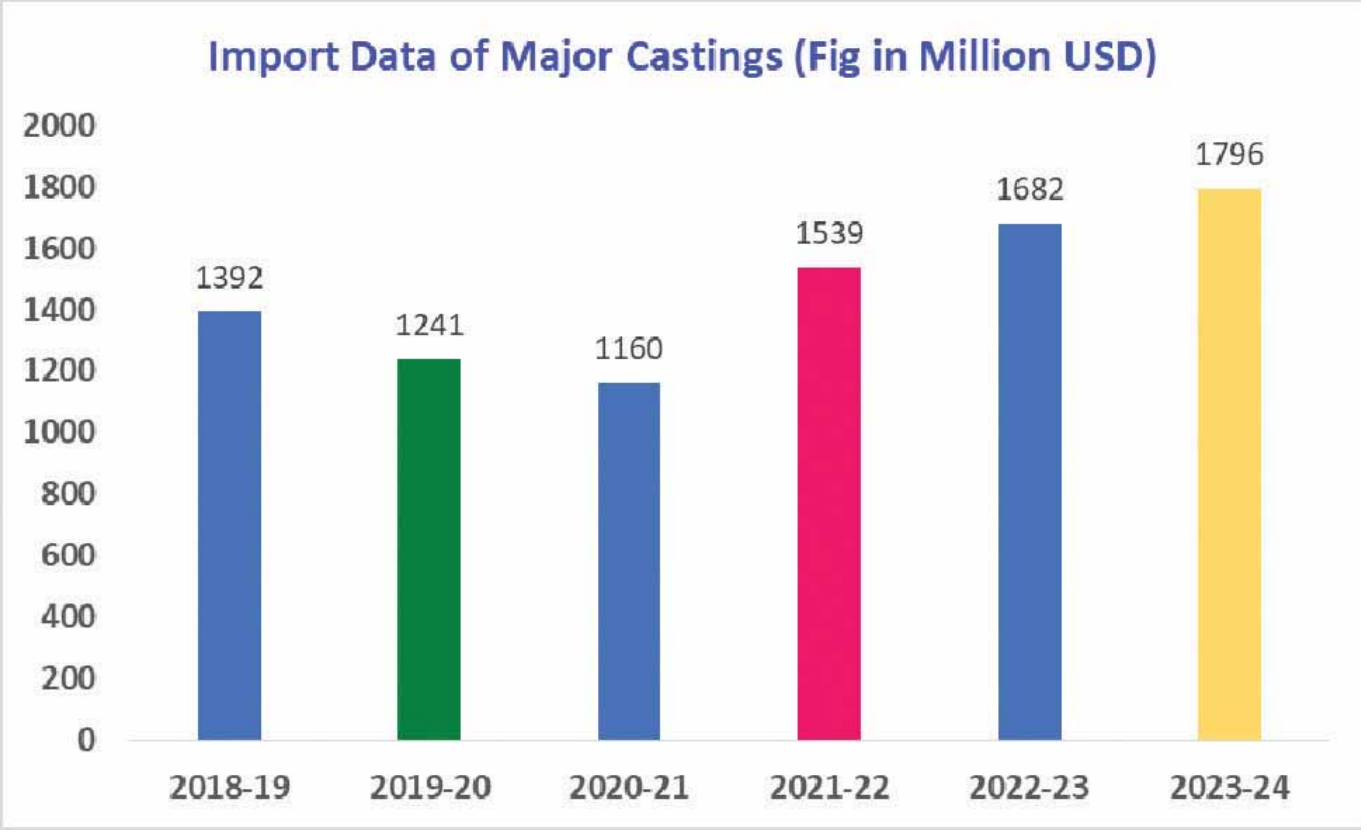
Castings, which are considered to be the key component in the supply chain of numerous niche sectors like Auto, Auto Components, Railways, Defence, Aerospace, Valves, Pumps, Sanitary, Agri Machinery, Construction Equipment etc. continued its growth trend to mark an increase of 4.47% in 2023-24 from the previous year. The export of major castings increased from 3.94 billion USD (2022-23) to 4.11 billion USD in 2023-24, touching the 4 Billion USD export mark for the first time ever. The casting export recorded positive year-on-year growth for the third straight year since 2020-21 growing at a CAGR of 12.84%.

The below expected growth of casting export in 2023-24 was majorly due to recessionary trends seen in the developed countries, especially the EU, which has caused issues for Indian casting exporters to a certain extent. The situation has been further worsened by the various market access barriers that countries in the EU and North America are imposing on Indian exporters. Such disruptions in trade has although hindered potential growth, but there remains optimism that in 2024-25, India will see better growth in the casting sector.

The following HSN codes recorded more than 15% growth in 2023-24 from the previous year 2022-23

73071190	Others non-malleable cast iron
84099114	Piston assembles
84811000	Pressure-reducing valves
84812000	Valves for hydro/pneumatic
84818030	Industrial valves (excl prv & tcv)
84835090	Others
84836090	Others





Similarly Imports also increased approx. by 7% from the year 2022-23. We saw major increase in the imports of items under HSN 73030030, 84812000, 84814000, 84819090, 84833000 etc.

The Indian government has introduced various initiatives to boost exports, including the National Export Insurance Account (NEIA) and the Remission of Duties and Taxes on Exported Products (RoDTEP) scheme. Additionally, the government aims to streamline regulatory and logistical processes for online trade through the National Trade Facilitation Action Plan (NTFAP).

Despite the positive outlook, India's export sector faces challenges such as sluggish global trade growth, geopolitical tensions, and disruptions in supply chains.

Overall, India's export prospects are promising, driven by growth in key sectors and government initiatives. However, the foundry sector must navigate challenges to achieve its full potential.

India remained net exporter of castings with balance of trade valuing 2.31 billion USD.

Major Items exported

- Industrial valves
- Spun pipes
- Grinding balls
- Various housings
- Sanitary castings

Major countries where castings are exported

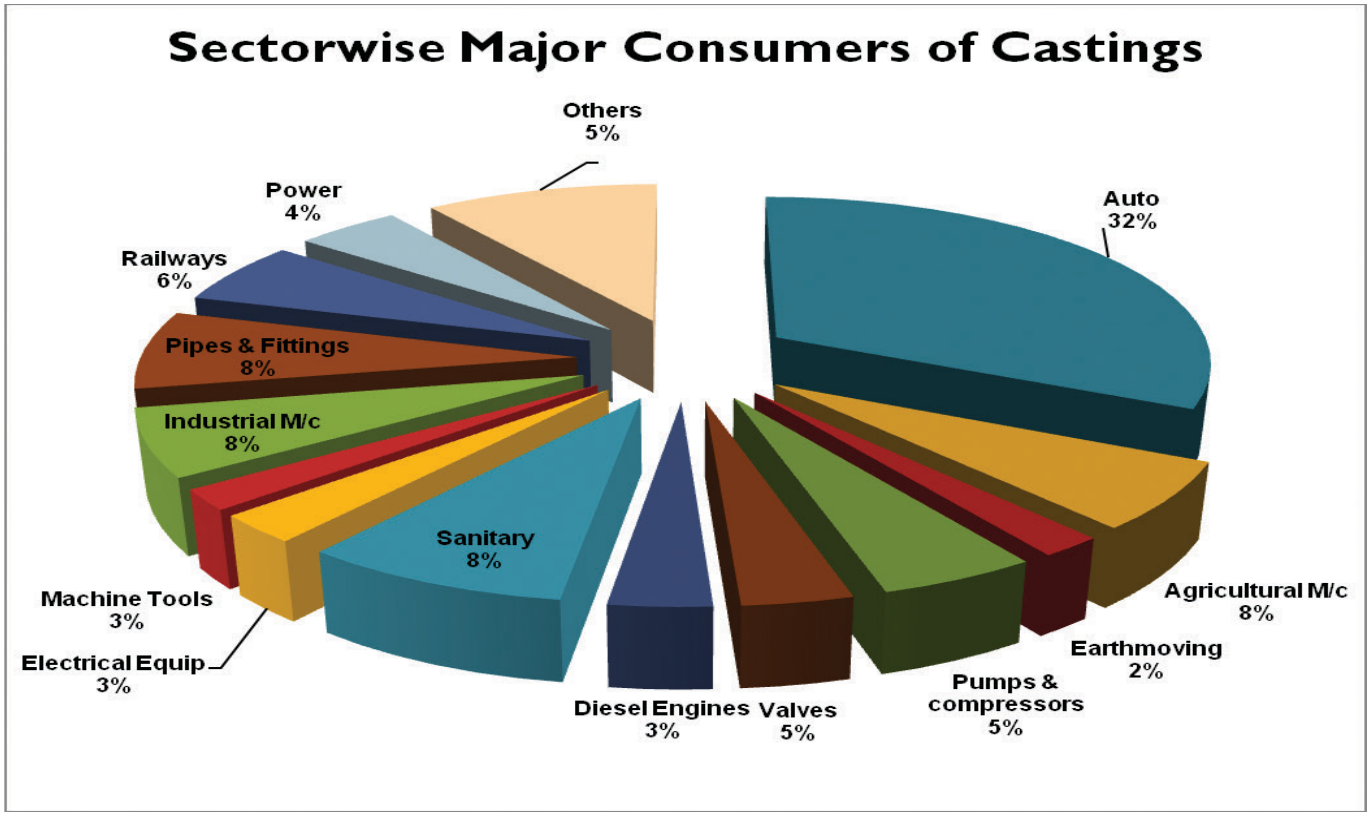
- USA, Germany, China, Korea, Japan, UK, UAE, Kuwait, Oman, Russia, Saudi Arabia, Spain

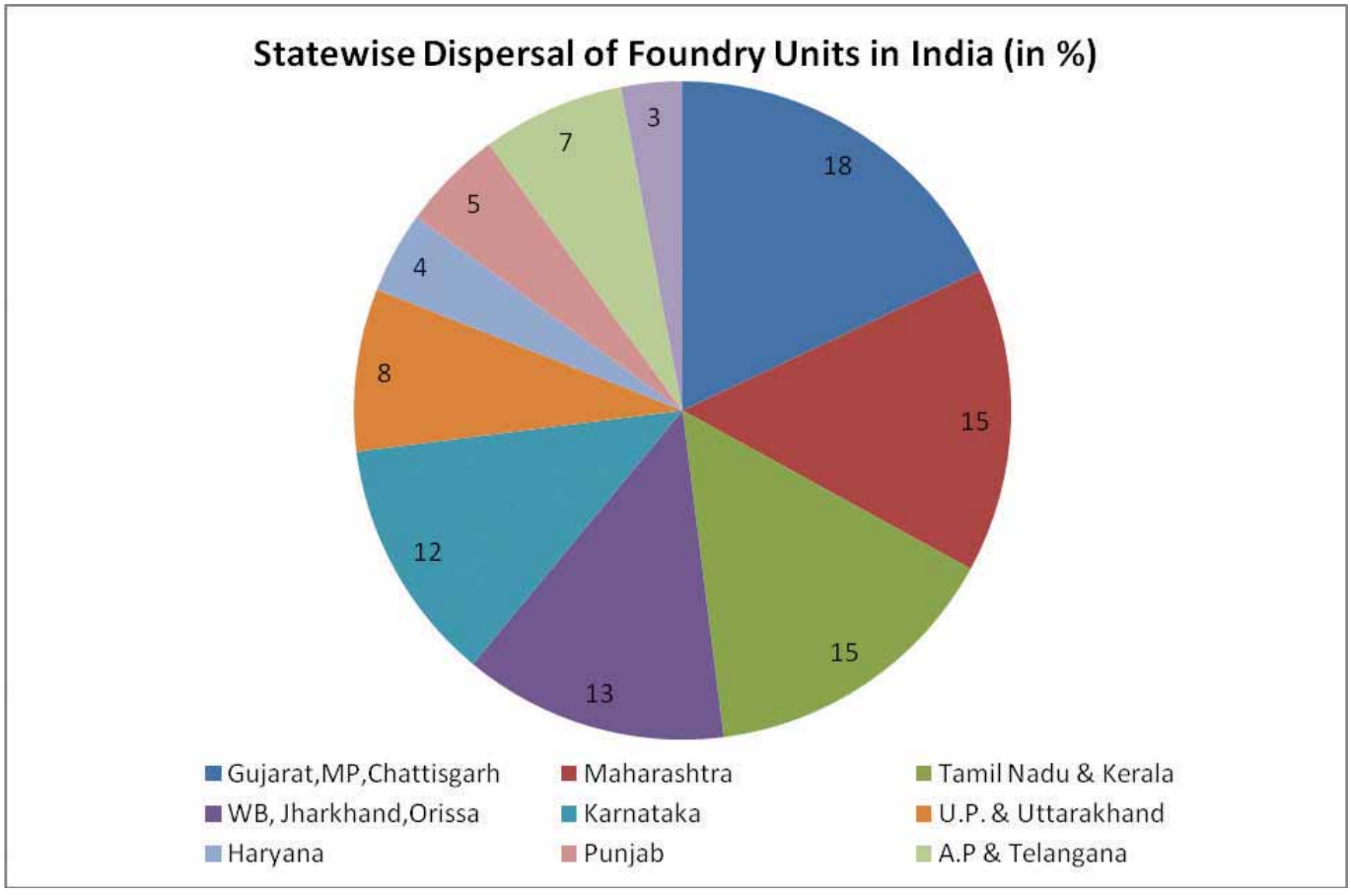
Potential Markets for Indian Castings

- Egypt, Bangladesh, Panama, Sri Lanka, Senegal, Ghana, Cambodia, Bolivia, Guyana

Sector-wise consumption of casting

- Automobile sector remains major consumer of castings, please see the chart below:


Sectorwise Major Consumers of Castings
Others 5%
Power 4%
Railways 6%
Pipes & Fittings 8%
Industrial M/c 8%
Sanitary 8%
Machine Tools 3%
Electrical Equip 3%
Diesel Engines 3%
Valves 5%
Pumps & compressors 5%
Earthmoving 2%
Agricultural M/c 8%
Auto 32%


Statewise Dispersal of Foundry Units in India (in %)
18
15
15
13
12
8
4
5
7
3
Gujarat,MP,Chattisgarh
Maharashtra
Tamil Nadu & Kerala
WB, Jharkhand,Orissa
Karnataka
U.P. & Uttarakhand
Haryana
Punjab
A.P & Telangana

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WORKFORCE SKILLING IN MSMES – A WAY TO STAY AHEAD OF THE CURVE

DR SIVAPRIYA CHELLAPPA
CO-FOUNDER, JNANA VIKAS JAGRATI
(A MSME CONSULTANCY & TRAINING FIRM)

Introduction

MSMEs are the bedrock of the Indian economy and they are driving India's workforce. As per the IBEF (India Brand Equity Foundation) report, in India the number of MSMEs is expected to grow from 6.3 crores to 7.5 crores. MSMEs need to have a clear strategy, to take a giant leap forward in this competitive world. Acquiring the right skills in MSMEs is essential for developing self-sufficiency internally. The secret ingredient is to have a strong workforce that can make significant impact on the growth of MSMEs and in turn on the Indian GDP.

Skill development is an essential aspect for a country's growth, and there is a need for a model with better coordination among Ministry of Skill Development & Entrepreneurship, Industries, (NSDC) National Skill Development Corporation, Institutions, Students, Job Seekers, Consultants & Trainees. Workforce skills are important for an individual to compete in the job market and also to contribute effectively for the organisation.

The onset of AI, IoT & many technological advances and machineries have enhanced operational efficiency, productivity, and sales in many sectors. Therefore, it is necessary that the operating workforce in MSMEs are also simultaneously trained. Today, we are in need of a workforce with specific skill sets that can cope with the emerging technologies and can also deliver quality products to satisfy the evolving customers. Organisations should not limit their training to just technical or job specific tasks, they should also train their workforce in soft & hard skills.

Recent Reports on skill gaps

1. As per TeamLease report, India has 500 million people in the working age and one out of every two are not employable.
2. As per NSDC report, in 2022 the demand for skilled labour is around 103 million and the supply is short by 29 million workers. Many sectors such as healthcare, green jobs, agricultural sector, semiconductor manufacturing are affected by this workers shortage.
3. As per World Economic Forum, 85 million jobs could get displaced due to the machine & human division of labour. But 97 million new roles can be expected due to technological advancements such as AI, IoT, robotics and machine learning.
4. As per National Employability Report for Engineering, 80% of Indian engineers don't have the necessary skills.
5. As per NASSCOM report, the demand-supply gap will increase by 3.5 time by 2026.
6. As per report by Amazon Webservices and Gallup,

there is enormous challenge in many large business houses in India such as Tata, Reliance, Mahindra & Mahindra with respect to finding ways to address the talent gap. As India is preparing for self-reliance in energy transition, manufacturing, new tech such as EV, green hydrogen etc we need more talents to take this forward. Advanced skill sets are the need of the hour and this could increase India's GDP by $508 billion.

7. As per World Economic Forum, 3.5 million jobs are available in information security across various sectors.

8. As per ILO -OECD report, workforce skills are essential to drive MSMEs productivity. Out of box thinking and new age skill sets can boost the growth further.

Therefore, addressing skill deficit is essential for any organisation (both MSME & Large Enterprises) and if not taken care it could lead to business loss and also disrupt future business strategies. Low skill sets could affect productivity, revenue, sales, delivery schedule and all this can result in losing to your competitor. But lots of scope & opportunities are there to address this issue. Lots of initiatives have been taken by the Indian Government on skill development. The link: https://msde.gov.in/en/schemes-initiatives may be referred to for further details.

Reasons for skill gap

- Curriculum of schools and colleges are more theoretical and doesn't focus on employable skills. More collaboration effort required between training institutions and industries with follow up meetings.
- Perception on the vocational training is inferior as compared to traditional training.
- Accessibility, Awareness and Mobility issues in skill development programs.
- Funding & infrastructure issues in skill development facilities
- Lack of new age skills and its related awareness in MSMEs
- Low Enrolment in ITI's and polytechnics by students compared to formal degree courses
- Less project trainees are entertained in MSMEs

The way forward

- Increase Expenditure on Training and Education
- Re-evaluation of course structure in training institutions to suit current and future industry needs. This needs collaboration and knowledge transfer between Industry and Institutes.
- Skill survey should be taken while designing the course structure. Emerging technologies such as on AI, data science should be introduced gradually to students to meet future demands.
- Special training programmes should be framed for marginalised groups and weaker communities so that they are inclusive in the skill gap bridging task.
- More teaching models from other countries like China, Japan, Germany should be researched in to frame a comprehensive model to strengthen our education system.
- More certification courses should be introduced to facilitate skill information transfer easily between skilled person and potential employer.
- Training the trainer is also important to address future demands.
- Organisations should look beyond training in Technical Knowledge for their workforce. Workforce skill requirements such as Digital literacy, Negotiation, Strategic thinking, Interpersonal skills, Communication skills, Networking, Analytical skills, Resilience, Decision making skills, Attention to details should also be included in the training agenda to build a strong workforce.

Foundry Industry

The Foundry Industry has evolved over the years. It is

slowly witnessing many automation processes and robotic systems to improve efficiency, quality and workplace safety. Some of them are:

- Energy-efficient practices, wherein modern foundries use advanced furnaces and melting techniques that address energy optimisation.
- Conservation of resources such as advanced process modelling, waste reduction, recycling of metal scraps.
- Emission control to reduce environmental impact, Process optimisation through CAD & CAM and also advancement in digital monitoring.
- Product improvisation and innovation such as addressing the demand for lighter and durable materials in Automotive industry & enhancing fuel efficiency of Vehicles.

Shortage of skilled labours in foundry industry is also a major issue but there are strategies which can attract and retain skills. Some of them are:

- Searching talent beyond the traditional sources where unemployment rate is more can be approached. This can address labour shortage as well as will give employment opportunities to many.
- Improving onboarding methods, standardising training, implementing training within industry.
- Allowing more college project trainees to get introduced to Foundry sector, inculcating interests in future generations.
- Choosing the right candidate with passion and dedication for training is necessary.
- Enhancing both technical and soft skills of the workforce.
- Training on new age skills like data analysis and developing new products.
- Up skilling can be done based on the workers performance, to advance his career and Cross Skilling can be introduced to workers who are doing repetitive tasks and are subject to boredom. This can help in retention and will also equip them with multiple tasks in case of any vacancy.
- Training the semi-skilled Supervisors.
- Improving the salary standards of the workforce to keep them motivated as the industry is highly labour-intensive.
- Looking at the option of more women recruitments in this sector.

The Foundry industry still has many opportunities like technological advancements, demand for lightweight materials and advancements in Global Infrastructure in the midst of threats such as Global competition, environmental regulations and economic fluctuations. The opportunities in the sector are definite to bring more demand for castings and newer products. It's up to the Foundry sector enterprises (both Large & MSMEs) to be in the race by building a strong workforce.

Conclusion

MSMEs are more agile and are quick at adaptation but it's time that they also train their workforce on advanced & specific skill sets. Learning skills such as data analysis for decision making & new product development with R & D (research & development) is needed in MSMEs to position themselves as leaders. They should also work on people skills that can promote a good team culture. Ultimately, in the age of AI, MSMEs should frame SMART Goals & Business Strategies and should try achieving them with SMART Workforce & Technology.

IT IS ALL ABOUT PASSION+

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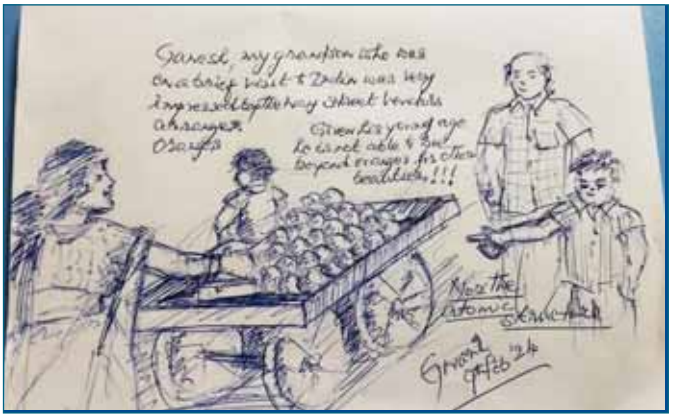
Ganesh, my grandson who was on a brief visit to India, was very impressed by the way street vendors arrange fruits, say oranges, in their push carts. I showed him at home, we can arrange fairly identical fruits, not the expensive tomatoes, as it was July at that time. After filing a row, the next one will be offset in the gaps. And the same way higher up too. He showed mild interest. I was waiting for that message to settle down before going big time.

I said that's how atoms are packed in some solids to make it compact. I arranged the coins in a carrom board and said 'see how nicely they are closely packed leaving. You may say white is gold and others are silver, in any proportion. Since they are about the same size, gold and silver can be mixed in any proportion and very difficult to separate once mixed. Now that I got his attention, I asked him to disturb the arrangements gently. No, he couldn't, not like the ones free on the table. I said that's what gives them strength together. Put a few small peas in the gaps, the assembly becomes even more rigid and resists breakup. Call them impurities if you like. That's how the very small carbon atoms fill the gaps and make steel stronger.

'OK thatha, that's solids, what happens in liquids?' 'Imagine Ganesh, we are all sitting in a room, hundreds of us. We'll be chatting with immediate neighbours stretching ourselves a little bit, but not moving. Now if the AC is switched off and the room gets hotter, we'll all move about freely within the room, not any more attached to our erstwhile neighbours. This is what happens when you heat a solid metal. It becomes liquid; atoms are free to move within the space. If you heat



further, the atoms will be free to move away from the old confined space. Call it gas now, like we'll wander out of the room if it's very hot. That's how heat changes solid to liquid and then to gas'.

Is it too much for the eight year old?

The idea is to kindle deep interest. From arrangements of oranges, which he only asked for, to go all the way to atomic structure due to the great John Dalton. While at an interview board in IIM, I asked a brilliant girl, a first rank post graduate and my erstwhile student, what's her subject of interest? Very shyly she answered she was good in all subjects. With a smile I said, it's not about who all like you, but whom do you love most?

Love is a bit far away for Ganesh.

But the message, well sowed in his young mind is to find for himself what he is passionate about, not just being good at, which are several given the mental ability of children. That's what matters for world class ground breaking work, whether science, art or sports.

It's about passion alright.

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CAST QUIZ

Q 1) In cold chamber die casting, what is the maximum pressure that can be applied?

a) 500 kg/cm^2 b) 1000 kg/cm^2
c) 1500 kg/cm^2 d) 2000 kg/cm^2

Q 2) In hot chamber die-casting, before the end of the Stroke, what uncovers the port?

a) Injector b) Plunger
c) Burning Flame d) Die Cavity

Q 3) Which of the following is not counted among the limitations of pressure die casting?

a) Only small parts can be produced
b) High cost
c) Low scale production
d) Castings are porous

Q 4) Up to what thickness can the sections be cast?

a) 0.3 mm b) 0.4 mm
c) 0.5 mm d) 0.6 mm

Q 5) What is the minimum temperature required in a compression moulding process?

a) 120°C b) 125°C
c) 130° C d) 135°C

Q 6) What is the maximum pressure required in a compression moulding process?

a) 35 MPa b) 40 MPa
c) 45 MPa d) 50 MPa

Q 7) Which of the following is not a furnace used for heating?

a) Cupola furnace b) Crucible furnace
c) Electric arc furnace d) Blow air furnace

Q 8) The heat needed for a change of state of a material without changing the temperature is called what?

a) Sensible heat b) Latent heat
c) Calorific heat d) Specific heat

Q 9) What is the unit of specific heat of solid metal?

a) J/kg b) J°C/kg
c) J/kg°C d) °C/kg

Q 10) In any flow through a system, if the area of cross section in which the metal is flowing, decreases, how will it affect the velocity?

a) Increases b) Decreases
c) No effect d) Quantities not related

Q 11) According to Bernoulli's theorem, energies at two points in a flowing liquid are equal.

a) True b) False

Q 12) What is the maximum capacity of a rocking furnace?

a) 0.5 tonne b) 1 tonne
c) 2 tonnes d) 3 tonnes

Q 13) Which of the following is not valid for rocking furnace operation?

a) Causes overheating
b) Uniform composition
c) Damage to the refractory lining
d) Fast melting

Q 14) Which material is used for making the roof of an acid-lined furnace?

a) Silica b) Dolomite
c) Magnesite d) Carbon Tetrachloride

Q 15) Which of the following terms is used for the presence of excess metal in the parting plane?

a) Toggle b) Platen
c) Flash d) Biscuit

Q 16) Which of the following products is the most suitable to cast by low-pressure die-casting method?

a) Crank cases b) Blades of turbine
c) Surgical instruments d) Connecting rods

Q 17) Which of the following methods of casting is best suited for casting of hollow pipes and tubes?

a) Investment casting
b) Permanent mould casting
c) Die casting
d) Centrifugal casting

Q 18) The axis of rotation of the mould should be horizontal for the casting of long pipes in centrifugal casting.

a) True b) False

Q 19) Which of the following parts is provided in between the mould and casing to reduce the vibrations?

a) Steel balls b) Metallic roller
c) Viscous fluid d) Grease

Q 20) In centrifugal casting, only sand moulds can be used due to the problem of sticking of metal.

a) True b) False

Q 21) In centrifugal casting, a movable pouring basin is employed for the pouring of molten metal.

a) True b) False

Q 22) The speed of rotation is almost double in semi-centrifugal casting as compared to the true centrifugal casting.

a) True b) False

Q 23) Which type of sand is used in shell moulding?

a) Black sand b) Wet and fine sand
c) Dry and fine sand d) Any of the sand

Q 24) Which of the following liquids is used for the formation of slurry in investment casting?

a) Ammonium hydroxide
b) Carbon disulphide
c) Sodium Silicate
d) Glycerin

Q25) Which of the following is not a heat-treatment process?

a) Tempering b) Nitriding
c) Honing d) Quenching

Q26) Which one of the following is the process to refine the grains of metal after it has been distorted by hammering or cold working?

a) Annealing b) Softening
c) Re-crystallization d) Normalising

Q27) The ability of tool steel to retain its hardness at high temperature commonly developed during cutting of materials is called

a) Red Hardness b) Hardenability
c) Strain Hardening d) Case Hardening

Q28) Which of the following is not the objective of Annealing?

a) Remove internal stresses
b) Refine grain size
c) Refine structure
d) Improve machinability

Q29) The allowance provided to a pattern for easy withdrawal from a sand mould is

a) Finishing allowance b) Shake allowance
c) Shrinkage allowance d) Distortion allowance

Q30) It is desired to make small number of intricate and highly accurate parts. Which of the following casting methods would be the most appropriate?

a) Slush casting b) Investment casting
c) Die-casting d) Pressed casting

Q31) When the pattern is made in three parts, the intermediate part is known as

a) Drag b) Cope
c) Check d) Slide

Q32) Which of the following is not a casting defect?

a) Scar b) Scab
c) Hot Cracks d) None of the above

(For answers, please see page 98)

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BS EN 1433:2002
Drainage channels for vehicular and pedestrian areas. Classification, design and testing requirements, marking and evaluation of conformity.

BS EN 681-1:1996
Elastomeric seals. Material requirements for pipe joint seals used in water and drainage applications. Vulcanized rubber.

BS EN 545:2010
Ductile iron pipes, fittings, accessories and their joints for water pipelines. Requirements and test methods.

BS EN 598:2007+A1:2009
Ductile iron pipes, fittings, accessories and their joints for sewerage applications. Requirements and test methods.

BS ISO 2531:2009
Ductile iron pipes, fittings, accessories and their joints for water applications.

ISO 7186:2011
Ductile iron products for sewerage applications.

BS EN 1090-1:2009+A1:2011
Execution of steel structures and aluminium structures. Requirements for conformity assessment of structural components.

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MANAGEMENT ASPECTS AND VARIOUS MODES OF IMPLEMENTING ANY NEW PROJECT

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Introduction

India is looked as a hub for export market because of strong market demand for next few years in North America, Europe and Brazil. Therefore, many new Foundry Projects are expected in near future and that is why it is necessary to know the proper ways to implement a New Project which is discussed in this article with explanations and tables. Project Management is a professional function which encompasses a comprehensive spectrum of talents and skills, knowledge of management practices and leadership strategies to complete objectives on time, within cost, and to the satisfaction of all concerned. Project management can be applied to almost any project or industry. Example of projects include; Developing or designing a new product or service; Effective change in structure; staffing or style of an organisation; Developing or acquiring a new or modified information system; Designing / Constructing a facility or plant; Implementing a new business procedure or process; conducting feasibility; marketing procurement and technical studies.

The Project Management discipline may be classified in the following broad categories

Project Integration Management, Project Time Management, Project Scope Management, Project Risk Management, Project Quality Management, Project Human Resources Management, Project Cost Management, Project Communications Management, Project Procurement Management. The projects can be for different type of industries such as engineering and construction, infrastructure, IT & MIS, software development, telecommunications, maintenance & operations, manufacturing, power, petrochemical, oil and gas, product development, quality implementation, military, information technology, government, educational, religious, finance, marketing, water development, chemical, mining and mineral, etc.

Why Project Management is needed?

Competence : Managing project is becoming increasingly complex. Projects are now more integrated, employ multi-disciplined team, share resources and cross-organisational boundaries. In this environment, success requires more than an understanding of scheduling. It depends on a broad range of technical and interpersonal skills.

Professionalism: Commitment to the job, integration of thinking and awareness of both technical and interpersonal dimensions of managing the project. The awareness helps in formation of teamwork.

Corporate Support: Backup support from the multi-disciplined environment of the principles. International Recognition.

Management pressure : What are the common problems for the pressured managers of today?

In decision – Inefficiency – Unanticipated interruptions that do not pay off – Procrastination – Unrealistic time estimates – Unnecessary errors – Crisis management – poor organization – ineffective meetings – micro management – Doing urgent rather than important tasks – Poor planning and lack of contingency plans – failure to delegate or delegation of responsibility without authority – lack of priorities, standards, policies and procedures

What to do? Work smarter rather than harder by making use of pareto principle. Check your focus and work effectively and efficiently. Plan your daily, weekly and monthly schedule. Prioritize your workload. Manage the decision making process not the decisions. Concentrate on doing only one task at a time. Establish daily, short-term, mid-term and long-term priorities. Handling of correspondence expeditiously. Establish personal deadlines and ones for the organisations. Ensure all meetings have a purpose and time limit. Maintain accurate calendars. Know when to stop a task, policy or procedure. Use check lists and to do lists. Adjust priorities as a result of new tasks. Communicate effectively because otherwise time will be lost. Working effectively with the secretary. Working towards paperless office. Do not allow indecision and delay to steal time (avoid crisis management). Get the best out of your staff by delegating your work and checking your work process. Develop and empower the staff. Schedule effective meetings by -Using chair person -Agenda and minutes-Getting the right mix of attendees. Working to a specific time. Analysing your own time log – How does ther current time usage measure. Involvement in too many areas – How to become more discerning in your time use. Inability to finish tasks – changing your approach to tasks. Scheduling the proactive and reactive time. Looking at over all objectives – scheduling of time for long-term goals. Choosing the own personal development plan.

There are three parties involved in implimentation of a steel project : 1) Client 2) Contractor 3) Consultant

A consultant /advisor is required to mediate between the client and the contractor to get the right things at right time for the project at right price.

What are the main services rendered by consultant/advisor?

1. Project consultancy.
2. Project management.

Project consultancy

- Feasibility Studies for deciding the go ahead of the Project.
- Making the Conceptual Design and the Layout.
- Technology , Plant Reviews and Raw Material Planning.
- Power, Energy, Utilities and Infrastructures.
- Environment Studies.
- Organisation and Man Power Planning.
- Evaluation of Capital Cost and Manufacturing Expenses.
- Complete Financial Analyses with Profit-Loss Account, Pay Back Period, Break-Even Analysis ,etc.
- Development of Management Information System.
- Checking of Basic Engineering.
- Checking of Detailed Engineering.
- Checking of Total Construction Schedule of the Project.

Project management

- Plant Design and Coordination of Design, Manufacturing and Supply.
- Assistance in Enquiry and Whole Time Bid Evaluation.
- Contract Strategy and Documentation.
- Contract Guarantees, Negotiations and Regulations.
- Contract Management.
- Project Program,Detailed Planning and Monitoring.
- Assistance in Site Management, Supervision of Construction and Surveillance.
- Commissioning Plans and Witness of Commissioning.
- Witness of Performance Tests.
- Assistance in Manpower Procurement and Training.

First stage for a project is preparation of Project Report.

This is for finalising the project concept, sizing of major equipment / facilities, layout preparation, time schedule for construction, estimation of man power and utilities requirements, capital cost and financial analysis. Such project reports are normally prepared by independent consultants, because it enables optimization of technology selection. Some clients having experience in similar projects, prepare project report on their own with the help of information from some supplier, where choice of process may be restricted to one supplier only. Feasibility Report is required for arranging finance for the project. Major Activities in a Project are as given below:

- Preparation of feasibility report
- Detailed project report
- Decision on project finalisation
- Specification for bid evaluation
- Invitation of bids for the following packages
  - Equipment Supply.
  - Civil Works and Steel Structural works.
  - Energy Distribution and Utilities Supplies.
  - Erection of Equipment
  - Training of Personnel
  - Bid evaluation of above packages

Main steps involved in execution of bids from evaluation up to the commissioning of the project and final hand over to the client are as follows:

- Bid Receipt and Evaluation.
- Order Placement and Finalize Equipment&Load Data.
- Finalisation of Layout Drawing of the Complete Plant.
- Preparation of GA Drawings, Assembly and Manufacturing Drawings of Equipment, Design and Fabrication Drawings of Steel Structures,Construction Drawings of Buildings and Equipment Foundations; Schematic, Arrangement and Construction Drawings for Energy Distribution and Utilities.
- Approval of Drawings where ever Required.
- Manufacturing and Inspection of Equipment, Fabrication of Steel Structures, Construction of Building Foundations and Equipment Foundations.
- Erection of Buildings , Equipment, Energy Distribution System and Utilities and Performance of Cold Tests.
- Commissioning and Demonstration of Performance Guarantees.

What are the modes of implementation ?

- Total turn - key
- Package turn - key
- Non turn - key

Total Turn-Key Project

The order for the whole plant is placed on one contractor. Only one contractor is responsible for everything of the project i.e., engineering, procurement and construction to build the complete plant and commission it to show the performance of the plant as per contracted guarantee within the contracted time schedule. Therefore, timely execution and performance of the plant is guaranteed. But there are two disadvantages. First by all the equipment and process may not be of the latest state of art technology. Secondly, plant cost may be little bit higher because the over heads of the contractors being included in the price and less flexibility in selection of sub contractors operating know-how is provided by turn-key contractor. This mode is generally preferred due to ease of implementation.

Semi (Package) Turn-Key Project

In this mode the whole plant is divided into several packages. Order is placed on turn-key basis for each package. The responsibilities of client, consultant and contractor remains same as turnkey mode. However, the consultant's work includes coordinating the interface amongst the packages and standardization of equipment. Operating know-how for the total plant is to be obtained from some know-how supplier although know how for each package is supplied by respective contractors. In this case, both the client and the consultant will bear more responsibilities and will have to work more. The advantage is that one can select the technology for all the packages.

Non-Turn Key Mode

In this mode the project is executed by different contractors / suppliers as separate agencies could be involved for supply, civil work, fabrication, erection of steel structures, etc. The client and the consultant become responsible for detail engineering, inspection, supervision of construction, erection and commissioning, progress monitoring, etc. Operating know-how may have to be obtained from some party with specialized knowledge. The main advantage of this mode is total flexibility to select contractors for each activity but actual implementation is very difficult particularly within the stipulated time schedule and the risk involved is very high. This is only possible where there is a very strong infrastructure available at the site location, and the client has very good experience in executing such projects in near past.

Comparison of the Activities of the above three modes are given in Table-1.

TABLE -1 COMPARISON OF ACTIVITIES FOR DIFFERENT MODES OF IMPLEMENTATION

SL. NO.	ACTIVITY	TOTAL TURNKEY	PACKAGE TURNKEY	NON-TURNKEY
1	Appointment of Independent Consultants	Not Necessary	Not Necessary or some times partly necessary	Necessary
2	Preparation of Project Report	Normally By Client	By Client with some help from Specialists	By Consultant
3	Project Coordination	By the Contractor for all facilities within the individual units as well as for interface between the various units of the plant. Also coordination with infrastructure facilities as required.	By the Contractor for all facilities within the individual package. Coordination for the interface between the individual package will be by the Client. Coordination with infrastructure facilities by Client / Consultant.	By Client / Consultant. Coordination with infrastructure facilities by Client / Consultant.
4	Preparation of specifications and other documents for bid invitation.	By Client's Project Team as one package for the whole plant.	By Client's Project Team in a few number of packages. One package being for each shop / facility.	By Consultant for different equipment. systems and items of Construction / fabrication / erection work.
5	Bid evaluation and recommendation	By Client	By Client's Project Team/Consultant	By Consultant
6	Order Placement	By Client	By Client	By Client
7	Detail Engineering.			
	-Development of plant general layout	By Contractor / Client	By Client/Consultant	By Consultant
	-Preparation of finalised layout of individual shop	By Contractor (May be Reviewed by Client)	By Contractors(To be Reviewed by Client/Consultant)	By Consultant
	-Preparation of design drawings for civil construction and structural steelwork	By Contractor (May be Reviewed by Client)	By Contractors(To be Reviewed by Client/Consultant)	By Consultant
	-Preparation of civil construction drawings.	By Contractor (May be Reviewed by Client)	By Contractors(To be Reviewed by Client/Consultant)	By Consultant
	-Preparation of structural steel fabrication drawings.	By Contractor (May be Reviewed by Client)	By Contractors(To be Reviewed by Client/ Consultant)	By Contractors(To be Reviewed by Consultant)
	-Preparation of equipment arrangement and assembly drawings.	By Contractor (May be Reviewed by Client)	By Contractors(To be Reviewed by Client/Consultant)	By Contractors(To be Reviewed by Consultant)
	-Preparation of installation drawings for service facilities.	By Contractor	By Contractors.	By Contractors(To be Reviewed by Consultant)
8	Execution of civil construction work.	By Contractor for the whole plant.	By Contractor for the complete package.	By Contractors(To be Reviewed by Consultant)
9	Fabrication and erection of structural steelwork.	By Contractor for the whole plant.	By Contractor for the complete package.	By Contractors(To be Reviewed by Consultant)
10	Procurement and delivery of structural steel and other materials.	By Contractor for whole plant.	By Contractor for the respective package.	By Client from different suppliers
11	Equipment manufacture and supply.	By Contractor for whole plant.	By Contractor for the respective package.	By manufacturer/supplier of different equipment.
12	Inspection of equipment and structurals.	By Contractor / Client(if needed).	By Contractor / Client(if needed)	By Consultant.
13	Erection of equipment and auxiliary systems.	By Contractor for the whole plant.	By Contractor for the complete package.	By Erection Contractor.
14	Start-up and commissioning.	By Contractor for the whole plant.	By Contractor for the complete package.	By Client under supervision of Contractors / Suppliers specialists and with assistance of Consultant.
15	Demonstration of performance guarantee.	By Contractor for integrated performance of the whole plant.	By Contractor for integrated performance for the individual package.	Facilities will be operated by Client under supervision of the specialists from Contractors / Suppliers with participation of the Consultant.
16	Training Needs'-Imparting training.	Generally by Contractor for operation and maintenance of all facilities within the plant.	Generally by Contractor for all facilities within the individual package. For personnel in cenralised departments and administrative section, separate agency is selected or client does it.	Separate agency is selected for operation of the individual shops as well as of the whole plant.
	-Monitoring of Training.	By Client.	By Client /Consultant(if	by Consultant.

Comparison of the main aspects are given below in Table-2.

Table -2 COMPARISON OF VARIOUS ASPECTS FOR DIFFERENT MODES .

SL. NO.	ASPECTS	TOTAL TURNKEY	PACKAGE TURNKEY	NON TURNKEY.
1	Coordination by the Client.	Limited need of coordination for engineering as well as construction and commissioning.	Easy coordination of engineering as well as construction activities within the package. However, coordination to be done for interface between the package.	Elaborate coordination of all engineering, construction and commissioning activities.
2	Standadisation.	High degree of standardisation for plant equipmet.	Degree of standardisation limited to the package.	Lower degree of standardisation.
3	Responsibility.	Single point responsibility of the contractor.	Conractor's responsibility is limited within the package. Multipoint respnsibility.	Each Contractor is Responsible for his job only. Therefore difficult to Assess & Control.
4	Monitoring the implementation process.	Easy.	Relatively elaborate.	Elaborate.
5	Integrated performance.	Assured.	Assurance limited to the packages.	Not assured.
6	Client's organisation.	Small	Small but dependent on number of packages.	Large organization for client / consultant.
7	Process know-how.	Forms a part of contractor's scope of work.	Assured for indiidual packages.	Appointment of a separate agency required.
8	flexibility in selection of plant and equipment.	Flexibility is less.	Limited	High
9	Competition during bidding.	Very Limited.	Limited.	Not Limited.
11	Flexibility of design modification during engineering.	Very Limited.	Limited.	High.
12	Training.	Arranged by contractor.	Arranged by contractors of individual packages.	Appointment of an independent agency required.

Conclusion

Main factors on which the Modes of Project Implementation depend are:

- Availability of financial resources for the project and sources of funding.
- Availability of equipment manufacturing capacity, construction facilities and contractors within the country.
- Time schedule of the project.
- Assurance of timely implementation of the project, quality of work and its performance to achieve the objective.

The total turnkey mode is particularly suitable under conditions of limited availability of resources and infrastructure, which is prevalent in most of the developing countries.

Package turn-key is advantageous from view point of technology selection and it is an optimized solution for Developing Countries.

Non-turn-key mode may be considered when the client has already got very good experience of implementing same type of project and very strong infrastructure is available at site in terms of contractors, construction equipment and man power.

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SPECIFICATIONS USED FOR MANUFACTURING PROCESS OF IRON & STEEL GRADED CASTINGS

R SIVAKUMAR

List of Pattern Standards			
Sl. No	**STD No.**	**Standard Description**	**Year**
1	EN 12890	Patterns, pattern equipment & core boxes for the production of sand moulds and sand cores	2000
2	EN 12892	Equipment for the production of lost patterns for the lost foam casting process	2000
3	EN ISO 5458	Geometrical product specifications (GPS) - Geometrical tolerancing - Pattern and combined geometrical specification	2018
4	ISO 3098	Technical product documentation — Lettering — Part 1: General requirements	2015
5	EN 12883	Equipment for the production of lost patterns for the lost wax casting process	2000

List of Mould / Core making and coatings Standards			
Sl. No	**STD No.**	**Standard Description**	**Year**
1	ASTM A90/ A90M	Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings	2021
2	IS 10033	Zircon And Graphite Based Core And Mould Washes - Specification	1992
3	IS 3018	Standard silica sand for raw material testing in foundries	1977
4	IS 12446	Bentonite for use in foundries	1988
5	CQI-23	Molding System Assessment	2023
6	IS 4604	Pattern plates for molding boxes	2003
7	IS 4269	Dextrin for use in foundries	1981
8	IS 10085	Methods for chemical analysis of zircon flour or sand	2003
9	IS 1811	Method of sampling foundry sand	1984
10	EN ISO 23062	Safety requirements for molding and core making machinery and associated equipment	2022
11	IS 3343	Specification For Natural Moulding Sand For Use In Foundries	1965

List of Material Manufacturing Standards			
Sl. No	**STD No.**	**Standard Description**	**Year**
1	DIN EN 1563	Spheroidal Graphite Cast Irons	2019
2	DIN EN 1561	Gray Cast Irons	2012
3	ASTM A536	Standard Specification For Ductile Iron Castings	2019
4	ASTM A48/A48M	Standard Specification For Gray Iron Castings	2022
5	ASTM A27/A27M	Standard Specification For Steel Castings, Carbon For General Application	2020
6	ASTM A395/ A395	Standard Specification For Ferritic Ductile Iron Pressure-Retaining Castings For Use At Elevated Temperatures.	2022
7	ASTM 371	Standard Specification for Castings, Austenitic, Austenitic-Ferritic (Duplex), for Pressure-Containing Parts	2000
8	ASTM A216 / A216M	Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service	2021
9	ASTM A 217 / A 217M	Specification for Steel Castings, Martensitic Stainless and Alloy, for Pressure-Containing Parts, Suitable for High-Temperature Service	2010
10	ASTM A 703/A 703M	Specification for Steel Castings, General Requirements, for Pressure-Containing Parts	2010
11	ASTM A126	Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings	2019
12	ASTM A128/ A128M	Specification for Steel Castings, Austenitic Manganese	1998
13	ASTM A148/ A148M	Specification for Steel Castings, High Strength, for Structural Purposes	2020
14	ASTM A159	Specification for Automotive Gray Iron Castings	2020
15	ASTM A278/ A278M	Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650 °F (350 °C)	2020
16	ASTM A297/ A297M	Specification for Steel Castings, Iron-Chromium and Iron-Chromium-Nickel, Heat Resistant, for General Application	2020
17	ASTM A319	Specification for Gray Iron Castings for Elevated Temperatures for Non-Pressure-Containing Parts	2020
18	ASTM A352/ A352M	Specification for Steel Castings, Ferritic and Martensitic, for Pressure-Containing Parts, Suitable for Low-Temperature Service	2021
19	ASTM A356/ A356M	Specification for Steel Castings, Carbon, Low Alloy, and Stainless Steel, Heavy-Walled for Steam Turbines	2021
20	ASTM A389/ A389M	Specification for Steel Castings, Alloy, Specially Heat Treated, for Pressure-Containing Parts, Suitable for High-Temperature Service	2018
21	ASTM A436	Specification for Austenitic Gray Iron Castings	2020
22	ASTM A439/ A439M	Specification for Austenitic Ductile Iron Castings	2022

Sl. No	STD No.	Standard Description	Year
23	ASTM A447/ A447M	Specification for Steel Castings, Chromium-Nickel-Iron Alloy (25-12 Class), for High-Temperature Service	2016
24	ASTM A476/ A476M	Specification for Ductile Iron Castings for Paper Mill Dryer Rolls	2018
25	ASTM A487/ A487M	Specification for Steel Castings Suitable for Pressure Service	2021
26	ASTM A488/ A488M	Practice for Steel Castings, Welding, Qualifications of Procedures and Personnel	2018
27	ASTM A494/ A494M	Specification for Castings, Nickel and Nickel Alloy	2022
28	ASTM A571/ A571M	Specification for Austenitic Ductile Iron Castings for Pressure-Containing Parts Suitable for Low-Temperature Service	2019
29	ASTM A644	Terminology Relating to Iron Castings	2003
30	ASTM A703/ A703M	Specification for Steel Castings, General Requirements, for Pressure-Containing Parts	2003
31	ASTM A732/ A732M	Specification for Castings, Investment, Carbon and Low-Alloy Steel for General Application, and Cobalt Alloy for High Strength at Elevated Temperatures	2014
32	ASTM A744/ A744M	Specification for Castings, Iron-Chromium-Nickel, Corrosion Resistant, for Severe Service	2021
33	ASTM A747/ A747M	Specification for Steel Castings, Stainless, Precipitation Hardening	2023
34	ASTM A757/ A757M	Specification for Steel Castings, Ferritic and Martensitic, for Pressure-Containing and Other Applications, for Low-Temperature Service	2015
35	ASTM A781/ A781M	Specification for Castings, Steel and Alloy, Common Requirements, for General Industrial Use	2017
36	ASTM A799/ A799M	Practice for Steel Castings, Stainless, Instrument Calibration, for Estimating Ferrite Content	2020
37	ASTM A800/ A800M	Practice for Estimating Ferrite Content of Stainless Steel Castings Containing Both Ferrite and Austenite	2020
38	ASTM A802	Practice for Steel Castings, Surface Acceptance Standards, Visual Examination	2019
39	ASTM A823	Specification for Statically Cast Permanent Mold Gray Iron Castings	2019
40	ASTM A834	Specification for Common Requirements for Iron Castings for General Industrial Use	2020
41	ASTM A842	Specification for Compacted Graphite Iron Castings	2018

Sl. No	STD No.	Standard Description	Year
42	ASTM A874/ A874M	Specification for Ferritic Ductile Iron Castings Suitable for Low-Temperature Service	2018
43	ASTM A890/ A890M	Specification for Castings, Iron-Chromium-Nickel-Molybdenum Corrosion-Resistant, Duplex (Austenitic/Ferritic) for General Application	2018
44	ASTM A897/ A897M	Specification for Austempered Ductile Iron Castings	2022
45	ASTM A903/ A903M	Specification for Steel Castings, Surface Acceptance Standards, Magnetic Particle and Liquid Penetrant Inspection	2017
46	ASTM A915/ A915M	Specification for Steel Castings, Carbon, and Alloy, Chemical Requirements Similar to Standard Wrought Grades	2018
47	ASTM A958/ A958M	Specification for Steel Castings, Carbon and Alloy, with Tensile Requirements, Chemical Requirements Similar to Standard Wrought Grades	2017
48	ASTM A985/ A985M	Specification for Steel Investment Castings General Requirements, for Pressure-Containing Parts	2021
49	ASTM A995/ A995M	Specification for Castings, Austenitic-Ferritic (Duplex) Stainless Steel, for Pressure-Containing Parts	2020
50	ASTM A1002	Specification for Castings, Nickel-Aluminum Ordered Alloy	2020
51	ASTM A1039/ A1039M	Specification for Steel, Sheet, Hot Rolled, Carbon, Commercial, Structural, and High-Strength Low-Alloy, and Ultra-High Strength, Produced by Twin-Roll Casting Process	2020
52	ASTM A1062	Specification for Steel Castings Sampling	2020
53	ASTM A1067/ A1067M	Specification for Test Coupons for Steel Castings	2018
54	ASTM A1095	Specification for High-Silicon Molybdenum Ferritic Iron Castings	2019
55	ASTM A1097	Specification for Steel Casing Pipe, Electric-Fusion (Arc)-Welded (Outside Diameter of 10 in. and Larger)	2022
56	ASTM B369/ B369M	Specification for Copper-Nickel Alloy Castings	2020
57	ASTM A532/ 532M	Standard specification for abrasion resistant cast iron	1993
58	ISO1083	Spheroidal graphite Cast Irons -Classification	2018
59	EN 10293	Steel Castings for General Engineering Uses	2015
60	IS 210	Gray Iron Castings-Specification	2009
61	IS 1865	Iron Castings with Spheroidal or Nodular Graphite-Specification	2005
62	IS 2644	High strength steel castings for General engineering and structural Purposes-Specification (High tensile steel castings)	2000
63	IS 2986	Steel castings for marine engines and boilers	1990

Sl. No	STD No.	Standard Description	Year
64	IS 276	Austenitic-Manganese Steel Castings — Specification	2000
65	IS 4522	Heat resistant alloy steel and nickel base castings	1986
66	IS 3038	Martensitic stainless steels and alloy steel castings for pressure containing parts suitable for high temperatures service	1992
67	IS 1030	Carbon steel castings for general engineering purposes	1989
68	IS 2708	1.5 Percent manganese steel castings for general engineering purposes	1993
69	IS 2985	Steel castings for ships structure	1990
70	GOST 977	Steel castings- General specifications	1988
71	GOST 26358	Cast iron castings- General specifications	1984
72	GOST 28394	Vermicular graphite iron for castings. Grades	1989
73	GOST 1585	Antifriction iron for castings. Grades	1985
74	GOST 24648	Pig iron for castings. Sampling and making the specimens for mechanical testing	1990
75	GOST 21357	Cold-resistant and wear-resistant steel castings. General specifications	1987
76	GOST 1215	Malleable iron castings. General specification	1979
77	GOST 1412	Flake graphite iron for casting Grades	1985
78	GOST 7293	Spheroidal graphite iron for castings Grades	1985
79	GOST 7769	Alloy cast iron for castings of special properties. Grade	1982
80	JIS - B 2031	Gray cast iron valves	1994
81	G 5101	Carbon steel castings	1991
82	G 5102	Steel castings for welded structure	1991
83	G 5111	High tensile strength carbon steel castings and low alloy steel castings for structural purposes	1991
84	G 5121	Corrosion-resistant cast steels for general applications	2003
85	G 5122	Heat-resistant cast steels and alloys for general applications	2003
86	G 5131	High manganese steel castings	2008
87	G 5151	Steel castings for high temperature and high-pressure service	1991
88	G 5152	Steel castings for low temperature and high-pressure service	1991
89	G 5501	Grey iron castings	1995
90	G 5502	Spheroidal graphite iron castings	2001
91	G 5503	Austempered spheroidal graphite iron castings	1995
92	G 5504	Heavy-walled ferritic spheroidal graphite iron castings for low temperature service	2005
93	G 5510	Austenitic iron castings	1999
94	G 5511	Low thermal expansive Fe-alloy castings	1991
95	G 5704	Pearlitic malleable iron castings	1988

Sl. No	STD No.	Standard Description	Year
96	G 5705	Malleable iron castings	2000
97	ASTM A518/A 518M	Standard Specification for Corrosion-Resistant High-Silicon Iron Castings	2022
98	EN 10213	Steel castings for pressure purpose	2016
99	EN 10283	Corrosion resistant steel castings	2010
100	EN 10295	Heat resistant steel castings	2002
101	EN 10340	Steel castings for structural uses	2007
102	EN 10349	Austenitic manganese steel castings	2009
103	Is 2707	Carbon steel casting for surface hardening	2002
104	IS 2856	Carbon steel casting for Pressure containing parts suitable for fusion welding	2004
105	ASTM A351	Standard Specification for Castings, Austenitic, for Pressure-Containing Parts	2024
106	ASTM A743	Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application	2021
107	ASTM A957	Standard Specification for Investment Castings, Steel and Alloy, Common Requirements, for General Industrial Use	2021
108	ASTM A560	Standard Specification for Castings, Chromium-Nickel Alloy	2011
109	EN 1562	Founding – Malleable cast irons	2012
110	EN 1563	Founding – Spheroidal graphite cast irons	2011
111	EN 1564	Founding – Ausferritic spheroidal graphite cast irons	2011
112	EN 1753	Magnesium and magnesium alloys – Magnesium alloy ingots and castings	1997
113	EN 1754	Magnesium and magnesium alloys – Magnesium and magnesium alloy anodes, ingots and castings – Designation system	2015

List of Non-Ferrous Casting Standards

Sl. No.	STD No.	Standard Description	Year
1	B26/B26M	Specification for Aluminum-Alloy Sand Castings	2021
2	ASTM B61	Specification for Steam or Valve Bronze Castings	2021
3	ASTM B66	Specification for Bronze Castings for Steam Locomotive Wearing Parts	2021
4	ASTM B80	Specification for Magnesium-Alloy Sand Castings	2023
5	ASTM B85/B85M	Specification for Aluminum-Alloy Die Castings	2021
6	ASTM B86	Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings	2023
7	ASTM B93/B93M	Specification for Magnesium Alloys in Ingot Form for Sand Castings, Permanent Mold Castings, and Die Castings	2021
8	ASTM B94	Specification for Magnesium-Alloy Die Castings	2018

Sl. No.	STD No.	Standard Description	Year
9	ASTM B108 / B108M	Specification for Aluminum-Alloy Permanent Mold Castings	2021
10	ASTM B148	Specification for Aluminum-Bronze Sand Castings	2018
11	ASTM B176	Specification for Copper-Alloy Die Castings	2018
12	ASTM B179	Specification for Aluminum Alloys in Ingot and Molten Forms for Castings from All Casting Processes	2018
13	ASTM B199	Specification for Magnesium-Alloy Permanent Mold Castings	2017
14	ASTM B208	Practice for Preparing Tension Test Specimens for Copper Alloy Sand, Permanent Mold, Centrifugal, and Continuous Castings	2014
15	ASTM B240	Specification for Zinc and Zinc-Aluminum (ZA) Alloys in Ingot Form for Foundry and Die Castings	2017
16	ASTM B403	Specification for Magnesium-Alloy Investment Castings	2020
17	ASTM B505 / B505M	Specification for Copper Alloy Continuous Castings	2018
18	ASTM B584	Specification for Copper Alloy Sand Castings for General Applications	2014
19	ASTM B618 / B618M	Specification for Aluminum-Alloy Investment Castings	2018
20	ASTM B427	Specification for Gear Bronze Alloy Castings	2015
21	JIS H5302	Aluminum and aluminum alloy castings	2006

List of Material Testing Related Standards

Sl. No	STD No.	Standard Description	Year
1	ISO 945-1	Microstructure Of Cast Irons- Part:1- Graphite Classification by Visual Analysis.	2019
2	ISO 6892-1	Metallic Material: Tensile Testing Part: Method of Test at Room Temperature	2019
3	ASTM A370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products	2023
4	ASTM E8/E8M	Standard Test Methods for Tension Testing of Metallic Materials	2021
5	ASTM E10	Standard Test Method for Brinell Hardness of Metallic Materials	2018
6	ASTM E18	Standard Test Method for Rockwell Hardness of Metallic Materials	2022
7	ASTM A247	Standard Test Method for Evaluating Microstructure of Graphite in Iron Castings	2019
8	EN 10002-1	Metallic Material: Tensile Testing Part:1 Method of Test at Ambient Temperature	2001

Sl. No	STD No.	Standard Description	Year
9	EN 10045	Charpy Impact Test on Metallic Material: Part-1: Test Method (V & U Notches)	1990
10	ISO 6506-1	Metallic Materials: Brinell Hardness Test: Part-1: Test Method	2014
11	ISO 148-1	Metallic Materials-Charpy Pendulum Impact Test-: Part-1: Test Method	2016
12	EN 10204	Metallic Products - Types of Inspection Documents.	2005
13	IS 7754	Method For Designation of The Microstructure Of Graphite In Cast Iron	2003
14	IS : 3018	Specification For Standard Silica Sand for Raw Material Testing In Foundries	2008
15	IS : 460 Part-1	Specification For Test Sieves - Part - I	2020
16	IS 13164	Ferro Silico magnesium - Specification	2010
17	IS 1170	Ferrochromium – Specification	2009
18	IS 1987	High Silica Sand for Use In Foundries - Specification	2007
19	IS 16052-3 (ISO 13765-3)	Refractory Mortars Part-3 Determination of Joint Stability	2013
20	IS : 4606	Specification For Steel Shot for Use In Foundries	2008
21	IS 1110	Ferrosilicon – Specification	2009
22	IS 1171	Ferromanganese – Specification	2011
23	IS : 3011	Specification For Ferro Silico-Zirconium	1985
24	IS 8502	Petroleum Coke –Specification	2011
25	IS : 2072	Specification For Comb Foundation Sheets	2009
26	IS 2281/ ISO 6506-2	Method For Verification of Brinell Hardness Testing Machines	2010
27	IS 1586	Method For Rockwell Hardness Test for Metallic Material	2010
28	IS : 3766	Method For Calibration of Pendulum Impact Testing Machines For Testing Metals	2009
29	IS 1828-1/ ISO 7500-1	Metallic Materials - Verification of Static Uniaxial Testing Machines	2010
30	IS : 3651 -2	Specification For Vernier Calipers Part 2 Vernier Caliper with Least Count 0.02 Mm	1985
31	IS : 3651 -3	Specification For Vernier Calipers Part-3 With Least Count 0.1 MM (Measuring Range Above 1000mm To & Including 4000mm)	1988
32	IS : 2967	Specification For External Micrometer	1983
33	IS : 2092	Specification For Plunger Type Dial Gauges	1985
34	IS : 3944	Method For Determination Of Flow Time By Use Of Flow Cups	2010
35	IS : 4239	Specification For Mechanical Bevel Protractors	1998

Sl. No	STD No.	Standard Description	Year
36	IS : 3104 -1	Specification For Density Hydrometers-Part 1	2008
37	IS 2291/ISO 3177	Tangential Keys and Keyways	2013
38	ISO 8062	Casting –system of Dimensional tolerances and machining allowances	1994
39	ISO 8062-1	Geometrical product specifications (GPS) – Dimensional and geometrical tolerances for molded parts. (Part 1: Vocabulary)	2007
40	ISO 8062-2	Geometrical product specifications (GPS) – Dimensional and geometrical tolerances for molded parts. Part 2: Rules (Technical Specification)	2009
41	ISO 8062-3	General dimensional and geometrical tolerances and machining allowances for castings	2023
42	ISO 14405-1	Geometrical product specifications (GPS) — Dimensional tolerancing	2016
43	ISO 14405-2	Geometrical product specifications (GPS) — Dimensional tolerancing —Dimensions other than linear sizes	2018
44	ISO 14405-3	Geometrical product specifications (GPS) — Dimensional tolerancing — Angular sizes	2016
45	ISO 2768	General Tolerances For Linear And Angular Dimensions	1989
46	ISO 2768-2	Geometrical tolerances for features without individual tolerance indication	1989
47	IS 2285/ISO 8512-1	Engineering Metrology - Measuring Equipment - Cast Iron Surface Plates - Specification	2008
48	IS 1865	Iron Castings with Spheroidal or Nodular Graphite - Specification	2010
49	IS - 2707	Carbon Steel Castings for Surface Hardening	2002
50	IS - 5519	Deviations For Un-Tolerance Dimensions & Mass - G I Castings	1979
51	IS 6601	Permissible Deviation in Chemical Composition for Product Analysis Of Steel Castings	1987
52	IS 6396	Methods Of Measuring Decarburized Depth of Steel	2003
53	IS 228	Methods of chemical analysis of Steel	1959
54	IS 1501	Method for Vickers hardness test for metallic materials	2002
55	IS 1501 PART-1	Method for Vickers hardness test for metallic materials (Part 1 HV 5 to HV 100)	2020
56	IS 1501 PART-2	Method for Vickers hardness test for metallic materials (Part 2 HV 0.2 to less than HV 5)	2020
57	IS 1501 PART-3	Method for Vickers hardness test for metallic materials (Part 3 Less than HV 0.2)	2020
58	IS 5072	Method for Rockwell superficial hardness test (N&T scales) for steel	1988
59	IS 6885	Method for Knoop hardness testing of metals	1973

Sl. No	STD No.	Standard Description	Year
60	EN ISO 945	Designation Of Microstructure of Graphite	2019
61	ASTM A 370	Standard Test Methods and Definitions	2012
62	ASTM E8/E8M-11	Standard Test Methods for Tension Testing of Metallic Materials	2021
63	ASTM E83	Standard Practice for Verification and Classification of Extensometer System	2010
64	ASTM A941	Standard Terminology Relating to Steel, Alloys	2010
65	ASTM A751	Standard Test Methods, Practice and Terminology for Chemical Analysis of Steel Product	2011
66	ISO 6892	Metallic Material: Tensile Testing Part: Method of Test at Room Temperature	2019
67	EN 10002	Metallic Material: Tensile Testing Part: Method of Test at Ambient Temperature	2001
68	ISO 6506	Metallic Material: Brinell Hardness Test: Part-1: Test Method	2005
69	DIN 1685	General Tolerances, Machining Allowances, Castings, Spheroidal Graphite Cast Iron	1998
70	DIN 1686	Rough castings of grey cast iron - General tolerances and machining allowances	1998
71	DIN 1690-2	Technical delivery conditions for castings made from metallic materials; steel castings; classification into severity levels on the basis of non-destructive testing	1985
72	GOST 26645	Metal and alloy castings. Dimensions and mass tolerances and machining allowances	1985
73	GOST 27208	Cast iron casting. Methods of mechanical testing	1987
74	GOST 3443	Cast iron castings with graphite of different forms. Methods of structure determination	1987
75	GOST 4-439	Product-quality index system. Castings. Index nomenclature	1986
76	GOST 805	Steelmaking pig iron. Specification	1995
77	GOST 4832	Foundry pig iron. Specifications	1995
78	JIS-B 0403	Castings - System of dimensional tolerances and machining allowances	1995
79	B 0703	Roundness of castings	1987
80	G 0307	Steel castings - General technical delivery requirements	1998
81	G 5903	Cast shot and grit	1975
82	MSS SP- 55	Quality Standard for Steel Castings for Valves, Flanges, Fittings, and Other Piping Components - Visual Method for Evaluation of Surface Irregularities	2001
83	IS 1918	Methods of physical test for foundry sands	2003

Sl. No	STD No.	Standard Description	Year
84	IS 4606	Steel shots for use in foundries	2003
85	IS 4683	Chilled iron shot and grits use in foundries	2003
86	CQI-27	Special Process: Casting System Assessment	
87	EN 1559-3	Founding – Technical conditions of delivery – Part 3: Additional requirements for iron castings	2011
88	EN 1559-5	Technical conditions of delivery – Part 5: Additional requirements for magnesium alloy castings	2017
89	GOST 1497	Method of tensile test	1984
90	GOST 12344	Steel alloyed and high alloy. Method for determination of Carbon	1988
91	GOST 11150	Methods of Tensile tests at low temperature	1984
92	GOST 12345	Steel alloyed and high alloy. Methods of determining Sulphur	2001
93	GOST 12346	Steel alloyed and high alloy. Methods of determining Silicon	1978
94	GOST 12347	Steel alloyed and high alloy. Methods for determination of Phosphorus	1977
95	GOST 12348	Steel alloyed and high alloy. Methods for determination of Manganese	1978
96	GOST 12349	Steel alloyed and high alloy. Methods for determination of Tungsten	1983
97	GOST 12350	Steel alloyed and high alloy. Methods for determination of chromium	1978

List of Non-Destructive Test (NDT) Standards

Sl. No	Standard	Standard Description	Year
1	ASTM A609	Standard practice for Castings, Carbon, Low -Alloy and Martensitic stainless steel, Ultrasonic Examination theory	2018
2	ASTM E709	Standard guide for Magnetic practical Examination	2021
3	DIN EN 1369	Founding –Magnetic particle testing	2013
4	ASTM E1444	Standard Practices for Magnetic Particle testing	2021
5	ASTM E428	Standard practices for Fabrication and Control of Metal Other than Al Reference blocks used in ultrasonic testing	2013
6	ASTM E125	Standard Reference Photograph for Magnetic Particles Indication on ferrous castings	2018
7	ASTM E94	Standard Guide for Radiography Examination 1	2017
8	ASTM E747	Standard Practice for Design, Manufacture and Material Grouping Classification of Wire Image Quality Indicators (IQI) Used for Radiology1	2018
9	ASTM E1025	Standard Practice for Design, Manufacture, and Material Grouping Classification of Hole-Type Image Quality Indicators (IQI) Used for Radiography1	2018
10	ASTM E1079	Standard Practice for Calibration of Transmission Densitometers1	2021
11	ASTM E1254	Standard Guide for Storage of Radiographs and Unexposed Industrial Radiographic Films1	2013

Sl. No	Standard	Standard Description	Year
12	ASTM E1316	Standard Terminology for Nondestructive Examinations1	2023
13	ASTM E1815	Standard Test Method for Classification of Film Systems for Industrial Radiography1	2018
14	ASTM E317	Standard Practice for Evaluating Performance characteristics of Ultrasonic Pulse -Echo Testing Instruments and Systems Without the use of Electronic Measurement Instruments 1	2021
15	ASTM E1390	Standard Specification for Illuminators Used for Viewing Industrial Radiographs1	2021
16	ASTM E280	Standard Reference Radiographs for Heavy-Walled (4 1⁄2 to 12 in. (114 to 305 mm) Steel Castings1	2021
17	ASTM E1742	Standard Practice for Radiographic Examination1	2018
18	ASTM E 165	Test Method for Liquid Penetrant Examination	1995
19	EN 12680-1	Founding- Ultra sonic examination -Steel casting for General Purpose	2003
20	EN 12680-2	Founding - Ultrasonic examination - Part 2: Steel castings for highly stressed components	2003
21	EN12680-3	Founding- Ultra sonic examination -cast iron casting for General Purpose	2012
22	ISO 4992-1	Steel castings for General Purpose	2020
23	EN 12668-1	Non-destructive testing — Characterization and verification of ultrasonic examination equipment General Purpose	2010
24	EN 12668-2	Non-destructive testing — Characterization and verification of ultrasonic examination equipment	2010
25	EN 12668-3	Non-destructive testing — Characterization and verification of ultrasonic examination equipment	2013
26	EN ISO 2400	Non-destructive testing —Ultrasonic testing —Specification for calibration block No. 1	2012
27	ISO 19232-1	Non-destructive testing — Image quality of radiographs — Part1: Determination of the image quality value using wire-type image quality indicators	2013
28	ISO 19232-2	Non-destructive testing — Image Quality of radiographs —Part 2: Determination of the image quality value using step/hole-type image quality indicators	2013
29	ISO 19232-3	Non-destructive testing — Image quality of radiographs —Part 3: Image quality classes	2013
30	ISO 19232-4	Non-destructive testing — Image quality of radiographs —Part 4: Experimental evaluation of image quality values and image quality tables	2013
31	ISO 19232-5	NDT- Image quality of radiographs - Part 5: Determination of the image un-sharpness and basic spatial resolution value using duplex wire-type image quality indicators	2018
32	EN 1370	Founding — Examination of surface condition	2011

Sl. No	Standard	Standard Description	Year
33	EN 12681-1	Founding - Radiographic testing Part 1: Film techniques	2017
34	EN 12681-2	Founding – Radiographic testing Part 2: Techniques with digital detectors	2017
35	EN ISO 3059	Non-destructive testing — Penetrant testing and magnetic particle testing— Viewing conditions	2012
36	EN ISO 9934-1	Non-destructive testing — Magnetic particle testing Part 1: General principles	2016
37	EN ISO 5577	Non-destructive testing — Ultrasonic testing —Vocabulary	2017
38	EN ISO 16810	Non-destructive testing —Ultrasonic testing — General principles	2014
39	EN ISO 16811	Non-destructive testing —Ultrasonic testing — Sensitivity and range setting	2014
40	EN ISO 16826	NDT— Ultrasonic testing —Examination for discontinuities perpendicular to the surface	2014
41	EN ISO 16827	NDT— Ultrasonic testing —Characterization and sizing of discontinuities	2014
42	EN 25580	Non-destructive testing Minimum requirements for industrial radiographic illuminators	1992
43	ANSI 2540-1/ ISO/IEC 17025	General requirements for the competence of testing and calibration laboratories	2017
44	ISO 1002	Measurement management systems - Requirements for measurement processes and measuring equipment	2003
45	ISO 5580	NDT Industrial Radiographic Illuminators Minimum Requirements.	1985
46	IS 9565	Acceptance standard for Ultrasonic inspection of steel castings	2017
47	IS 11732	Acceptance standard for Liquid Penetrant inspection of steel castings	2017
48	IS 2595	Code of practice for Radiographic testing	2008
49	IS 10724	Acceptance standard for Magnetic Particle inspection of steel castings	2017
50	IS 12938	Acceptance standard for Radiographic inspection of steel castings	2017
51	JIS-G 0585	Radiographic inspection for steel castings	2002
52	MSS SP-53	Quality Standard for Steel Castings and Forgings for Valves, Flanges, Fittings, and Other Piping Components - Magnetic Particle Examination Method	2012
53	MSS SP-54	Radiographic Examination Method	2013
54	MSS SP-93	Liquid Penetrant Examination Method	2020
55	MSS SP-94	Ultrasonic examination	2020
56	MSS SP-112	For visual and tactile method	2021
57	ASTM E186	Standard Reference Radiographs for Heavy-Walled (2 to 412 in. (50.8 to 114 mm)) Steel Castings	2020
58	ASTM E446	Standard Reference Radiographs for Steel Castings Up to 2 in. (50.8 mm) in Thickness1	2010
59	EN ISO 9712	Non-destructive testing — Qualification and certification of NDT personnel	2021
60	EN 1371-1	Liquid penetrant testing- Part 1: Sand, gravity die and low pressure die castings	2011
61	EN 1371-2	Founding – Liquid penetrant inspection – Part 2: Investment castings	2015

List of Heat Treatment Standards			
SL. No.	**STD No.**	**Standard Description**	**Year**
1	AMS 2750	Aerospace Material Specification- covers pyrometric requirements for thermal processing equipment used for heat treatment	2012
2	ASTM E 220	Standard Test Method for Calibration of Thermocouples by Comparison Techniques	2019
3	ASTM B661	Practice for Heat Treatment of Magnesium Alloys	2020
4	ISO 10424 /API 6A Annexure-M	Qualification of Heat-Treating equipment	2007
5	CQI-9	Heat Treat System Assessment	2020
6	CQI-12	Coating System Assessment to provide much more detail on pyrometry requirements	2020

List of Pressure Testing Standards			
SL. No	**STD No.**	**Standard Description**	**Year**
1	ASME B31.1 & B31.3	Hydrostatic test Specification	2022

List of Packing Standards			
SL. No	**STD No.**	**Standard Description**	**Year**
1	AA51401	Wooden packing specification	---
2	AA51416	Thermocole packing specification	---
3	AA 51420	Polyethylene sheet Specification for packing	---

List of Painting Standards			
SL. No	**STD No.**	**Standard Description**	**Year**
1	EN ISO 8502-3 & 4	Preparation of steel substrates before application of paints and related products - Tests for the assessment of surface cleanliness	2017
2	ISO 12944-1	Corrosion protection of steel structures by protective paint systems	2018
3	ISO 12944-2	Deals with the classification of the principal environments to which steel structures are exposed, and the atmospheric corrosivity	2017
4	ISO 12944-3	Paints and varnishes: Corrosion protection of steel structures by protective paint systems Part 3: Design considerations	2017
5	ISO 12944-4	Paints and varnishes: Corrosion protection of steel structures by protective paint systems Part 4: Types of surfaces and surface preparation	2017
6	ISO 12944-5	Paints and varnishes Corrosion protection of steel structures by protective paint systems Part 5: Protective paint systems	2018

SL. No	STD No.	Standard Description	Year
7	ISO 12944-6	Paints and varnishes Corrosion protection of steel structures by protective paint systems-Part 6: Laboratory performance test methods	2018
8	ISO 12944-7	Paints and varnishes Corrosion protection of steel structures by protective paint systems-Part 7: Execution and supervision of paint work	2017
9	ISO 12944-8	Paints and varnishes Corrosion protection of steel structures by protective paint systems-Part 8: Development of specifications for new work and maintenance	2018
10	ISO 12944-9	Paints and varnishes Corrosion protection of steel structures by protective paint systems Part 9: Protective paint systems and laboratory performance test methods for offshore and related structures	2018
11	ISO 2808	Paints & Varnishes - Determination of film thickness	2019
12	ISO 4628	Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance 2016	
13	ISO 8503-1	Preparation of steel substrates before application of Paints and related products - Surface roughness characteristics of blast cleaned steel substrates. Part-1: Specifications and definitions for ISO surface profile comparators for the assessment of abrasive blast cleaned surfaces	2012
14	ISO 9227	Corrosion tests in artificial atmospheres — Salt spray tests	2022
15	ISO 19840	Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Measurement of, and acceptance criteria for, the thickness of dry films on rough surfaces	2012
16	ISO 8501-3	Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 3: Preparation grades of welds, edges and other areas with surface imperfections 2006	
17	ISO 2409	Paints and varnishes-Cross-cut test	2020
18	ISO 4624	Paints and varnishes — Pull-off test for adhesion	2023

List of Quality Management System Standards			
SL. No	**STD No.**	**Standard Description**	**Year**
1	ISO 9001	Quality Management Systems	2015
2	ISO 9004	Managing for the sustained success of an organization: A quality management approach	2009
3	ISO 14001	Environmental Management Systems- requirements with Guidelines for use	2015
4	ISO 45001	Occupational health and safety management systems —Requirements with guidance for use	2018
5	IATF 16949	Automotive Quality Management Systems	2016
6	ISO 19011	Guidelines for auditing Management System	2018
7	ISO 31000	Risk Management Principles Guidelines	2018
8	ISO/IEC 31010	Risk management: Risk assessment techniques	2009
9	ISO 26000	Guidance on Social Responsibility	2010
10	ISO 27001	Information security managements system	2013
11	ISO 28000 /28001	Supply Chain Security Management System	2022
12	SS 444	Hazard Analysis and Critical Control Point (HACCP)	2018
13	SS 506	Occupational Safety and Health Management System (OSHMS)	2021
14	ISO 22301	Business Continuity Management Systems	2019
15	ISO 20121	Event sustainability management systems-Requirements with guidance for use	2012
16	ISO 20400	Sustainable procurement- Guidance	2017
17	ISO 37001	Certification – Anti-Bribery Management System	2016
18	ISO 37301	Compliance management systems-Requirements with guidance for use	2021

List of Energy Management System Standards			
SL. No	**STD No.**	**Standard Description**	**Year**
1	ISO 50001	Establishment of systematic energy management	2018
2	ISO 50002	Energy management systems - Requirements with guidance for use	2014
3	ISO 50003	Certification instructions for auditors	2021
4	ISO 50006	Development of energy performance indicators	2023
5	ISO 50015	Systematic measurement	2014

List of ZED Related Standards			
SL. No	**STD No.**	**Standard Description**	**Year**
1	NIC DIVISION 24	Manufacture of Basic Metals	2021
2	NIC DIVISION 32	Other Manufacturing	2021

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All Grades SG Iron & Grey Iron, Plain Carbon Steel, Abrasion Resistant Castings, NI-resistance & ADI. Weight per casting upto 800 kg.

MANUFACTURING FACILITIES

MELTING: Induction Furnace 4 nos. IGBT based: 1000 kg. each ARC Furnace 1no. : 2000 kg.

MOULDING: High Pressure Line, Automated ARPA 450 & 900 Moulding Line, Nobake, Co2 Hand Moulding Line & Vacuum Assisted Lost Foam Casting(VLFC).

CORE MAKING: Cold Box with fully automated sand mixing & feeding, Nobake. Core are painted and dryed in automatic core oven.

QUALITY CONTROL: Spectrometer, Chemical Lab, CE Meter, Temperature Measurement, Mechanical Testing (Tensile, Hardness, Impact Testing), Sand Testing, NDT-(Ultrasonic, DPT, Magnetic particles).

DESIGN & DEVELOPMENT: AutoCAD, CREO for 3D Modeling, Pattern design, Pattern & Core Boxes through CNC/VMC Route.

SIMULATION SOFTWARE: SOFTCAST software.

MACHINING FACILITY: We have modern in-house machining facility with tool Pre setter of Zoller make, Horizontal Machining Centers (HMC), Vertical Machining Centers (VMC), Vertical Turret Lathe (VTL), Conventional Machines & CNC Lathe Machine for fully machined castings which are checked with 3D CMM of Carl Zeiss make software Calyso 5.4 with Automatic Renishaw Probe system & 3D CMM ACCURATE make with Rational DMIS64 with Automatic Probe System.

CERTIFICATION:

- ISO 9001:2015 & TS/ISO 16949:2016
- ISO 14001:2015, BIS-210:2009 Certified
- IRIS ISO/TS 22163:2017
- RDSO Approved for "A" Class Foundry
- Approved by Ordinance Factory
- Approved by Integral Coach Factory, Rail Coach Factory & CLW

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WORK TO LIVE OR LIVE TO WORK – THE DILEMMA OF GENERATION AHEAD

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Raging discussions around Working Hours triggered by two Indian Stalwarts who have built Business Empires bringing in Co-ownership of Organisations, the modern-day Cooperative Model through ESOPs. It's needless to highlight achievements of their respective organisations in the global diaspora, apart from providing careers to thousands directly and millions indirectly, to say so.

As budding career professionals, every aspiring qualified, sorry rightly qualified individual will not give a second thought if given a chance to work for them. Both personally and professionally, opinion of Leaders from Organisations of international repute and indomitable spirit, has snowballed into an uncalled for and unwanted controversy, where people from any walk of life easily offer their opinion, thus claiming to be worth its salt.

Setting a context

To me, it appears to be a situation of Socio Economic Evolution, creating a lot of confusions in the minds of today's youngsters in the name of Alternate Careers. It's said well, probably in anticipation of such emerging scenarios, "Other side of the Valley is Always Greener" though it continues to remain so - for Entrepreneurs and Intrapreneurs alike, by way of diversification of businesses and career growth respectively.

Practically, it's supposed to be the third generation of business economy world over…obviously offering multifarious options to demographic shifts, both as means of living and of course, spending. Naturally, it's quite easy to be spoilt with choices - Failed Businesses resulting in Bad Loans and stuck careers giving very fewer options to recruiters.

The foundation

Businesses and careers world over are built on the principle of Extreme focus and hard work. Belonging to a city known for its entrepreneurial spirit, if not an essential part of its many growth stories, have been a witness to.

Evolution of many organisations today those boast of at least Rs.500 CR revenues were all once started as a means of Self Employment. It's anyone's imagination how once such micro enterprises have grown as business colossal. Couldn't find a better anecdote than that of a Symphony by which the then engagement between employers and employees can be compared to.

Well, today many say such symphonies can be re-orchestrated through offering advices through media, further confusing the already confused Youngsters - both would be entrepreneurs & intrapreneurs, who believe, if not hope, that working smarter is a viable substitute for working harder. The epitome of smarter harder work conveniently forgotten in the milieu.

One should check with the toppers, successful athletes and renowned artists, how many hours of practice they put in

to gain a foothold in their respective fields, if not learn from alike entrepreneurs and professionals. Once a famous first generation entrepreneur quipped "You don't grow by working looking at the Watch", and I have seen majority of who have grown were just so. It's needless to say, not being so have led to many failures just because of lack of enough attention, if not motivation.

Parable of growth and success

It's just right to imagine in a highly competitive & complex economic world, success always follows the ones who put in their extra bit - commonly known as effort. It's simply the difference between ordinary & extraordinary.

Once my favourite tennis legend spoke about the many willing sacrifices one has to make as part of focus to remain at peak consistently. Guess he is not alone in being so.

This is true for any profession, which only is not adequately recognised. A systematic, focused approach, irrespective of time without diverting attention helps to recognise and manage risks effectively than the ones who give divided attention to their core of existence - due to so called work-life balance.

Differential needs

Measurement is the base to succeed - if you don't measure, you can neither control nor improve. Each industry has its own differential needs for measurements - from mass to class to niche, and agriculture to manufacturing to services. Needs therefore will also be characterised by specific industry requirements.

The beauty of negative reactions to observations made by the Stalwarts on working hours, is unfortunately avoiding either carefully or ignorantly the reasoning behind such specific needs of those industries they belong to. Quite naturally, calibre of individuals will also be very different - from 80:20 to 20:80.

It's a fact that the socio-industry evolution has rendered the core industries starving for right resources. This therefore has necessitated the capable work force to double up for shortfalls, be it by putting those needed extra efforts or just being there when needed.

It's important to recognise sustained success can only be through sustained and consistent efforts. Rest all becomes mere excuses for not giving the desired and needed attention towards ones task or responsibility. Organisational needs are paramount to those of individual or personal needs.

Living for an earning or earning to live

For most of the successful people, earning in terms of money is a result of recognition and status acquired through diligent and meticulous working towards it. This can be understood by analysing how only 7% of the people grow either as businessmen or as professionals when the world provides equal opportunity to all.

There is only one Elon Musk as much as there is only one Djokovic or Messi or Woods, or our own Tendulkar, the New Gen Gukesh apart.

So, it's the Individual's desire to work to live or live to work. It simply is "to be on Top, one Needs to be Better than the Best".

■■■

Cast Quiz

Answers

1 (d)	2 (b)	3 (c)	4 (c)	5 (b)	6 (d)	7 (d)	8 (b)	9 (c)	10 (a)	11 (a)	12 (c)
13 (a)	14 (a)	15 (c)	16 (a)	17 (d)	18 (a)	19 (b)	20 (b)	21 (a)	22 (b)	23 (c)	24 (c)
25 (c)	26 (c)	27 ( )	28 (c)	29 (b)	30 (b)	31 (c)	32 (d)				

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R E V I E W : A SIMPLE BUT IGNORED AVENUE FOR MAKING PROFIT IN FOUNDRY

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Abstract: *The foundry industry is an essential part of the Indian manufacturing sector. With its current growth and vast potential for future growth, making profit in the foundry industry can be both lucrative and sustainable. However, achieving profitability in this sector is always found challenging. A deep understanding of the market dynamics, operational efficiency, technological advancements, strategic approach for repositioning and customer engagement are generally the key factors to keep the foundry business profitable. Indian foundries, being the second largest in total world casting volume, are aware of these facts and spend a lot of time and money to nurture those aspects. However, in this journey, most of the foundries ignore the simple and basic rules and got jammed in the lanes and by-lanes of complex business management practices.*

This article will review some basic steps which are mostly overlooked in regular day to day business process in foundry but can make and sustain the profitability of the organisation without any significant capital investment, manpower or costly consultancy services.

Indian foundry industry and the profitability aspect

India is the second largest casting producer in the world, producing approx 12 million tonnes of castings which is 11% of total global production. Having approx. 4500 foundries in the country, the average production per plant numerically appears to 2000 MTPA. But only 20% of these foundries belong to the category of medium to high scale and rest are in the small-scale level. Therefore, the average production per plant hardly represents the actual production capacity of foundries across India. This fact reasons the variation of profitability of each foundry and the various nature of challenges faced by the foundries to sustain the good health of the book.

Most of the foundries in India generally operates in two

Myths about profitability

	Profitability Concept	Myth	Reality
1)	Profitability and cash flow is equal	If a company is profitable, it will have ample cash.	Profitability is measured on an accrual basis, meaning revenue and expenses are recognised when incurred, not when cash changes hands. A profitable company can still face cash flow issues if collections are delayed, or liabilities are high.
2)	Higher sales mean higher profitability	Increasing sales will automatically improve profitability.	If input costs rise disproportionately with sales, profitability can decline. Efficient cost management is essential alongside sales growth.
3)	Cost cutting always increases profitability	Reducing costs will lead to higher profits.	Inappropriate cost cutting can compromise product quality, employee morale, or customer satisfaction, potentially harming long-term profitability.
4)	Profitability is only about numbers	Profitability is purely a financial metric.	Non-financial factors like customer satisfaction, employee productivity, brand reputation, and innovation significantly impact profitability.
5)	All profitable foundries are financially healthy	Profitable businesses don't need external funding.	Even profitable businesses may require investments to scale, expand into new markets, or adopt new technologies.

separate streams – one in the technical route focusing solely on the manufacturing processes without knowing or considering the financial aspects and another is the commercial stream which focuses only on the financial matters without linking to the factors of manufacturing, technicality of the operations. This results into two different objectives in the organisation leaving a major gap between Productivity and Profitability. In this article, a simple concept of business profitability linking to the factors of manufacturing operations is described for those engineers and accountants who need to understand the other side of the business operation.

This is imperative to understand this concept and myths of profitability to make wise business decision in the foundries. Dispelling myths and focusing on a balanced approach that integrates profit, cash flow, and investments is essential for sustainability in business profitability.

Foundation of making and maintaining profit in foundry business

Being a highly material, power and labour-intensive sector, the most significant contributors to profitability in any foundry operation is maintaining cost efficiency. In the foundry industry, raw material constitutes the lion's share of the total cost followed by the labour and energy costs which constitute a substantial portion of the overall expense. The foundation required to combat such cost pressure are the followings which provides a solid base for growth and profitability.

A Dynamic Leadership and Safe Working Premises are the first two conditions or say the pre-requisites on which the business to be build upon. Other two aspects which are also better to be considered at the first step of making a profitable foundry business are:

- **Automation:** Automation can yield long-term savings and better quality control. Automation of processes such as moulding, core making, melting and fettling can reduce the throughput time significantly resulting into healthy cash flow. This also reduces the man-dominated processes and allied challenges.

  For example, a High-Pressure Moulding Line (HPML) can replace dozens of workmen (which can be used in other manual processes) engaged in the sand preparation, moulding, core setting and mould closing of conventional machine moulding. Such automation also increases the consistency and quality of castings.

  A robotic fettling and finishing process can not only reduce manpower cost of fettling area but also all other post processing functions due to precision finish in parting line and core print locations.

- **Modern technology:** Unlike yesteryears, foundry is no more a "less science more commonsense manufacturing process". Days have mostly gone to wait for the casting results till it comes out of the shot blasting machine. Since last three decades, and now in this AI generation, technology is available and improving rapidly to predict the quality and the challenges well before the castings are poured. Not only the product quality but the plant health also can be monitored precisely on real time.

  For example, adopting state-of-the-art technologies like 3D printing for prototyping, computer-aided design (CAD) software, FEA, FEM based solidification and thermal simulation, CFD based casting design solution etc. yield to better product design, fewer defects, and enhanced productivity.

  Similarly, using a customised digitisation can add significant efficiency in the predictive and preventive maintenance preventing the unplanned plant stoppages. AI based digitisation system is also proven highly effective offering 100% plant availability.

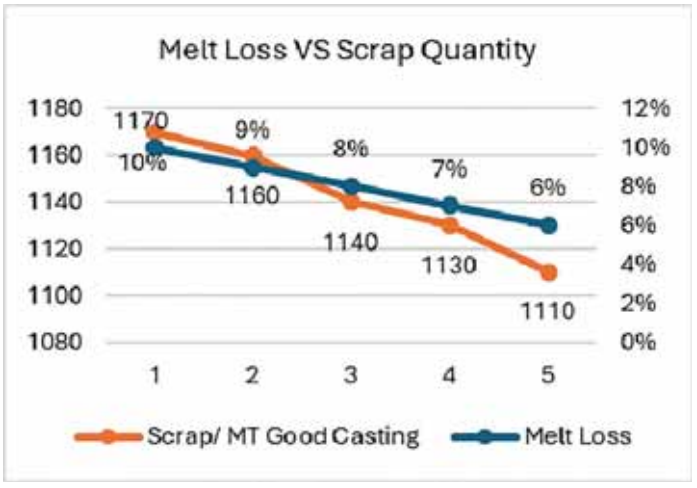
R E V I E W: a simple and ignored process of profitability

Needless to mention that even after adapting reasonable level of automation and technology, foundry can't guarantee profitability if the efficiency of the plant is not improved. Efficiency of any foundry plant irrespective to the product or process must be covered Safety, Cost, Quality & Delivery. There are multiple avenues to reach to the high level of efficiency ensuring quality castings at optimum price within time. But in this article, I will only discuss the simplest yet most ignored route to reach the goal and continue with the journey of excellence.

This is Six steps process, I named as REVIEW which in other way also the process needs reviewing continuously.

REVIEW – Raw material optimisation, Energy savings, Value stream mapping, Inventory optimisation, Efficiency building and Waste elimination.

- **Raw material optimisation:** In Indian foundries, heavy melting scrap (HMS) along with pig iron, borings etc contributes almost 35-40% of the total manufacturing cost (may vary significantly based on product and process). Since the material cost is mostly market driven, this is utmost important to manage this cost very efficiently.



The hidden cost of the raw material lies in the quantum of melting loss incurred by most of the Indian foundries. This has been observed that foundries are mainly tracking and monitoring the metal yield from the liquid metal to the good casting. Though, efficient foundries value the melt loss and keep monitoring the same as a part of business process. Factors responsible for the melting loss are mainly the scrap quality, quantity and quality of slag, melting skill, tapping and liquid metal handling process. Depending on the nature of process and alloys, standard melting loss may vary from 3 to 5%. As a typical estimation, it is found that 1% of additional melt loss can lead to 10-20 kg extra material per ton of good casting.

Another effective factor is recycling of raw materials in charging. What's new in that? 30 – 40% foundry return is always recycled in the foundries depending on the casting yield. True! But still very often melter charges fresh steel scrap in the heat despite having heap of runners and risers in the scrap yard of melt shop. Product profitability get reduced drastically with each one percent additional use of fresh steel scrap. Moreover, inadequate and inefficient use of foundry return in the charge mix leads to huge inventory resulting into lowering the margin. The root cause of such situation in the foundry is mainly mixing of different types of returns in the scrap yard. For example, a foundry having two different grades of returns say one with 0.9% nickel and another with 0.7% molybdenum. Now if these two returns are not segregated and stored properly, this can't be used in the charge as the final composition can't be met. In this case melter will have no other option but to charge fresh steel scrap along with nickel (or moly) keeping the returns with these elements unused. Such wrong practice increases the raw material cost significantly. Therefore, segregating the various grade of foundry returns and storing those properly can be the easiest but game changing action in our drive to increase the foundry profitability.

- Energy savings: After raw material power and fuel consumption rate is another major contributing factor in the profitability. In a foundry with electrical furnace (induction/arc), power cost can vary from 10 to even 12% of the total manufacturing cost. Therefore, even a small saving in energy consumption shall yield notable improvement in profitability. Besides, selecting of right equipment, it is utmost imperative to gather the energy consumption data at various consumption points to the extent feasible. Analysis of energy consumption data is the first and most important step in the energy saving drive. Some of the most common causes (malpractices) of higher power and fuel consumption are found to be:
  - Idle running of auxiliary equipment (belt conveyors, blowers, large ID fan of DE systems etc.)
  - Unnecessary super heating of melt in the furnace.
  - Interrupted operations (frequent stoppages).
  - Prolong holding of metal.
  - Keeping forklift and other material handling equipment in start mode even when not in operation.

Foundry must ensure a robust communication system between the process owners (moulding to melting, sand plant to moulding, production to maintenance etc) to facilitate start and stop of various equipment efficiently.

For sustainable improvement in energy efficiency, an energy audit by competent authority and implementation of actions thereafter has been proven to be highly effective. Use of renewable energy, variable drive, interlocking in equipment are the smart options for the high level of energy optimisation.

Implementing eco-friendly practices also adds credit score to the foundry's reputation, which can be a selling point to environmentally conscious domestic and global customers.

Value Stream Mapping (VSM): This specific process keeps a good foundry different from average foundries. Both the Value Engineering (VE) and Value Analysis (VA) are truly a cross functional activity and mainly based on foundry's engineering strength and domain knowledge. Like human body or the society, in the foundry operation also with the growing age, lot of undesired elements, non-value-added practices, unnecessary operations, motions and people get added, incurring significant additional cost to the casting. Seven classic wastes which are generally addressed and

attempted to eliminate through VSM are Transportation, Inventory, Motion, Waiting, Overproduction, Overprocessing, and Defects.

Though this subject is complex and vast, foundrymen can do this practice in a simpler but effective way following the 5 steps as mentioned below:

Identification of the Value Stream (the process or product).

I. **Mapping of current operation.** In this stage, detail process flow clearly defining the input and output of each stage to be drawn. Quantity, value, time, people assigned to all steps must be defined.

II. **Identification of non-value-added activities**. These are mostly idle time, waiting time, excess inventory, rework, cris-cross process flow, unnecessary transportation etc. At this stage, it is highly important to refer the product specification, customer specific requirement, effect on internal customer (next and allied process).

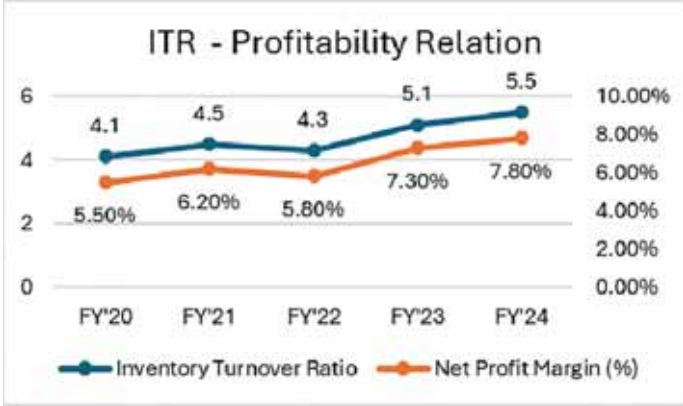
III. **Mapping of desired / optimum future state.** Benchmarking of similar product or process, competition mapping, and domain knowledge on the product and the process are important input for this all-important decision. Customer review and consent are MUST to avert any gap between contractual requirement and deliverable.

IV. **Implementation of changes/ improvements.** Time is the essence of this step. Prolong implementation period may damage the momentum of the team and the foundry will continue to incur higher expenses on each casting.

Foundry team engaged in value stream mapping must ensure that all the desired revised characteristics of the process or product are implemented only after customer confirmation. Value stream mapping and its implementation keeps the foundry casting and post processing operations slim and efficient resulting into sustainable profit in foundry business.

Inventory optimisation. For a highly material intensive industry like foundry, cash flow is very often more important than the profit itself. Significant working capital is required to purchase raw and bulk materials (scrap, pig iron, ferro alloys, sand and additives etc.), massive electricity bills, payment of salary and wages etc. Poor cash flow can lead to delayed payments, disrupting production and reducing efficiency resulting into lowering the profitability in the foundry to the great extent.

Besides 10-15% efficient foundries, most of the foundries in India overlooked (unaware also) this important cost parameter.



Inventory turnover ratio (ITR) is the key and mostly used indicator of any plant's material stock health and a regular dashboard light for the finance head of the foundry. Though the desirable ITR for foundries varies from one to another depending on the factors like type of product, customer sector, manufacturing process, plant location and the procurement process, typical ITR may vary from 4.5 to 6.5 in Indian ferrous foundry sector.

Foundry net profit margin is directly proportional to it ITR (a theoretical representation is shown in the chart). Therefore, in our drive to increase the profitability in the foundry, it is one of the priority tasks to optimise the inventory at all stages i.e. raw material & store consumables, work in progress and the finish good. For such important and priority task, engaging any consultant or managing complex financial spreadsheet are not required if foundry managers can simply work on the following smart ways by:

- Defining re-order level of top cost contributing materials.
- Reducing the throughput time (procurement to despatch).
- Adopting Just In Time (JIT) approach to the extent feasible.
- Reducing rework by improving product quality.

This is also a fact that in many small-scale foundries in India, the inventory is automatically maintained at lowest limit due to over sensitivity on cash flow. However, maintaining a very low stock level to improve the cash flow and thereby increasing the profitability may not be smart choice always as it may lead to stoppage of production due to sudden interruption in supply chain for the reasons beyond the control of the foundry. So, it is preferred not to reduce only but optimise the inventory to the best of your foundry scenario.

Efficiency building: This is the absolute basic amongst the six aspects of this REVIEW methodology. Having a state of art equipment and infrastructure, modern technology can't

guarantee the increase in profitability of the foundry if the efficiency of the people and overall process are not adequate. Foundry, being mostly the people dominant process (even with higher degree of automation), significantly dependent on the skill of individual and team in most of the small and medium scale Indian foundries.

Some of the most concerning areas in the foundry which always need high degree of skill and efficiency to prevent incurring additional cost are core setting, chills and chaplets settings, mould and core painting, fettling – finishing, and inspection. Efficiency as wrongly believed can't be improved merely by motivational speech and behavioural training only. Even random technical / vocational training also found to be inadequate to improve skill and efficiency of the people or the process. Efficiency improvement objectives must be exercised in a disciplined and systematic manner. An adequate and compatible Training Modules (TM) followed by well spread Training Need Identification (TNI) covering all layers of foundry employees are the two stages to be designed and derived first. Thereafter, a detail training calendar, monthly and weekly training schedule clearly assigning the faculties and the trainers should be prepared before conducting the trainings. A training effectivity checking mechanism also to be followed as a part of this efficiency and skill improvement process. Small Group Activity, Quality Circle, KAIZEN, Personal Productivity Improvement (PPI) etc are the mostly used tool to engage the workforce in efficiency improvement process. A skilled and efficient workforce is the most valuable asset in the foundry industry for making and sustaining profit.

- **Waste elimination:** Waste is a cost, and elimination of waste is naturally gets added to the profit. In a true sense, most of the wastes from the foundry business process can be eliminated with the practice of efficient Value Stream Mapping (VSM) as discussed in this article. But in a foundry, there are many other wastes which add significant (also hidden sometime) cost to the casting and generally either overlooked or ignored. Besides the seven classic wastes as mentioned in the VSM, following wastes must be eliminate to the extent possible to increase the profitability of the foundry:
  - **Knowledge & skills waste** - Very often it is observed that foundry having people with multiple skill, knowledge and expertise but use them in confined locations with limited responsibility only. In case of requirement of other skill or knowledge, foundry hires another person causing additional manpower cost. Whereas a thoughtful deployment of manpower based on skill and appraisal matrix can reduce the manpower cost significantly with a bonus of high degree of motivation to the employee.
  - **Space waste –** Unused floor space, excessive storage area are the common waste in most of the Indian foundries. Floor space being one of the costliest cost input, this is utmost importance that each square inch is used efficiently in the foundry.
  - **Environmental waste –** Foundry due to its inherent nature of process generates huge amount of waste in terms of used sand, slag, paints, oil, resin and chemicals. Inefficient ways of storage and disposal of such waste can be a major cost contributor to the foundry. On the other side a proper recycling of some of these materials can bring back money to the balance sheet of the foundry. Slag processing, use of disposed sand in construction are some of the good practices should be considered seriously to increase the margin in this foundry business.
  - **Communication & decision-making waste** – Planning, Reviewing, Standard Operating Procedure are definitely part and parcel of the modern business management but overdoing such exercise and practising a critical hierarchy system in the organisation can put a big dent in profitability in many ways. Some of the mostly observed such wastes which must be eliminated carefully and smartly are
    - Delays due to poor information flow.
    - Unnecessary meetings and misalignment among departments.
    - Waiting for approvals leading to process bottlenecks.

These are the six steps of simple R E V I E W mechanism to make, sustained and improve margin in the foundry. Adhering to the fundamentals, remain practical in approach, believing in and improving the team's capability and most importantly keeping the eyes open on each waste are the basic mantra of keeping the book healthy in foundry.

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