Internet of Things (IoT) a Boon for Smart foundry 4.0

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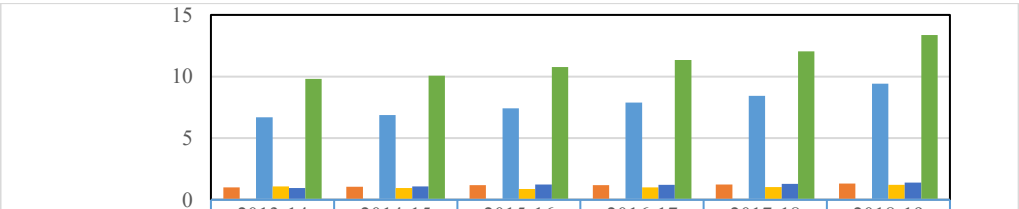
***Abstract*- 21st century is the era of internet and electronics, these have expanded into almost every sections of life, from domestic to space technology, The cutting edge technology can be utilized for manufacturing industries and in particular foundry industry as its present trends not energy efficient and undergoing many challenges, by using IoT resources into foundry industry leads to new innovations, for example, the Internet of Things (IoT), enormous information investigation, distributed computing and cybersecurity to adapt to framework unpredictability, improve the process execution, and increase upper hands in the rate of production. This is and advanced tool for speedily empowering efficiency of the foundry industries by digitalization of foundry process in reducing the rejection rate, power saving, manpower, industrial pollution can be controlled and condition monitored by using IoT with virtual ventures in the internet.**

***Index Terms*- Internet of Things (IoT), Foundry 4.0, castings, Automation, Quality, Rejection**

I. INTRODUCTION

The Indian foundry industry producers metal cast segments for applications in Automotive, locomotives, marine, agriculture equipment's, Machine devices, Defense, Aerospace, Earth Movers, Cement, Electrical, Pumps / Valves, turbine generators and so forth. Foundry Industry has a turnover of approximate 1500 billion rupees.

There are approximately 6000 units in India out of which 90% can be named MSMEs. Approximately 600 units are having International Quality Accreditation. Only a few large foundries are present day and internationally serious about their upcoming challenges as they are facing several difficulties like skilled labor, government pollution norms, waste disposal, changing technology of machineries and as a consequence huge capital is required. India produces castings at an estimation of 11 Million tons in 2018, and is normal extend at a compound yearly development rate (CAGR) of ~12.7% from 2018 until 2023 [1]. The fig.1 shows the production rate of castings in the country and is second largest casting manufacturers in the world followed by China in the year 2018-19.



	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
SG Iron	1	1.07	1.18	1.18	1.23	1.31
Malleable Iron	0.06	0.06	0.05	0.05	0.05	0.05
Grey Cast Iron	6.7	6.88	7.41	7.89	8.44	9.41
Steel	1.1	0.968	0.88	1.01	1.03	1.21
NonFerrous	0.95	1.093	1.25	1.22	1.3	1.4
Total	9.81	10.071	10.77	11.35	12.05	13.38

Figure 1, shows the Foundry castings production rate in India (Million Tonnes)

Sector wise consumption of Casting

The market survey shows the distribution of foundry castings are catering to some specific end-use markets like automotive, locomotive, energy, diesel engines, machineries, pipe fittings etc. in which automobile sector is the largest consumer of castings. Fig. 2 shows the general view and subdivisions in the foundry industry.

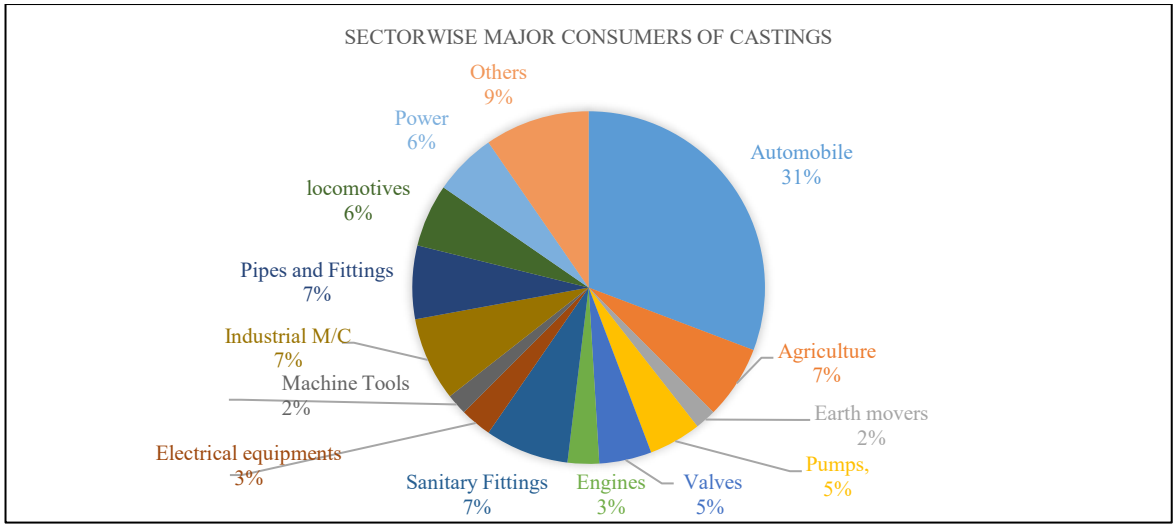


Figure 2, shows the sector wise major consumer of castings

A general foundry industry comprises of many sections as shown in fig. 3, where each section has many variable significant contribution in producing the quality of castings. Despite everything stays a workmanship, with immense factors and changes, there are a few zones which have advanced into a science, giving a likelihood to build up regulate the framework, A great deal of quantifiable data has been collected and broke down prompting take the foundry from "workmanship" to "science" by automation. Earlier till last decade all foundry section activities were carried out by manual process, during the period of foundry being workmanship, the creation procedure likewise was manual, a greater amount of the Industry 1.0 level, requires skilled workmanship to reduce the rejection rate, and even as we are in the year 2018 there are a few foundries in India which are at 1.0 to 2.0 level gradually started shifting to mechanization of processes only to smaller capacity as there was no data available and large capital investments in order to streamline the process by automation [2]. The foundry needs the executives of various interdisciplinary engineers to evaluating the process variables in order to stream line the processes. The overall efficiency of the foundry process is comparatively low compared to other industries. Hence, presently foundry industry is facing lot of challenges for its survival due to many factors like skilled labor, industrial pollution, power tariffs, technology transfers and non-stable government policies.

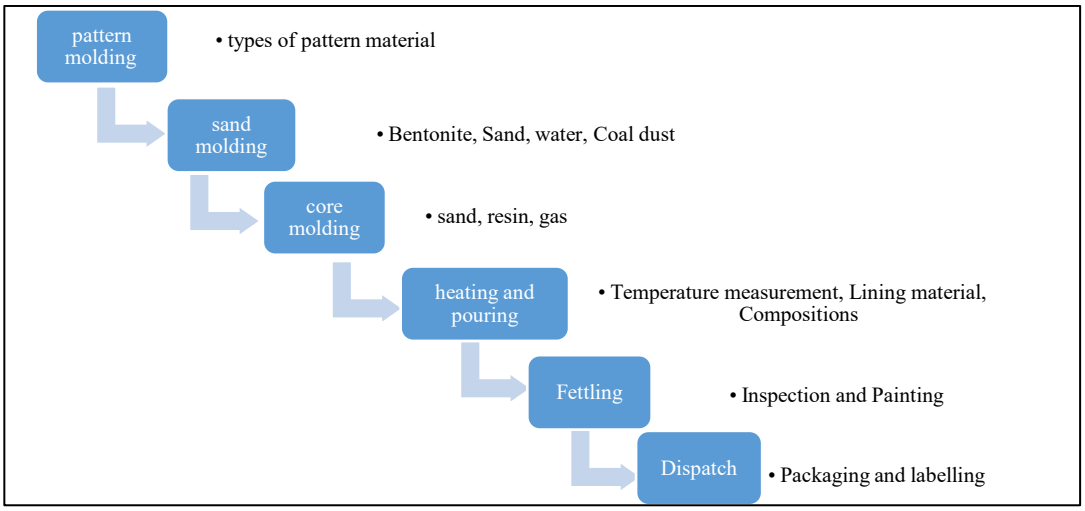


Figure 3, General foundry layout

MSME foundry Sector in a threatening situation

A large number of foundry units which are under miniaturized scale (MSME) (little and medium ventures) have confronted risk of closure. The Indian government is concentrating on foundry is a segment which faces a large number of talented laborers leaving this industry to decide on elective methods for survival [3]. Additionally, attributable to dubious government strategy, the up and coming age of existing foundry unit holders has begun relocating into high profit making industries.

Numerous foundry players need to redesign their units to overcome the labor problem by mechanizing the process, however as it is costly as it requires huge capital, small units can't bear the cost, and there are no supportive measures from government. The foundry segment in India is set to experience some significant development throughout the following four years, posting a Compound Annual Growth Rate of 19.67 percent in terms of income from 2013-2018.

Shortfall of Skilled Manpower

Presently Indian foundries are facing major setback due to shortage of skilled manpower, government is focusing on skill development of manpower named “Skill India” and also Foundry Development Councils, foundry clusters, Indian steel making councils started the training programs under the Branch of Industrial Policy and Promotion (DIPP) secretary and different partners has started many training programs but still problem is not resolved, and there is always shortage of talented workforce in the foundry industry.

II. IIOT AS AN ALTERNATE SOLUTION FOR SMART FOUNDRY 4.0

IIOT – Industrial Internet of Things is currently turning into a revolutionary empowering influence for foundries from any of the levels 1.0 to 3.0 to change to a Smart Foundry or Intelligent Foundry 4.0.

Foundry 4.0 isn't one innovation however a combination of present day innovations joined to make a 'clever industrial facility'. The 4.0 represents the fourth mechanical insurgency which from the start sounds extraordinary yet when you begin to take a glance at the potential outcomes it is anything but difficult to see how these advancements can turn out to be genuine game changers [4]. The principle point is to make more intelligent, progressively effective assembling through the utilization of SMART production lines in the not very far off future. As to the foundry business, this implies the improvement in effectiveness also, increasing speed of the procedures and processes.

Industry 4.0

Industry 4.0 is a name for the present pattern of robotization and information trade in assembling advancements. It incorporates digital physical frameworks, IIoT distributed computing and intellectual processing. Industry 4.0 makes what has been known as a "powerful processing plant". It is called Industry 4.0 on the grounds that it is the fourth modern instrument. The three earlier transformations of the cutting edge time are:

1. Motorization, water power, steam power
2. Mass creation, mechanical production system, transports, electric force
3. Electronics, PCs, IT, multi-pivot modern robots Present day data and correspondence advancements like digital physical framework, enormous information investigation and distributed computing, will help early location of sections, machine conditions, work progress, components, etc. and work progress lead and lag time, consequently empowering and increasing profitability, quality and speed of manufacturing by reducing the wastage of scrap castings. Huge information examination comprises of 6Cs in the coordinated Industry 4.0 and digital physical frameworks condition.

The 6C framework of Industry 4.0 involves:

1. Connection / Interface (sensor and systems)
2. Cloud (processing and information on request)
3. Cyber (model and memory)
4. Content/setting (which means and connection)
5. Community (sharing and joint effort)
6. Customization (personalization and worth)

Right now so as to give helpful understanding to foundry the board, information must be handled with cutting edge strategies to create important data.

In present world many applications and manufacturing industries are progressing very fast by improving their company's performance by implementing the industry 2 and 3.0 by robotics and automation, but they are not self-sufficient to advance industry or smart industry 4.0, Fig. 4, shows the growth of IoT in India, in the beginning of internet in 2003 was very limited and was used for only limited applications like banking and educational purposes, but now a days it has entered into almost every sector and reducing the human efforts.

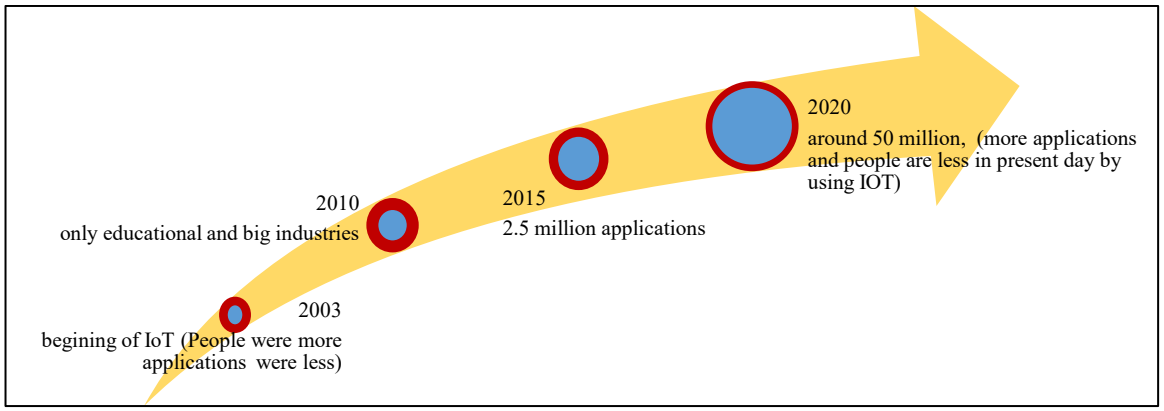


Figure 4, road map of Internet in India

Benefits of Foundry 4.0

The technology is always being a boon, if used in positive way. Following are few benefits.

1. Foundry 4.0 is not labor demanding. As conventional foundries are labor concentrated, subjected on the skill and experience of labors
2. Manufacturing targets can be achieved easily by automatization of the process.
3. Decreasing the cycle time.
4. Lower inventory.
5. Lower rejection rate, hence Quality product is obtained
6. Higher Productivity gain and higher profits.

III. UNDERSTANDING THE ELEMENTS OF BUILDING SMART FOUNDRY 4.0

When we have comprehended the procedure, we move onto the five basic components for Foundry 4.0:

Process Automation – This is the most powerful and testing component. There is no set procedure which will give a conclusive result where the item will be with no abnormalities. It is hard to advance something whose procedure isn't characterized. By assortment of information of procedures required over some undefined time frame, there can be greater clearness with respect to what are the criteria for ideal execution.

Machine Automation – Many big organizations are moving towards the robotization to its hardware. The foundry process should be reframed for reconciliation. The Process data needs to originate from Casting Manufacturer (Foundry) and they have to mutually work with machine producers to share their foundry information to conquer any hindrance.

System Automation – There are two issues in System Automation. Firstly, currently, there are Discrete Manufacturers, Discrete Platforms and Discrete Systems. There has to be a single layer to bring all of these together. Secondly, we are processing Electronic Records (ERP) which is doing a postmortem of the system instead of doing proactive system control. We have to go back the basic theories of Manufacturing Processes - Production Planning and Control (PPC), for which systems need to be seamlessly integrated and directed by demand. The system should be equipped enough such that, if an order is received, one is able to tell when the casting will be produced, which machines will be utilized, how much material will be used accurately.

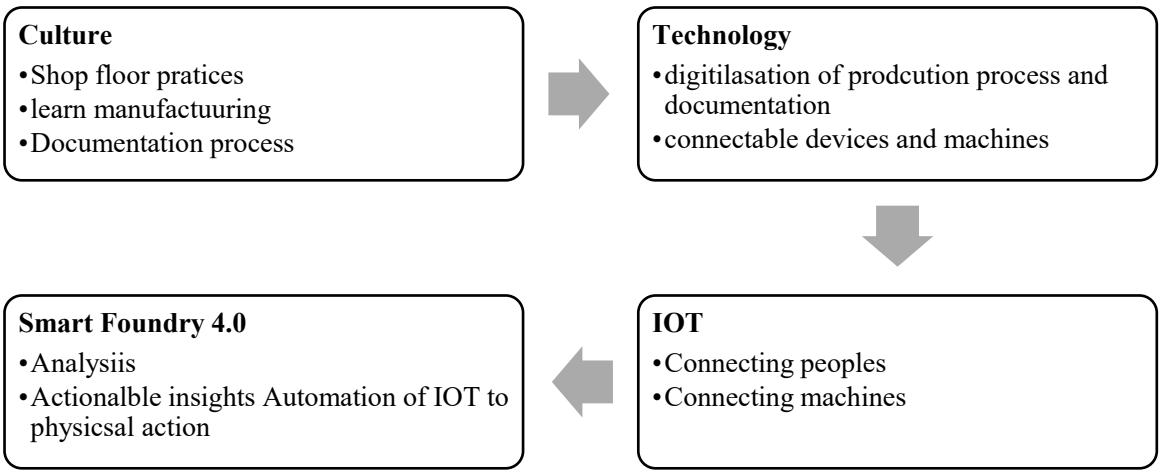


Figure 5, Steps to build smart foundry 4.0

Upskilling Human Resources – Presently in our country, the foundation for human resources are missing. SMART Foundry has to be managed by SMART and enabled people to make it truly Industry 4.0. The industry and colleges in India do not communicate with each other, neither is prepared to extend a hand and work with other. The gap can only be bridged when there is strong communication between the industry and the academia.

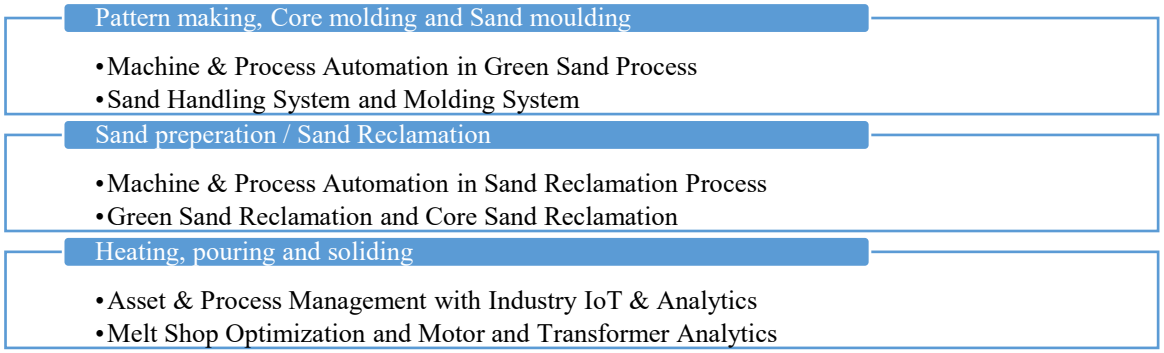
IV. ROLE OF IOT IN FOUNDRY

Everything is about DATA and all Decision Making or Business intelligence Tools Need to start with data Every Decision requires an Action or physical Activity to realize the goals IoT - Internet of Things collects Data & use decision-making Tools to provide actionable insights on the physical activity. In today's modern world technology is the strongest tool [5, 6].

Steps to build a Smart Foundry4.0

- Culture
- Shop Floor Practices
- Learn Manufacturing
- Documenting Processes
- Smart Foundry 4.0
- Analytic
- Actionable Insights
- Automation of Insights
- to physical action
- Technology
- Digitization of process production & Documentation
- Connectable Devices & Machines
- IoT
- Connecting Machines
- Connecting people

Different sections of foundry which are shown in Fig. 3 can be grouped into There are three verticals



V. CONCLUSIONS:

Foundry 4.0 is here, there is no going back. The rate at which industries are changing with Agility, Speed to adopt technology with a stable process base supported by an aligned business model are the key to success of Industry 4.0 implementation in Manufacturing Sector.

Industry 4.0 with IoT Machines believes Indian foundry industries has the ability and capability to align very quickly once we first accept we have to do it, secondly upgrade the Engineers to "thinking" assets instead of "clerical or unskilled man power" staff, thirdly engage with the academia for integration of the IoT/ IT/ Technology in Industry and lastly be ready to realign their business models with transparency, flexibility, adaptability. The foundry segment in India is set to experience some significant development throughout the following four years, posting a Compound Annual Growth Rate of 19.67 percent in terms of income from 2013-2018.

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