

Research Article

Casting a New Manufacturing Gameplan Thru 'Make in India'

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A B S T R A C T

To support the making of a powerful India, an initiative titled "Make in India" was instituted in 2014 duly complimented by National Manufacturing policy. This paper reviews the various imperatives and challenges, along with the success levels in light of Make in India, and measures in terms of the relationship of Manufacturing (growth) to GDP.

The various manufacturing options are classified, and a case is raised for preferences of founding as a dominant manufacturing process, in view of the capability for complex products, through its attributes or thru' flexibility. The challenges and constraints, if any, are also discussed. Thus, Grounded over the exquisite competence of founding, the paradigm of 'Cast in India' is proposed.

For a competitive benchmarking the case of China is considered.

Keywords: Cast in India, Foundry Workers, Zero Defect, Casting Technology Qualtek-nology

W'how the Indian Manufacturing Got Starved?

In not so recent past, India's (Economic) story was full of pessimism. The imports of mobile telephonic instruments, computers, laptops and other electronic gadgets were unavoidable as the local manufacturing competencies had not kept pace @ global technology boom. The cheap imports of fast moving consumer goods and even capital goods, consumables and many innovative products had all started squeezing our hard pressed industry further. Gross Domestic Product (GDP) was though growing, but the numbers were essentially bloated with inflationary pressures and proverbially, not with actual dough into the bun as shown in Figure 1.¹

Though India's Gross GDP, through the two decades, was on the rising spree, considered net of inflation. It was seen to rise from 60 trillions of INR as on 2006-07 to nearly 130 trillions of INR estimated for 2017-18, yet it was not securely grounded. It is because it was not secured on

the contribution of manufacturing, as the manufacturing underpins the actual backbone of any country. Data wise, India's GDP grew from being marginally above 4.5 percent in 2012/ 2013 to 4.9 percent in 2013/ 2014. But manufacturing growth performance declined to 0.2 percent in 2013/ 2014 compared with a 1.1 percent growth in previous year. Against this performance in manufacturing growth as on 2012/ 2013/ 2014 and the erratic performance, the situation is now trying to stabilize, though with limited success. Broadly seeing, the percentage of the manufacturing industry in India's GDP has come down to 15 percent in 2017 from 17.4 percent in country's overall GDP in 2006,² dragging down simultaneously the overall economy.

Given, the contribution of manufacturing into GDP was erratic over the years and so was the manufacturing IIP growth (as in Figure 2), it could be said that the manufacturing processes were not in control. The quality guru Dr WE Deming argued that 96% of the problems³ are system level problems, that were assignable to the

higher level causes and the manufacturing industry could be seen as responsible for only 4% of the causes. It could therefore be said that this manufacturing stagnation was the after effect of wrong ministerial/ governmental support or wrong policyming. Hence the Make in India paradigm was a welcome policy initiative.

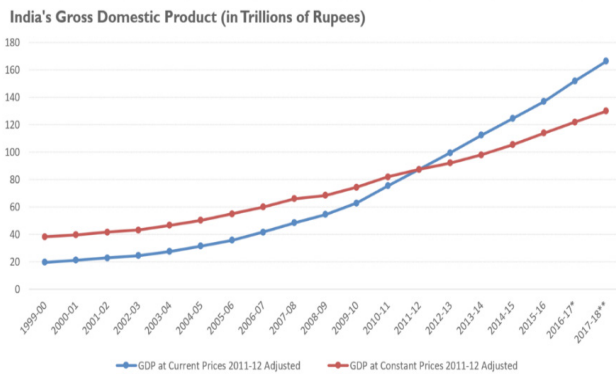


Figure 1. The India's Gross Domestic Product, Actual and Adjusted Net of Inflation¹

The manufacturing IIP is falling too..

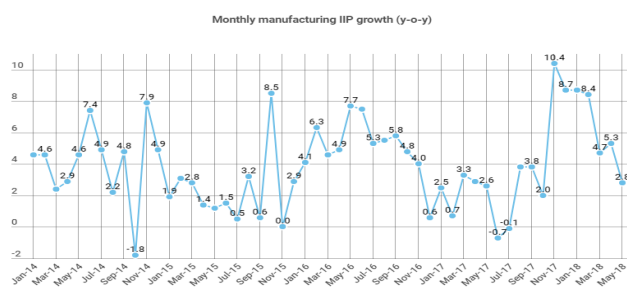


Figure 2. The Erratic Behavior of Manufacturing Growth¹

Techno-economically 'Make in India' paradigm was guided by the premise of Economist Nicholas Kaldor, who stipulated that there exists a close relationship between the growth of manufacturing output and the GDP of a country.⁴ As Kaldor theorised "Manufacturing as the Engine of Growth", it gave credence to objective of improving manufacturing for the ultimate affluence of any nation.

But first, why and how (w'how) Manufacturing is so vital, needs be earnestly considered and evaluated? To recall, on February 17, 2014, Finance Minister P. Chidambaram⁵ referred to "manufacturing 15 times", while talking about the state of the economy. He summed up the scenario aptly proclaiming: "Manufacturing is the Achilles heel of the Indian economy. The deceleration in investment in manufacturing is particularly worrying. Consequently, there is no uptick yet in manufacturing". Unfortunately, such a mention was only a validation of 'an awareness' at the level of a finance minister, but never backed by a serious intent of doing something worth while to abort from the situation (for a prognosis to this act refer to exhibit 1).

Exhibit- 1. The Economic Freedom of the States of India 2013 Report on Lack of Investment

The Economic Freedom of the States of India 2013 report, put together by the Cato Institute and Indicus Analytic, estimated that the Indian average for what is basically a promise-to-projects metric comes out to about 6 percent: which means, that in the states evaluated in 2010-11, only 6 percent of all the amount promised actually turned into investment. Mere investment proposals or securing expressions of interest will continue to make hollow news headlines.

Ref⁶

The drop in contribution of manufacturing industry was attributed to largely:

- China's euphoric growth of manufacturing industry which makes a relative contribution of about 30%.⁷
- The shortage of competent workers locally, in view of higher demand further pressurized by technological pressures, which viciously enforces poor deployment of resources into their development (for their upgradation, lest they are wooed by their competitors).
- Decline in skilled jobs over the years in India Annual Survey of Industries (ASI), in 2011-2012 surveyed people engaged in factories declined from 13.43 million to 12.95 million a drop of 3.6% (480,000) inspite of 2% increase in number of units.⁸
- Lower prospectus of manufactured products in India due to plethoric dumping and unstable governmental policies.
- Ignoring India because of poor infrastructure, the erstwhile 'Make in west' and 'manufacture in China' policies greatly enhanced 'volumes-led' manufacturing. This led to a manufacturing boom in China that asymptote global prices. Consequently Indian goods became high priced and uncompetitive.
- Erratic energy supply and higher administrative interference that caused interruptions in production activities. These restricted performance and hence competitiveness of Indian Industry.

All above listed factors added to the vicious story of discouragements to the struggling industry and also the startups, resulting into a lost interest of entrepreneurs or would be entrepreneurs as and when the indices fell.

Moreover, the shying away of manufacturers from their workplaces and the general lowering of euphoria in Indian economy, both concurrently facilitated loss of competitiveness of Indian industry. It not only impacts the jobs which were lost as a result of being in competitive, increased mechanization etc. but also leaves economy as unpredictable, even critical and subject to vagaries of threats.

This, notwithstanding the increasing additions 'youth' as a consequence of population boom at the eve of 21st century in India, further burdened the job market; as 7mn plus work seekers entered the job force every year,⁹ while only 0.41mn jobs were created in 2016-17 against such a requirement. This unemployment sure was expected to threaten not only the growth of GDP in coming years (which was already erratic as evidenced in Figure 2), but additionally serves to provide proverbial air to fire the fuel of social and unsocial problems of various sorts.

The Breakthrough', Thru' "Make in India"

Perturbed over the falling performance of manufacturing industry and the consequent shift to service sector, high imports of fast moving consumer goods and even capital goods and increasing gap in imports (over exports), the criticality was (recognised and) acted upon 5 years ago by the changeover in party to man government of India. The new Prime Minister Narendra Damodardas Modi finally launched the assault-against the deteriorating economics, on September 25, 2014, engineering a correctional programme titled "Make in India".¹⁰ Such was essentially a promise and assurance by the new government to improve business environment by easing processes to do business in the country. The strategy was three pronged:

1. By help the existing Indian SME' to effectively further the manufacturing environment they indulge in
2. By enthusing new investment by Indian entrepreneurs to set up manufacturing ventures
3. By inviting Foreign Direct Investment (FDI), and also set up Made in India manufacturing facilities, including those which may be relocating out of China

Rightly so, to facilitate the third objective, India has already improved our rating as on 2018 in terms of the global ranking in 'Ease of doing business' to a level of 77, upward from 142 on 2014 across 190 economies.¹¹

The Jugad for National Revival:

Policing through "Make in India", the government envisaged to activate not just rapid growth of manufacturing, but also enable providing a ground where manufacturing assumes a lead role so as to fuel India's growth process. The modus operandi is through value oriented manufacturing, complimented by innovations.¹² In this way, Make in India initiative endeavoured policyming and implementing measures which should aim at raising the contribution of the manufacturing sector to 25% of the GDP by 2020 (from current 15%). The experts view 'Make in India' initiative as a comprehensive overhaul of processes and policies, as they notice a complete change of the mindset of bureaucracy who are advised to not only practice, but also demonstrate. 'Minimum Government, Maximum Governance'. the new tenet of Modi's Government.¹³

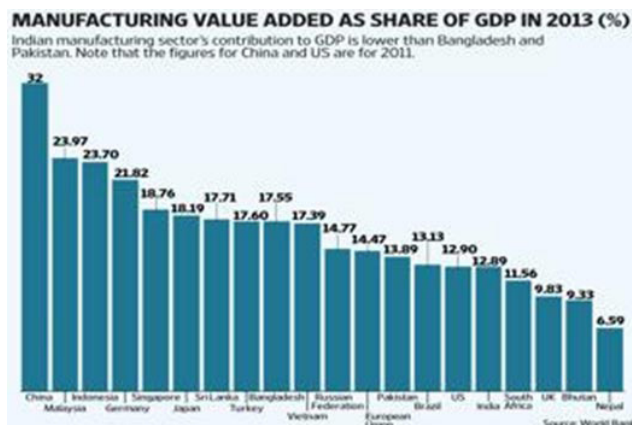


Figure 3. Share of Manufacturing into GDP for India, Bangladesh and Pakistan as in 2013¹⁴

The 'Make in India' gesture was indeed an incubator for the patriotic fervor for the manufacturing sector in addition to the hopes of recovery from recent rough weathers. It is because the previous performance (say of 2013 from Figure 3) was indeed more than shameful, especially when we compared it with those of our neighbours Bangladesh (manufacturing value added as share of GDP at 17.55%) and Pakistan (13.89%) who were superior to that of India (12.89%).¹⁴

Given Prime Minister Modi's initiatives to connect with global leaders, he generated confidence, duly grounded with "make in India" strategy, spelled sincerity in his 'invitations' to potential partners and investors around the world, to invest in India both directly and through strategic partnership. The concerted action gave effect to the institution of a National Manufacturing Policy (NMP).¹⁵ Concurr Pollard, (1990) "Industrialisation should be seen as a single global process, in which individual countries follow different paths depending on their initial conditions and moment of their entry into the race".¹⁶ The manufacturing sector is expected to accelerate to 8.3 percent this fiscal while, India's GDP is expected¹⁷ to grow at 7.3% in 2018-19. However the challenge remains to improve upon the consistency in performance of manufacturing growth.

With recent endeavours @ NMP, whose objectives are stated below the ailing situation of industrialization is likely to be reversed. The various purposes of the initiatives are detailed as:

- Creating millions of jobs in the country.
- Making India a global manufacturing hub.
- Ease and improve local manufacturing skills.
- To encourage Domestic companies and Multinationals to manufacture their products in India.
- Attract foreign investments. And saving of some foreign exchange outgo to reduce the foreign exchange deficit which had dwindled as a result of hardening of prices of crude globally.

- Policymaking to shape ecological values. This because 'Modern day ethical dispositions value dimensions of safety and environment more than quality and productivity reading between the lines.¹⁸
- To fully exploit the tenet of 'desi' innovation-termed Juggad in manufacturing.¹²

The proposal to make India a competitive nation in terms of manufacturing performance and/ or global manufacturing capacities, as envisaged in NMP calls for increase skill levels of people. This will also serve to improve their earning power while enhancing equity with growth. Well! Until each link of the chain is strong enough, prosperity in the system cannot be achieved to its fullest designed state¹⁹ These imperatives are inherent elements of the chain namely:

- By inculcating Jugad 'desi' Innovation (also called frugal engineering), which is a subset of improving skill level of people.²⁰
- Through tapping of new avenues or opportunities for manufactured products .
- Facing the challenges of investments and growth to keep the right balance, while abating the imports of capital goods.

The Imperatives of Job Provision Versus Resourcing Manpower for Manufacturing:

Before we discuss the cult of innovation, it is worth while aligning the potential workmen for the manufacturing role. Statistically as per *National Sample Survey-2009-2010*, Manufacturing employed 12% of the Indian workforce or about 53 million people,²¹ (currently about 15%) which should be enhanced to 26% by 2022 by creating 100 million additional jobs *in the manufacturing sector alone*.²² This is also expected to serve the rural population who were hitherto dependent upon the agricultural economy and are now shifting to the cities. The urbanization is not only a necessity for manufacturing sector but also a savior for the agricultural labour which (occupation) is increasingly becoming unremunerative because of lower increase of agricultural income in view of both dissection of field sizes with enlargement of families and also because of overall inflation whose benefits does not accrue to agriculture, being at the starting point of hierarchy. A McKinsey report projects that urbanisation will increase to 38 percent from 29 percent over 2005-2025.²¹ These migrant workers will deserve to be skilled in various vocations of manufacturing, given their low levels of education vis-à-vis those required for services sector.

Given the need to rejuvenate manufacturing, NMP sought availability of skilled people in manufacturing to enhance it to 12% to 14% over the medium-term period in early 2015 and push it from current 16% to 25% by 2022.¹⁴ But to meet such levels the Indian Industry shall have to

augment both the capatence (capacity + competence) and the manufacturing culture. Especially where the processes are complex, the role of people who must govern those processes becomes more vital, as industrial sophistication is proportional to the complexity of the processes.²³ The capacity is enhance able by increment of resources (infrastructure, technology, plant and machinery) and competence by people and their accent on Qualtek-nology²⁴ (Quality, Knowledge and Technology). Further the policy or trainers need to facilitate the "process of change duly set-in, in motion, in last few years [capable of] increasing quality-productivity and environmental awareness and the trend is likely to sustain with attendant inputs in technology, improvements in methodology, culture and system conscientiousness".²⁵ It is because, both the quality levels integrated into the production (product) and also into the processes and zest of production are important. Hence it is vital to educate the people to achieve desired competence and Qualtek-nology. Thus the initiative NMP solicits supporting the migrating population from rural to urban was rightly supported with the policy of deifying unskilled-intensive sectors more without defying (Skill Intensive) sector.²⁶

Thanks to such policy initiatives, the employment in India is projected to witness marginal increase between 2017 and 2018. Though the International Labour Organisation (ILO) released its 2017 World Employment and Social Outlook

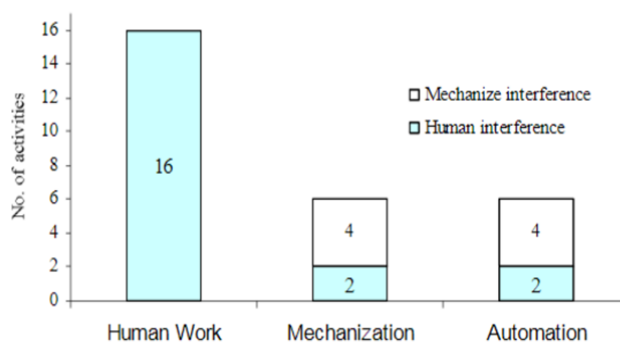


Figure 4. The Impact of Human Interference and that of Mechanization w.r.t Human Indulgence

expects this as stagnation in job creation.²⁷ This is also attributed to extensive mechanization and automation since these improve both the unit's competitiveness, improve quality and also grant better execution of planning for productivity. The human reduction is enabled by mechanization since the capacity of doing work is greatly enhanced, worker's fatigue gets reduced and both speed and safety of doing work is increased. The extent of mechanization or automation reduces the human involvement in a proportion as shown in Figure 4.

As per estimates, the unemployment in India is projected to

increase from 17.7 million last year to 17.8 million in 2017 (say 3.4 percent in 2017-18) and 18 million next year.²⁸ The corrective and preventive action is through their expeditious deployment in newly generated manufacturing activities. It is recommended that as a strategy, “the goal of creating a skilled workforce has to be coupled with corresponding employment opportunities for the youth,²⁹ without which it will not resolve the core challenge of unemployment in the country”.

Shah³⁰ quips ‘Policy consistency and coordination is essential if we are to achieve inclusive growth and significantly reduce unemployment. Productivity and investment-led transformation can inject new dynamism into the economy and ensure future growth, employment and prosperity’.

However, such policyming attributes and the various initiatives are not likely to abate the manufacturing bottlenecks, much of it is because of the lacking competencies of people, including those who are classified as skilled. Additionally there is poor attitude of unskilled workers and poor people’s zeal of considering workshop as a sequel of worship.³¹ Ucharia reports the poor state of employability of Indian engineering graduates,³² attributed to lack of workshop skills. Such bottlenecks are the sore points impacting possible success of Make in India initiatives. Viz the report in economic times quoting McKinsey’s survey that only 6% students are prepared for active deployment,³³ without having been subjected to dedicated skill improvement and alignment initiatives. The three issues which limit their competence are (a) lack of technical skills, (b) poor awareness of Principles of Quality engineering & Management and (c) lack of team culture for project management and competitiveness.³⁴

Well, since the manufacturing sector offers special opportunities for capital accumulation in developing countries, the expenditure on training and education will be worthwhile. Also because the productivity is higher in the industrial sector than in the agricultural sector, the transfer of resources into manufacturing (from other sectors viz agriculture and services) promises a structural change bonus.

The various initiatives guided by NMP include expeditious removal of the obstructive barriers to active industrialization, which have been now made transparent and user friendly (as demonstrated by the improvement in ranking for ease of doing business). These have further helped drive investment, develop skills, foster innovation, protect IP and build best-in-class manufacturing infrastructure.³⁵ The most striking indicator of progress is the unprecedented opening up of key sectors-including Railways, Defence, cheaper transport system through Indian rivers etc., which will not only facilitate manufactured products enriching supply chains system and also fire up manufacturing for

servicing these industries.

The Paradigm of ‘Cast in India’

From the aforesaid discussion we conclude that Reviving manufacturing and making the sector internationally competitive, which have been the twin goals of the Make in India program and underpinned by a strategy of reducing the costs of doing business³⁶ is the right mantra for increasing the inherent strength of India. Since the manufacturing composes of five technologies or processes, namely shaping by:

- Metal cutting

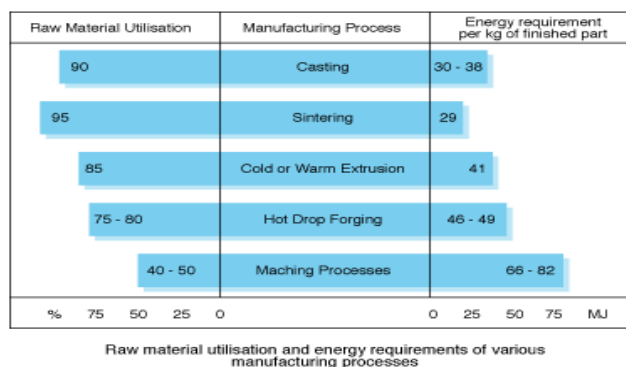


Figure 5. The Relative Contribution of Raw Material and Energy on product’s competitiveness

- Metal forming
- Metal casting
- Metal joining
- Powder metallurgy

A competitive comparison of these methods (in terms of cost and its components-energy consumption, raw material wastages), as in Figure 5, suggest though powder metallurgy is posed as the best method, looking at the cost of powder and the limitations of component size and complexity, the flag is handed over to next close method which is metal casting.²⁴

Over a critical comparison of the two, the metal casting (though at a relegated place w.r.t. particulate technology) scores to be a leader in terms of the race in meeting size and complexity of the product. The size could be small enough or a large one with theoretically no limits. The achievement of complexity has no bars, which can be achieved mostly independently, with an added facility of integration of parts before solidification. Thus with flexibility abound: of the choice of blending of methods, a great product can be suitably developed after integration of specific products (produced using other methods in the list of five methods) of chosen attributes.

Such a paradigm may be advocated in concepts, but not practically exploited, perhaps due to several reasons viz:

- The per se casting technology is critical of process irregularities and thus the foundmen are invariable involved in fire fighting rather than devoting to innovation.
- The foundries are dirty and the excessive and frequent accumulation of used sands/ wastes tend to drive away the spirit of thinking beyond.
- The inadequate understanding and evaluation of revered strengths of products produced by other methods and their strategic deployment.
- The lack of use of innovation due to environment full of process noise (of signal to noise character).
- The lack of competence in designing of complex cast products.
- The lack of competence in product designing & methoding.
- Lack of quality of skills and education in totality for manufacturing with due process grounding in that of founding.

Most of above imperatives may be overlooked as vital requirements by most foundrymen, essentially due to involvement in managing the common day-to-day challenges faced by foundrymen. These are difficult because of the complicatedness of the various recommendations in terms of identification, practicability, validation and benefits. These are constituents of the philosophy of 'a paradigm', which in the parlance of science and philosophy, is defined as being "a distinct set of concepts or thought patterns, including theories, research methods, postulates and standards for what constitutes legitimate contributions to a field".³⁷

We discussed the paradigm of designing complex cast products, which must in turn increase the competitiveness of manufacturing. Addressing complexity by design linked innovation, in competitive product development, it tends to improve competence. Guruprasad seems to support a graduation in design, basing on the fact that "the balanced growth theory as guided in Make in India is an economic theory pioneered by the economist Ragnar Nurkse which hypothesizes that the government of any under developed country needs to make large investments in a number of industries [in terms of use of the 5 methods as above] simultaneously. [Thus the industry which uses the paradigm in question relates to solely manufacturing, nevertheless these are all different and distinguished in terms of the different product attributes of 5 methods. Their qualification and exemplification though cannot be covered in the scope of this paper]. This [integration and/ or diversification] will enlarge the market size, increase productivity and provide an incentive for the private sector to invest".¹³

Afore stated defend for the cast products is based upon technical reasons. The commercial reasons in support of

new investments into casting industry in India are also many. Viz.

- Interruptions in China's foundry industry due to strict environmental norms. At least 10 percent of Chinese foundries are not able to meet the advanced technical and environmental demands.³⁸
- The increase in running cost due to cost of labour which is likely to rise even higher i.e. fourfold from the current levels.
- The American trade barriers is likely to impact Chinese foundries severely, since they already have excess manufacturing capacity in their 2.6 million foundries. These American sanctions/ trade barriers on China are likely to benefit Indian exporters.
- The trend of shifting of production preferences away from foundry, into more value added products in electronics etc.

The indications in favour of Foundry industry's rejuvenation are already evident. E.g. India has surpassed the Chinese growth rate by more than 250% (@ 15.70 % in last 4 years versus China 6.07%). Considered for last 8 years India excelled China by more than 150 % (India at 52.49% in last 8 years c/f China 33.71%). Thus with a better trend for Indian growth, the potential behoves well.³⁹

The Potential in the Paradigm of 'Cast in India'

Given that India is fast graduating in 'Make in India' scenario in terms of quality infrastructure, eased regulatory controls and in ease of doing business, the foundry industry should also attempt to fully respond to the national call. The action points are to have a renewed thrust on our improving export competitiveness, R&D development and market development for quality raw material supplies and the competence to cast and supply complex castings.

Riding over such requirements, the Indian foundry sector has launched an investment of 500 million dollars in the last two years for expansion and modernization, Thus the industry is planning to grow @ about 13-14% per year in the next two years. This however has not included the potential of growth in case the 'Cast in India' initiatives are incentivized, in line with policyming on 'Make in India and Ease of Doing Business' and relaxing of FDI norms by the government of India.⁴⁰

In order to catch up with the lead, Chinese Foundries leave India Foundries behind. It requires both learning thru emulation and also innovation. To understand the former schema that China pursues, Indian Foundry should also master advanced casting technologies with clear targets. Viz Chinese foundries are incentivized such that 50 percent of them modernize to match by 2020 the technology standards of foundries of developed countries.⁴⁰ They should also match, if not better, the competitiveness so as to acquire

a global market share of 20 percent. Evidently, apart from competence, the organization must invest in their business process so that they may help themselves to become fit for future. The global trend is to become lean and thus pursue cleaner and green technologies.⁴¹ The Chinese foundries have thus fixed levels of achieving a 10 percent reduction in energy consumption and a 15 percent reduction in industrial waste.

Other requirements could be the control of supply chain processes, so that delivery schedules and requirements are maintained. Better control of supply chain can improve utility of manufacturing.⁴² support supplier is responsive to customer requirements, changes, necessary documentation, qualification w.r.t quality, environment, energy, safety, information security etc. standards.

The foreign buyers expect assurance of quality in terms of required tolerances within narrow limits and freedom from defects. Since the rejection rate of cast components after machining can be significant and inventory models of raw castings can be complex, to woo global casting sourcers, the people at foundries need to act more professionally and proficiently, such that they serve distant customers without any issues left to chance and which have a chance to bounce back. Thus avoiding all deviations from specs should be the first and foremost motif for the industry.

The wise counsel today is to implement preventive action, rather than correction and corrective action. Since the foundry processes are complex, it is difficult to implement zero defect approach. Notably there are in all 31 types of defects where a maximum of 19 defects may be influenced by each of 11 process parameters. It implies that if one of the process parameter suffers a deviation, then any or all of the 19 defects in that basket may be impacted both positively or negatively. Today, it is time that the lost Meaning is researched.⁴³ Say, our productivity stays at the mean: of production while lowering the consequences of production.⁴⁴ Both the men and the processes they control-additionally be made lean.⁴³ Thus the study and realization of risks or change in conditions or process parameters becomes vital for which due understanding and experience is not enough. Rather a higher level of iterative and interactive competence will be necessary to predictably manage the defects.

The foundryman and the organization aware of the interactive nature of foundry processes and variables⁴⁵ are duly challenged to explore, innovate and succeed towards production of a casting, continuously meeting the specifications, customer requirements and closer to the world class standards.⁴⁶

Conclusion

Indian foundry industry has slowly positioned itself as a

dominant contributor of cast products displaying better growth than that of China in recent years. However it is still obsessed with various difficulties. Before 2014 the manufacturing sector per se was also starved and manufacturing growth erratic, with contribution to GDP declining. This gave lead to the National Manufacturing Policy and the 'Make in India' urgency, that has shown some effectiveness to rejuvenate manufacturing.

However, in case of Foundry industry, unlike this 'Make in India' initiative is adapted towards the foundry sector the necessary acceleration in solicited growth cannot be achieved. This paper reiterates the need for a "new knowledge infrastructure, and new economy @ competence. Integrating over manufacturing knowledge, with quality for sustenance"⁴⁷ applied to Foundry industry, For its enabling, and to gear up the success of 'Make in India', the paradigm 'cast in India' in which way the foundry industry should feel inclusive and feel responsible to further the objectives of NMP is proposed. However, such an adaptation of 'cast in India' is also required to facilitate (i) fresh capital for upgradation of technology (ii) policyming to sort out resource difficulties, (iii) help graduate specific competencies such are required by the foundry operators, (iv) the initiation and application of quality-technology-knowledge (Qualteknology) and innovations into design and development, product and process improvements.

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