



# **OPERATIONAL EXCELLENCE IN INDIAN MANUFACTURING**

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## EXECUTIVE SUMMARY

The Indian manufacturing sector is striving for operational excellence. Companies are restructuring operations and adopting world-class practices in their bid to expand profits and become competitive globally. The implementation of lean manufacturing practices in the automotives sector has helped companies to cut costs and improve employee productivity. Consequently, auto companies were able to offer reduced prices to enhance competitiveness.

Indian manufacturing companies are laying more emphasis on quality. Manufacturers in the country have extensively adopted the total quality management (TQM) approach. Consequently, the sector currently enjoys a cost advantage of 15 -20% compared to 2000. Increased focus on quality has also helped companies in this space to bag a number of CII-Exim Bank Awards for Business Excellence and Deming Prizes.

Manufacturers are using captive plants to meet a part of their energy requirement in an attempt to decentralise. Engineering, metals and chemicals are the major industries that use a significant quantity of captive power. The government supports firms in these sectors through subsidies and by allowing them to sell excess power generated from captive centres as this would reduce the grid's deficit.

The manufacturing sector which accounts for a bulk of the nation's hazardous emissions, is taking initiatives to reduce emission levels through the use of alternative fuels. Indian cement companies are ahead of others in using environment-friendly substitutes. Besides providing cost benefits, this is helping these firms contribute to India's efforts to reduce its carbon footprint.

The use of IT solutions such as enterprise resource planning (ERP) and manufacturing execution systems (MES) in the manufacturing sector has grown over the last few years as companies look to enhance productivity. Digital manufacturing, another IT-enabled solution, is helping Indian manufacturers, especially automotive players, improve productivity and efficiency.

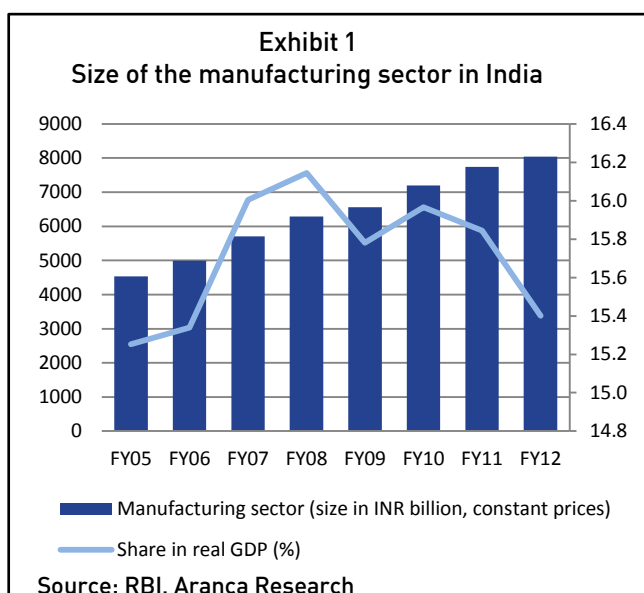
Besides adopting best practices, Indian manufacturers are increasingly deploying technology to enhance operational efficiency. Operational excellence is fast becoming a norm rather than an exception associated with a certain firm or an industry.

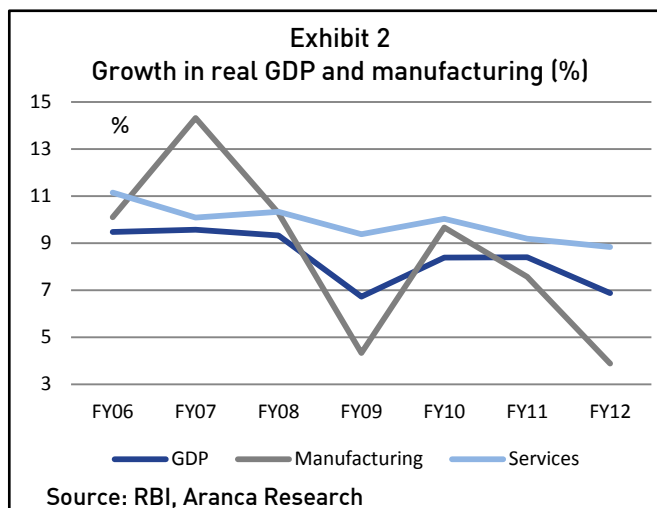
## 1. INDIAN MANUFACTURING SECTOR: AN OVERVIEW

### 1.1 Role of manufacturing in the Indian economy

Manufacturing holds a key position in the Indian economy, accounting for nearly 16 per cent of the real GDP in FY12 and employing about 12.0 per cent of India's labour force. Growth in the sector has been strong, outpacing overall GDP growth over the last few years. For example, the real GDP expanded at a CAGR of 8.4 per cent in FY05-FY12, while growth in the manufacturing sector was higher at around 8.5 per cent over the same period. Consequently, the sector's share in the economy increased during this period to 15.4 per cent from 15.3 per cent.

Strong growth in India's manufacturing sector has been accompanied by a change in the nature of the sector; it has evolved from a public sector-dominated setup to a more private enterprise-driven one with global ambitions. After China, India is currently the largest producer of textiles, chemical products, pharmaceuticals, basic metals, general machinery and equipment, and electrical machinery, as per the United Nations Industrial Development Organisation (UNIDO). In the coming years, the sector's importance to the domestic and worldwide economy is set to rise even further as a combination of supply-side advantages, policy initiatives and private sector efforts set India on the path to become a global manufacturing hub.





The rising competitiveness of India's manufacturing companies is reflected in the country's ranking as second in the world in terms of competitiveness as per the 2010 Global Manufacturing Competitiveness Index (GMCI), prepared by the US Council on Competitiveness and Deloitte. This index factors in market dynamics and policy issues that influence the sector. India is ahead of major developed and emerging economies such as the US, South Korea, Brazil and Japan. Going forward, the nation's competitiveness would increase further with its index score set to improve to 9.01 (out of 10) in the next five years from 8.15 in 2010.

**Exhibit 3**  
**2010 Global Manufacturing Competitiveness Index**

Current Rank	Country	Index Score	Rank after 5 Years
1	China	10.00	1
2	India	8.15	2
3	Republic of Korea	6.79	3
4	United State of America	5.84	5
5	Brazil	5.41	4
6	Japan	5.11	7
7	Mexico	4.84	6
8	Germany	4.80	8
9	Singapore	4.69	11
10	Poland	4.49	9
New add*	Thailand	-	10

Source: Deloitte and US Council on Competitiveness  
\*New addition among the top-10 countries. Currently Thailand is ranked 12th with an Index Score of 4.17

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The Indian manufacturing sector is striving towards operational excellence as companies follow a range of strategies, including going lean, automating systems and using non-conventional ways such as captive generators, and using alternative fuels to attain energy security. With the government's support, these companies are also innovating and spending on R&D to improve operations.

## 2. INDIAN MANUFACTURING GOING LEAN

### 2.1 What is Lean Manufacturing?

Lean manufacturing is a continuous way of producing what the customer wants, when they want it, at a price they are prepared to pay and using the least amount of resources<sup>1</sup>.

The core idea behind lean is minimising waste, therefore creating more value for customers with fewer resources<sup>2</sup>.

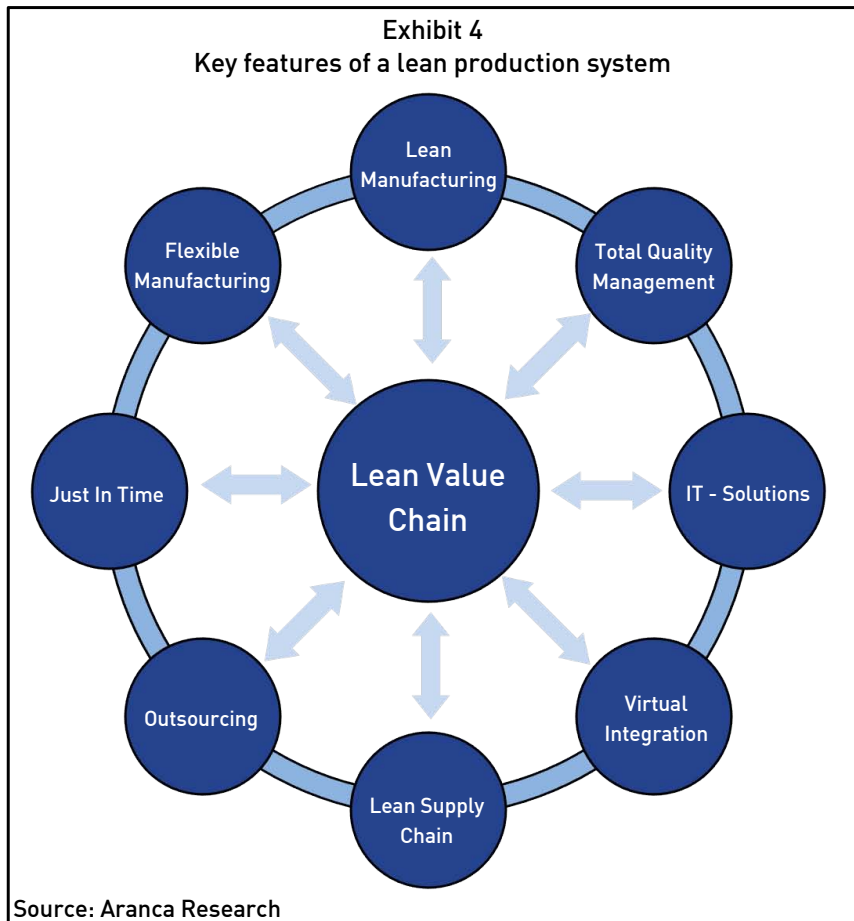
A company can reduce costs and keep prices low without adversely affecting profits or quality by controlling the amount of waste generated during production. Estimates<sup>3</sup> suggest that on an average 95 per cent of manufacturing activities fall either under non-value adding time or non-value adding cost. Lean manufacturing tries to minimise this waste and benefit consumers in the form of lower prices. Toyota, the world's largest car manufacturer, was the first company to successfully adopt this model. The company's steady growth from a small company to the world's largest automaker has made the Japanese carmaker an acknowledged benchmark in lean manufacturing. Thus, the lean manufacturing process is sometimes also referred to as the Toyota Production System.

There are several potential areas in a production chain, where an organisation can eliminate waste by going lean. For example, using production equipment up to the maximum potential can significantly help reduce waste. Similarly, low-cost automation is another area that can cut costs. On the sourcing side, purchasing standard parts and re using parts by dismantling old machines can also assist in waste reduction. The key features of a lean production system are depicted in the figure below:

<sup>1</sup> National Productivity Council, Government of India

<sup>2</sup> Lean Enterprise Institute

<sup>3</sup> Globalising Indian Manufacturing : Competing in Global Manufacturing and Service Networks



## 2.2 Indian manufacturing companies are going lean

Recently, Indian manufacturing companies have been increasingly restructuring operations and implementing world-class practices. The companies range from Bharat Forge, Bajaj and Tata in the auto sector to Larsen & Toubro, and Godrej & Boyce in the specialist engineering space as well as Ballarpur Industries in paper, and others in the pharmaceutical and textile sectors. These practices help companies become globally competitive, especially in sectors such as auto and auto components.

In addition, India's vast pool of scientific talent helps these companies locally design and procure some of the more expensive inputs. For example, **TATA Group** leveraged the country's low-cost engineering skills to develop India's first indigenously designed, developed and produced car – TATA Indica. The Indica's V2 version received numerous quality awards and is now being sold in Europe and South Africa. Following this, the Group developed the world's most economical car – TATA Nano – for a price as low as USD2,200. Despite being relatively inexpensive, the car uses leading-edge materials such as composites and industrial adhesives.

By adopting lean manufacturing practices, Indian companies have been able to significantly cut down costs. For example, **Sundaram-Clayton Limited**<sup>4</sup>, one of the country's largest auto component manufacturers, has been able to reduce 2.5–5 per cent of costs and product prices by going lean. Through the adoption of lean manufacturing practices, the company significantly boosted employee productivity and was ranked by Lean Enterprise in the US as one of the leanest companies in the world.

The world's largest forging<sup>5</sup> factory is based in the industrial city of Pune, Maharashtra (Western India). The state-of-the-art factory belongs to **Bharat Forge**, which is rapidly placing India on the world map for manufacturing. It has embraced a strategy that includes heavy investment in technology, a scientifically skilled workforce, and aggressive overseas acquisitions. Also, the company recalibrated its business strategy and put an emphasis on streamlining operations to create a leaner and more cost efficient enterprise.

### **Bajaj Auto – The transition from traditional to lean**

#### **Case Study**

Bajaj Auto is one of the largest automobile companies in India and has been in business for over four decades. The company is ranked as the world's fourth-largest two and three-wheeler manufacturer<sup>6</sup>.

During the 1980s and 90s, the manufacturing model adopted by the company resulted in inefficiencies, higher fixed costs and a large inventory with hidden quality issues. Bajaj Auto's manufacturing model is depicted below:

<sup>4</sup> Globalising Indian Manufacturing : Competing in Global Manufacturing and Service Networks

<sup>5</sup> Forging is a manufacturing process involving the shaping of metal using localized compressive forces

<sup>6</sup> Bajaj Auto website



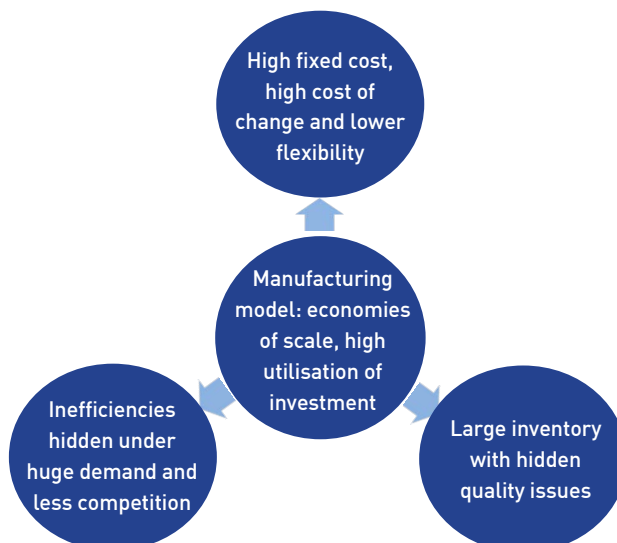
**Exhibit 5**  
Bajaj Auto's manufacturing model during the 1980s and 90s



Source: Aranca Research

The limitations of the manufacturing model are depicted below:

**Exhibit 6**  
Limitations of Bajaj Auto's manufacturing model adopted during the 1980s and 90s



Source: Aranca Research

During the late 1990s and early 2000s, strong competition and growing customer aspirations led the company to move to:

- Lean manufacturing (on the lines of the Toyota Production System)
- Total Productivity Management (TPM)
- Statistical Process Control (SPC) in manufacturing operations

**Exhibit 7**  
**Growth strategy adopted by Bajaj Auto during the late 1990s and early 2000s**



Source: Aranca Research

The lean manufacturing drive involved reorganisation and a fundamental redesigning of Bajaj Auto's core business processes. The objective was:

- To create a high performing organisation by restructuring, re-staffing and establishing a performance management system
- Launch new products
- Restructure channels and build capability to increase retail sales, dealer profits and overall customer satisfaction
- Implement an integrated ERP system
- Reduce purchasing costs
- Cut down conversion costs

- The main aim was to boost the top line 100 per cent and bottom line 10 per cent

The move towards a lean manufacturing process resulted in significant gains for the company. Bajaj Auto's workforce productivity rose 10 times<sup>7</sup>. The company was able to reduce the inventory for raw materials from one week to half a shift stock<sup>8</sup>. The inventory for finished goods was cut down from one month to three days<sup>9</sup>. The number of rejected items was reduced from 20,000 parts per million (PPM) to less than 2,000 PPM<sup>10</sup>.

### 3. EMPHASIS ON QUALITY

In the last decade, quality standards in Indian manufacturing have improved significantly. The sector is now well-known globally for high quality. The country's manufacturers have extensively adopted the Total Quality Management (TQM) approach. Thus, the sector currently enjoys a cost advantage in the range of 15–20 per cent compared to the beginning of the decade. Ongoing and new best practices would continue to benefit the sector in the medium term through their influence on the top line and bottom line.

#### India's quality revolution

The nation is currently second only to Japan in terms of hosting companies awarded for quality excellence. These include 21 companies that were awarded the Deming Excellence Award and 153 companies with the Total Productive Maintenance (TPM) Excellence Award by the Japan Institute of Plant Maintenance (JIPM). Of the 165 Indian companies that were awarded the CII-Exim Bank Awards for Business Excellence since its inception in 1994 till 2010, around 80 per cent are in the manufacturing sector. It should be noted that this award is globally accepted as an equivalent to the European Foundation of Quality Award.

In sectors such as auto components, a large number of firms have upgraded technology and processes; this made these companies reliable suppliers of parts to foreign automakers. Over a dozen companies such as Sona Koyo Steering Systems, Sundaram Clayton, and TVS Motor have won the Deming prize<sup>11</sup>.

<sup>7</sup> Lean Manufacturing in Bajaj Auto: A presentation by Mr. Anil Kapoor, Vice President, Bajaj Auto, August 2009

<sup>8</sup> Lean Manufacturing in Bajaj Auto: A presentation by Mr. Anil Kapoor, Vice President, Bajaj Auto, August 2009

<sup>9</sup> Lean Manufacturing in Bajaj Auto: A presentation by Mr. Anil Kapoor, Vice President, Bajaj Auto, August 2009

<sup>10</sup> Lean Manufacturing in Bajaj Auto: A presentation by Mr. Anil Kapoor, Vice President, Bajaj Auto, August 2009

<sup>11</sup> The Deming prize, established in December 1950 in honour of W. Edwards Deming, was originally designed to reward Japanese companies for major advances in quality improvement. Over the years, it has grown under the guidance of the Japanese Union of Scientists and Engineers (JUSE); it has been extended to non-Japanese companies, albeit usually operating in Japan, and also to individuals, who have contributed majorly to the advancement of quality.

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## Sundaram Clayton – Harnessing the power of TQM

### Case Study

Sundaram Clayton Limited (SCL) is part of the USD4 billion TVS group, one of the largest auto components manufacturing and distribution group in India. SCL is a leading supplier of aluminium die castings to the automotive and non-automotive sectors.

The company commenced operations in 1962 in collaboration with the UK-based Clayton Dewandre Holdings Limited (now part of WABCO Automotive group). It manufactures aluminium pressure die castings for heavy commercial vehicles, passenger cars and two wheelers. Its product range includes flywheel housing, gear housing, clutch housing, filter heads, air connectors, lube oil cooler cover assembly, filtration module casting, turbo chargers, compressor cover assembly, charge air pipes, intake manifold and cover coolant duct for the truck segment; cylinder head, case transaxle assembly, oil pan, chain case, cylinder head cover, adaptor oil filter, fuel pump housing, fork gear shift, starter housing and A/C compressor housing for passenger cars; and crank case, cylinder head, cylinder barrel and wheel hub for powered two wheelers and brake equipment valve bodies<sup>12</sup>.

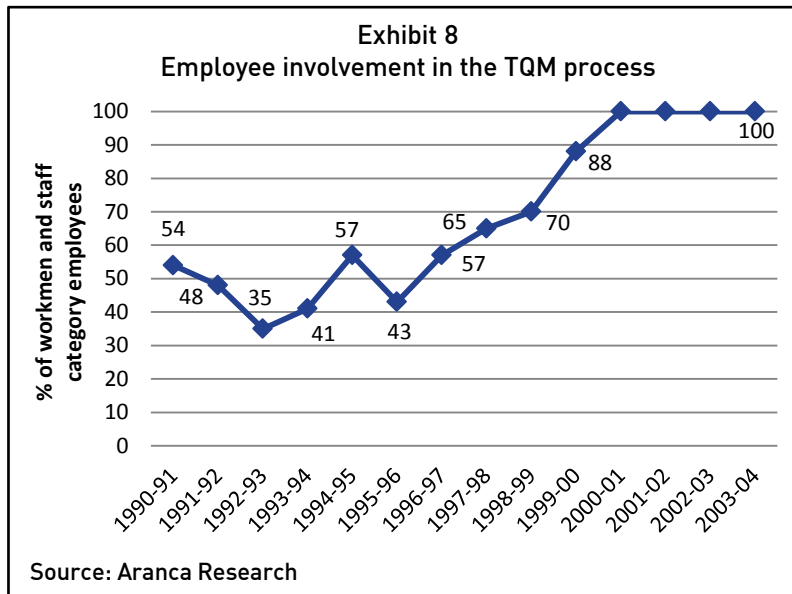
SCL started its total quality management (TQM) processes in the late-1980s. Prior to introducing TQM, the company had a traditional manufacturing layout and hierarchical organisational structure leading to inefficiencies and waste. During that time, the man to machine ratio was 3:1. That meant each machine required three workers – one to load and unload the product, another to switch on the machine and the third to inspect the quality of the product. Similarly, since the plant layout was process-oriented, it resulted in the build up of inventories. Also, the communication among various peer groups was poor. Moreover, both middle level management and the workers resisted change.

After undergoing a thorough diagnosis of these issues, SCL decided to adopt a three-phase implementation of TQM. This involved encouraging the culture of quality control and quality assurance, which was achieved through intensive staff education and training.

<sup>11</sup> The Deming prize, established in December 1950 in honour of W. Edwards Deming, was originally designed to reward Japanese companies for major advances in quality improvement. Over the years, it has grown under the guidance of the Japanese Union of Scientists and Engineers (JUSE); it has been extended to non-Japanese companies, albeit usually operating in Japan, and also to individuals, who have contributed majorly to the advancement of quality.

<sup>12</sup> Sundaram Clayton Website. <http://www.sundaram-clayton.com/Products.htm> accessed on 26 August 2011 at 1200 hrs.

The implementation of TQM enabled the company to not only increase its market share, profit and the productivity of workers but it also helped in getting business from overseas players. SCL was awarded the Deming prize for quality in 1998.



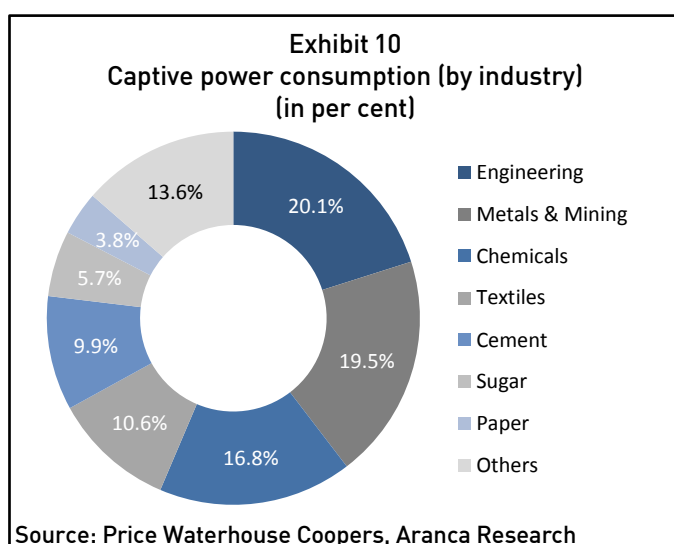
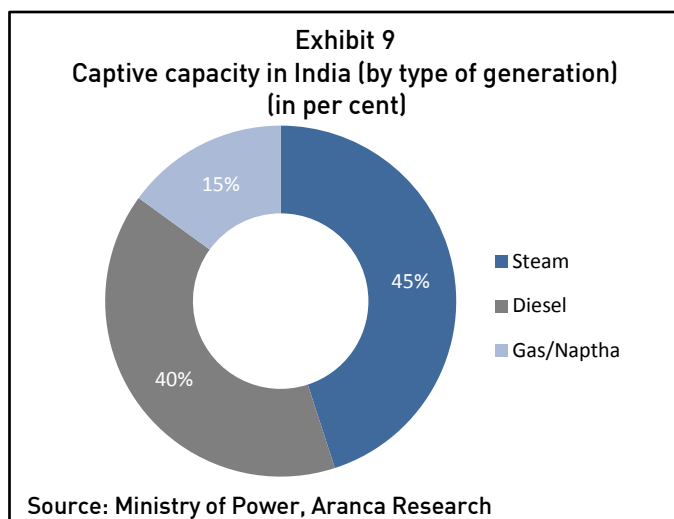
#### 4. USE OF CAPTIVE POWER

The manufacturing sector aims to increase its share in the national GDP to 25 per cent by 2025 from the existing 16 per cent in 2011. Energy security, therefore, becomes vital if the aspirations of the sector are to be fulfilled.

Other Asian economies have incentivised the industry with lower electricity tariffs and energy costs, thereby enabling it to flourish. For instance, China's manufacturing industry accounts for 30 per cent of the nation's GDP. This is partly because the sector consumes 74 per cent of the country's electricity, while in India the figure stands at 45 per cent.

13 states in India have more than 10% peak deficit, with five<sup>13</sup> of them being the most populous and industrialised states in the country. Captive power generation units reduce the dependence of the industries on the grid power supply for their manufacturing process. Different types of fuels are used for captive power generation. While majority of it is generated from steam and diesel, gas/naphtha is also used in few plants.

<sup>13</sup> Maharashtra, Uttar Pradesh, Bihar, Karnataka, Tamil Nadu



Engineering industry is the largest user of captive power, using 20.1 per cent of all the captive power generated in the country. Metals and mining is a close second, accounting for 19.5 per cent, while chemicals, textiles and sugar are the other major consumers. Captive centres are used to generate 30 per cent of the energy requirements of the industries in the country. The effort on their part to decentralise energy off the grid is facing the hurdle of the high cost of generation. The cost per unit varies largely depending on the type of fuel used and the size of the power generator. However, it is at least 50 per cent costlier than commercial power offered by the grid in today's scenario.

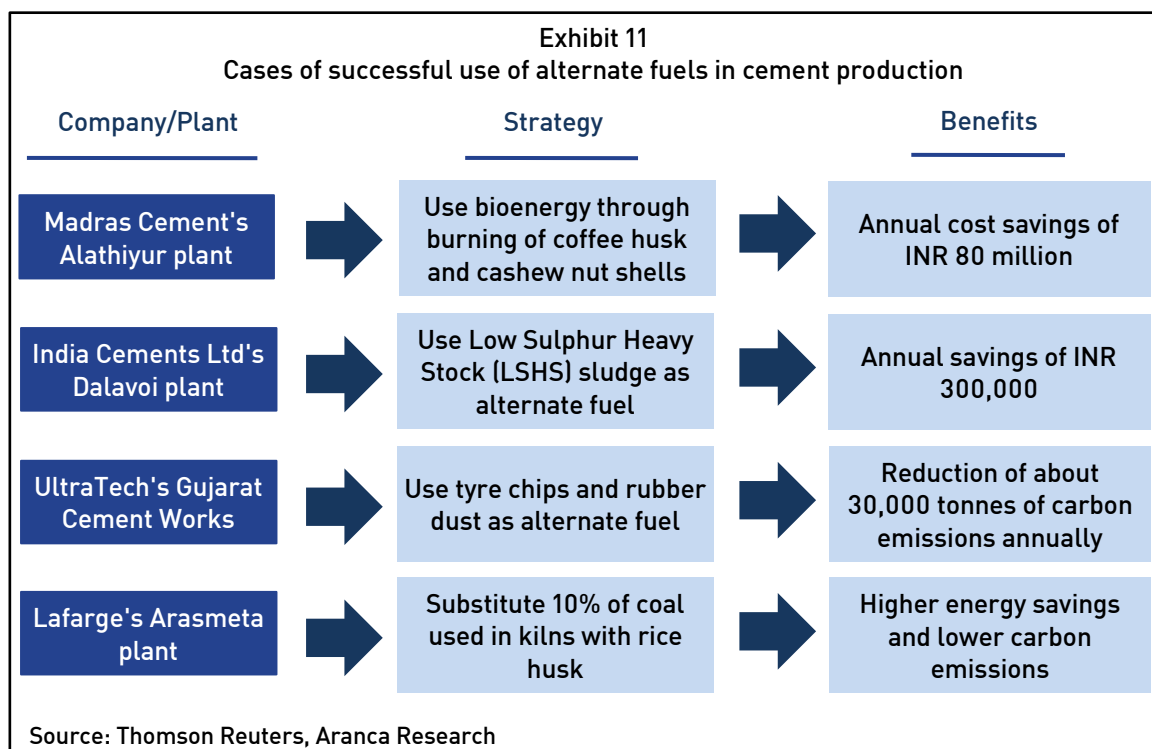
Government is taking definitive measures to encourage the decentralisation of power. An example is Bihar government, which is offering 50 per cent subsidies to the companies buying equipment for generating captive power. The Ministry of Power has now granted permission to sell the excess power generated by these captive generating units to the grid. This is expected to increase interest among

the manufacturers towards decentralising the power, which, in turn, would reduce the load on the grid.

## 5. TAKING TO ALTERNATIVE FUELS

India produces over six million tonnes of hazardous waste and about 50 million tonnes of non-hazardous and municipal wastes, apart from a large quantity of agro-waste every year. The manufacturing sector, which accounts for majority of these emissions, is taking up initiatives in order to reduce the emissions. One such way is by using alternative fuels in the manufacturing processes.

The Indian cement industry is the leader in this front, with its major players now using industrial, municipal and agricultural wastes to utilise these as alternative fuels in order to fire their kilns. This helps them in two ways – it saves fuel costs and more importantly, contributes to India’s efforts to reduce carbon intensity by 25 per cent of the 2005-level by 2020. These companies are following the global trend in the cement industry, which is working towards reducing carbon emissions from the factories. An estimate from the industry experts suggests that the Indian cement industry has the potential to reduce the nation’s green house gas emission by over 1.7 million tonnes annually if it can increase its thermal substitution to just five per cent. Other manufacturing industries would now fall in line, taking the lead of cement manufacturers to reduce the emissions from their factories.



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## 6. AUTOMATION IN INDIAN MANUFACTURING

Indian manufacturers are increasingly using IT solutions such as Enterprise Resource Planning (ERP) and Manufacturing Execution Systems (MES) in order to enhance their productivity. ERP and MES are IT systems that facilitate the flow of information throughout the organisation, thus enabling optimisation of production activities right from the receipt of order to delivery of finished goods. This typically includes functions such as workflow management, quality control, cost management, manufacturing process, manufacturing projects, manufacturing flow, activity-based costing and product lifecycle management.

The Indian MES market is worth over USD4.7 billion in 2011 and is expected to reach at USD8.9 billion by 2016 at a CAGR of 13.6 per cent<sup>14</sup> over 2011 to 2016. It is expected to expand at a brisk pace, given the need for real-time information to improve operational efficiency as well as the need to comply with regulatory standards, such as the FDA regulations<sup>15</sup>.

The oil & gas industry currently accounts for majority of the Indian MES market. However, the growth over the next decade is expected to be driven by the pharmaceutical, and food and beverage industries. Other end-user industries such as consumer packaged goods, steel, speciality chemicals, automotive and auto ancillary are also expected to contribute to the growth.

Digital manufacturing is another IT-enabled solution that has been improving the productivity and efficiency of the Indian manufacturers, especially the automotive players. It is a simulation of the engineering operations, which allows for verification and correction of designs even before the metal is cut. Indian manufacturers such as Tata Motors use this technique to achieve savings on time and cost of at least 20–30 per cent in most of the cases.

Use of such production-enhancing tools are not just good for the Indian manufacturing sector but they are also helping the Indian IT sector in establishing itself as the global industrial automation sourcing centre. The Indian MES market is expected to expand at a CAGR of 18 per cent over FY10-16.

## 7. CONCLUSION

Indian manufacturing landscape has adopted various methods to achieve operational excellence including going lean, total quality management, automating systems, captive power generation, and alternative energy. Reduction of waste, improvement in quality, higher throughput and an overall more efficient production system is leading India towards a manufacturing revolution.

<sup>14</sup> [http://www.researchandmarkets.com/research/48e69a/manufacturing\\_exec](http://www.researchandmarkets.com/research/48e69a/manufacturing_exec)

<sup>15</sup> Frost & Sullivan



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Leaving their traditional approach of focusing on economies of scale and return on investment, industry is gradually shifting to generating value at all links of the value chain. Lean manufacturing approach is optimising the operations of Indian players by reducing their finished goods inventory, work-in-progress inventory on the shop floor, subcontracting peripheral activities, process reorganisation and optimisation etc. Implementation of ERP is helping Indian firms to cut down on waste from the initial step of sourcing itself.

Another important step is the Indian manufacturers' drive towards quality using tested and verified methods like TQM. Sharper focus on quality is leading to reduction of waste and improving the profitability of Indian players. There already has been substantial progress, as can be seen from the fact that India is currently second only to Japan in terms of hosting companies awarded for quality excellence.

Indian manufacturers are also making strides in areas of alternate energy and automation. Engineering, metals & mining and chemicals industries are decentralising their power requirements through captive centres to reduce their dependence on grid. Cement industry has been increasingly using alternative fuels in order to reduce their carbon footprints and save on energy costs. Oil and gas and automotive sectors are relying more and more on automation of their shop floor – through use of MES and digital manufacturing.

Thus, in addition to following the best practices within their industries, Indian manufacturers are increasingly harnessing technology to improve further on their operational efficiencies. With Indian manufacturing moving ahead on its way to strong global competitiveness, operational excellence will more and more resemble a norm than a unique feature.

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