Manufacturing in India

Creating a **smarter** future

Contents

Chairman's Message

Make in India over the last 2-3 years has brought about significant excitement within industry on the growth for the manufacturing sector. It has placed India right in the centre of the world's attention.

Through the Make in India campaign, Hon'ble Prime Minister Shri Narendra Modi set the country a specific target i.e. to increase contribution of manufacturing to GDP from 16% in 2015-16 to 25% by 2022.

If this target has to be achieved, the manufacturing sector will need to grow from a USD 300 Billion industry to a USD 1 trillion industry at an annual growth rate of more than 15%. The first step of achieving this would entail a capital investment of ~2 trillion into the manufacturing sector. Additionally, with the Indian economy growing at 5-7 %, manufacturing companies in India will be required to capture a larger share of the global market and achieve double digit growth year on year.

This has several implications both at the firm and eco-system level. For industry, this translates to increased need for global competitiveness, higher integration with global supply chains, investments in building advanced manufacturing capabilities etc. At the eco-system level, there is a need for strengthening the building blocks that facilitate this high growth.

With global shifts in manufacturing taking place on account of higher availability and use of technology and digitalization, various companies across the world are deploying next generation manufacturing practices that are further driving increased competitiveness.

Together these shifts are being considered as a move towards Industry 4.0 or smart manufacturing. By deploying smart technologies and applications companies are witnessing several benefits such as an increase in cost savings, increased throughput and productivity, efficient use of materials etc.

Indian industry needs to respond. While companies in India too have initiated deployment of various smart manufacturing technologies at the company level there is a need for end-to-end integration. Smart manufacturing needs to be driven from the boardroom as it entails a change in the mindset of the whole organization.

The CII Smart Manufacturing Council is working on focussed initiatives to help Indian industry leverage smart manufacturing to drive economic growth.

The CII study on Champion Manufacturing Industries has already identified 28 champion industries across 9 major manufacturing sub-sectors such as automotive, aerospace and defence, chemicals, engineering, textiles and apparel, electronics, steel, pharma, cement in which India could be number #1 or #2 and that have the potential to drive significant double-digit growth in manufacturing and job creation in the next 10 years. The CII Smart Manufacturing Council is committed to work with Government to enable deployment of smart manufacturing in these industries to help achieve the significant growth required.

The case study compendium 'Manufacturing in India: Creating a Smarter Future' has been produced with the focussed objective of showcasing the benefits accrued by deploying smart systems. I do hope this compendium will act as an inspiration to all companies regardless of their size and industry to invest in transforming into future ready organizations.

Sunil Mathur

Chairman, CII Smart Manufacturing Council
and MD and CEO, Siemens Ltd., India

Director General's Message

Globally, manufacturing is traversing new domains led by disruptive changes in technology and breakthrough innovations. The fourth industrial revolution has become a reality with several countries driving focussed programmes to support this transformation.

Confederation of Indian Industry is of the view that smart manufacturing is a phenomenon that is here to stay and Indian manufacturing will be compelled to understand the possibilities and embrace the opportunities.

The implications for a country such as India where all levels of industry 1.0, 2.0, 3.0 and 4.0 co-exist are significant. Vast efforts are required at the macro and firm level to help ride this wave.

Building the requisite digital and advanced manufacturing infrastructure shall be critical as these will act as the backbone for the proliferation of these new age technologies in the country. Upskilling for industry 4.0 will necessitate the need for bolstering skills and higher education. Promoting innovation and R&D will also be key.

At the firm level, companies too will need to look at smart manufacturing holistically starting from the boardroom, moving to the shop floor and then to the supply chain to address the various change management implications.

CII is working closely with the Department of Industrial Policy and Promotion (DIPP) towards building a future ready industrial policy and with the Department of Heavy Industry to create awareness on the benefits of deploying these technologies across the country.

The CII Smart Manufacturing Council is playing a key role in supporting industry navigate the emerging opportunities and challenges posed by Smart Manufacturing. The CII Smart Manufacturing Summit, which is in its third edition this year has been instrumental in creating awareness on the benefits of smart manufacturing and helping industry connect with the right stakeholders in their journey towards transforming into future ready companies. CII recently launched a monthly e-newsletter on smart manufacturing to help various stakeholders stay abreast on the latest trends in this space.

The Compendium 'Manufacturing in India: Creating a Smarter Future' is another significant initiative under the aegis of the Council that brings forth examples of deployment of smart manufacturing in India and the resulting benefits. I do hope industry will learn from these examples and be inspired to explore how smart technologies can be leveraged at their firm.

The way forward must be an all-round approach that aims at building world-class competitive companies that are ably supported by superior infrastructure and a favourable domestic regulatory eco-system, with a strong focus on design and platform innovation that can support the needs of a growing nation.

Chandrajit Banerjee

Director General
Confederation of Indian Industry

think

smart

strategy

manufacturing

analytics

revolution

technology
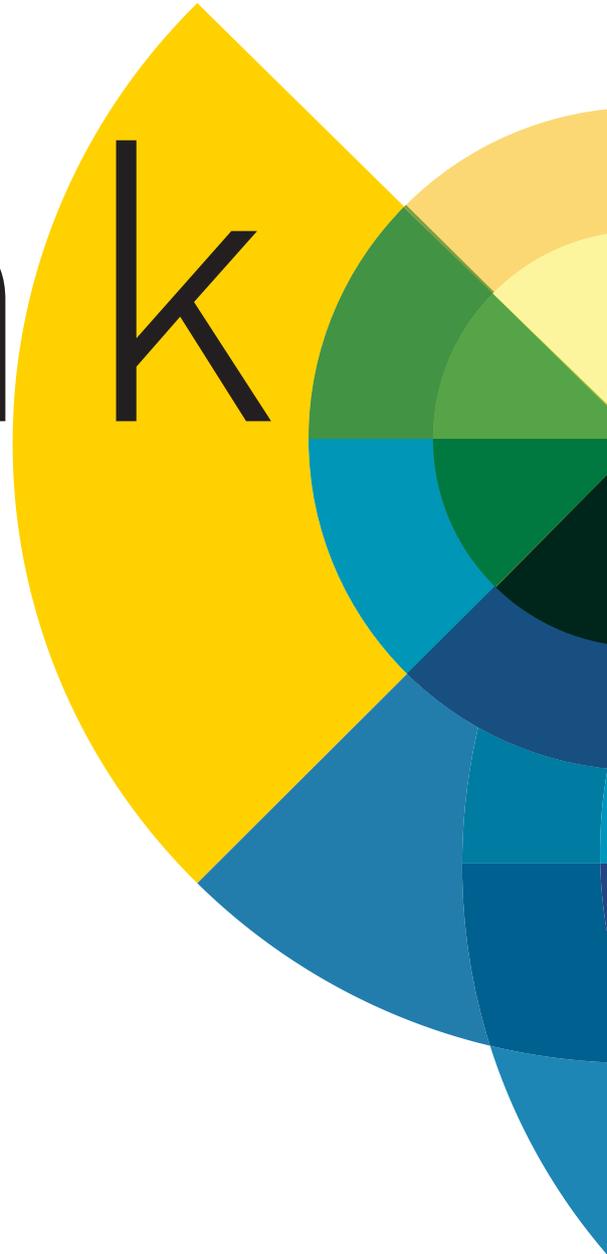
REVOLUTIONS AND THEIR REVERBERATIONS

In the hyper-digital age that we inhabit, technology innovation leading to smarter digital solutions will consistently have a transformative effect on almost every aspect of human life. Over the last three decades, Information Technology (IT) has already indelibly changed the way we live, the way we work, the way we communicate, and the way we produce and deliver the services and products that fuel our economies.

The IT revolution at the end of the 19th century (computerization and the internet) broke the previous mould and force-spawned new industries, cutting-edge technologies, software solutions, telephony and connectivity. It reformed the economic, industrial and social landscape of the world. The Internet was the definitive technology of the Information Age. With the explosion of wireless communication and telephony in the early 21st century, the transformation was exponential. We can all agree that the world we know now is almost entirely interlinked and exists within an Internet-communication-information matrix – with differing levels of connectivity, access, application and advancement – giving rise to innumerable opportunities across business and industry.

The conversation in terms of opportunities in the manufacturing sector has picked up keenly in light of the convergence of many advanced technologies in recent years. The concept of "Industry 4.0" an "Internet of Things" of "Smart Factories" has been extensively discussed and many theories and hypothesis abound. (It was the primary focus of the World Economic Forum in Davos, in January 2016 and 2017).

A short glance at history throws up similar situations, where advancements in the technologies of the time converged to transform the world.

Two centuries previous, the first industrial revolution at the start of the 18th century saw the transition of manufacturing processes over the span of 60-80 years. This included moving from hand production to machines and the development of machine tools. Arkwright created the cotton mill which brought production processes together in a factory. Not before long, steam power was applied to drive textile machinery. The supply of cheaper iron and steel aided a number of industries, such as those making nails, hinges, wire and other hardware. The development of machine tools allowed better working of iron, causing it to be increasingly used in the rapidly growing machinery and engine industries, and giving rise to the factory system.

By the end of the 18th and start of the 19th century, a synergy between iron and steel, railroads and coal developed. The expansion of rail and telegraph lines after 1870 allowed unprecedented movement of people and ideas. The steam turbine and the diesel engine were invented. The first telegraph system was installed. The telephone was created by Bell. Italian inventor Marconi successfully commercialized radio. The most significant however was the harnessing of electrical power. The first modern power station in the world built by Ferranti, pioneered the use of high voltage alternating current. On its completion in 1891 it supplied high-voltage AC power to central London. Electrification allowed the final major developments in manufacturing methods of the Second Industrial Revolution, namely the assembly line and the age of mass production. The period saw the greatest increase in economic growth. Living standards improved significantly in the newly industrialized countries as the prices of goods fell dramatically due to the increases in productivity.

Each industrial revolution saw products being manufactured faster and with higher consistency, efficiency and complexity; allowing us today to develop products that are even more complex and have that much greater value to human beings.

THE NEXT WAVE

What does all this mean for manufacturing companies today in 2017? Are we on the brink of the next revolution? Are we already in the throes of it? Does the convergence of internet technologies, digitization, automation and the impact of using information analytics, robotics and artificial intelligence within existing industry frameworks, have the potential to unleash a fourth industrial revolution? Will cyber-physical systems overhaul traditional, labour-intensive, mechanical processes? How will this affect existing industries, economies, geographies? What kind of future companies will it create? What disruptions will it bring? These are questions that are important and relevant for all countries, governments and businesses that stand to be impacted by pace of technological advancement and choose to explore the frontiers ahead.

" **While the cases in our research can hardly assume to provide all the answers to these pressing concerns, they do however try to shed light on manufacturing companies in India that are already gearing up and getting equipped to ride the wave.** "

Fig 01: The Fourth Industrial Revolution: Complex cyber-physical production systems will have far reaching impacts on business and industry.

First programmable logic controller (PLC) Modicon 084 1969

4 Industrial revolution based on Cyber-physical Systems

3 Industrial revolution uses electronics and IT to achieve further automation of manufacturing

First production line, Cincinnati slaughter houses 1870

2 Industrial revolution follow introduction of electrically-powered mass production based on the division of labour

First mechanical loom 1784

1 Industrial revolution follow introduction of water-and steam-power mechanical manufacturing facilities

Complexity ▲

Time ▶

End of 18th century   Start of 20th Centurty   Start of 1970s   Today

Source: DFXI 2011

WHAT IS INDUSTRY 4.0?

Industry 4.0 is the combination of several major technology innovations expected to significantly shift the landscape of the manufacturing industry in the world, during the second half of the first quarter of the 21th century. These technologies – advanced robotics, artificial intelligence, cloud computing and big data analytics – all exist in manufacturing today in some form, but as they integrate with one another, experts predict, the physical and virtual worlds will interlink to such a seamless extent that it will create an entirely new manufacturing eco-system.

The idea of computerising manufacturing originated in Germany in as a high-tech strategy project of the government in 2011. Siegfried Dais (Partner of Robert Bosch Industrietreuhand KG), in 2013, told consultancy firm McKinsey & Company, "It is highly likely that the world of production will become more and more networked until everything is interlinked with everything else". The term Industry 4.0 was further popularised by Klaus Schwab, Founder and Executive Chairman of the World Economic Forum, in his 2016 book. As such, the idea of Industry 4.0 has been heavily discussed and debated by economists, business leaders and governments over the last few years.

The concept is ambitious and has far-reaching implications. As manufacturing adopts better technologies to improve efficiencies; processes across separate functions, factories and machinery will eventually get entirely interconnected. These linkages between the digital and physical world will replace some of the human interface of the manufacturing process. Information technology will integrate with operational technology generating cyber-physical systems within 'Smart Factories' that can use a constant stream of data from connected operations and production systems to digitally communicate across the 'Internet of Things'. Next generation machines will be able use data analytics to drive intelligent decision making for optimisation across the manufacturing process. They will be able to monitor the factory floor and make decentralized, real-time decisions.

Some of the these aspects are already being implemented, such as using advanced data analytics from the market to deliver superior quality goods or services. As they expand and integrate that will lead to greater cost efficiencies; for example by using sensors to monitor the health of machinery in use, companies will be able to shift to a condition-based maintenance model (maintaining equipment when there is an actual need through predictive analytics) rather than relying on a regular maintenance schedule or repairing equipment only when it breaks down.

Other ground-breaking developments such as Artificial Intelligence (AI) and Robotics could have the ability to completely disrupt and reform existing manufacturing systems all-together and shift the world into a new-age of manufacturing.

Fig 02: Convergence of Information Technology and Operational Technology and the bridging of digital and physical.

Intelligent Marketing
Customer Driven Engineering
Social Media Analytics
Connected Products
Productive Customer Insight
Smart Product and Service
Demand Sensing & Shaping
Service Analytics
Industry 4.0
Omni Channel Enablement
Strategic Enabled Ecosystem
Digital Supply Chain
Collaborative Planning
Plug & Play logistics
Intelligent Procurement
Facatory 4.0

Fig 03: Drivers of success in the Fourth Industrial Revolution

Percentages represent the proportion of respondents prioritizing each issue as a key driver of success on the road to fourth generation manufacturing, regarding each as a strategic pressured challenge.

82% Provide the basis for competitive pricing

76% Improve competitive positioning

76% Increase operational efficiency

70% Increase production capacity / flexibity

76% Acquire new-generation technology

73% Improve working capital / cash flow management

Smart finance

Expert and transparent
Easy and flexible
Reliable and sustainable

4.0
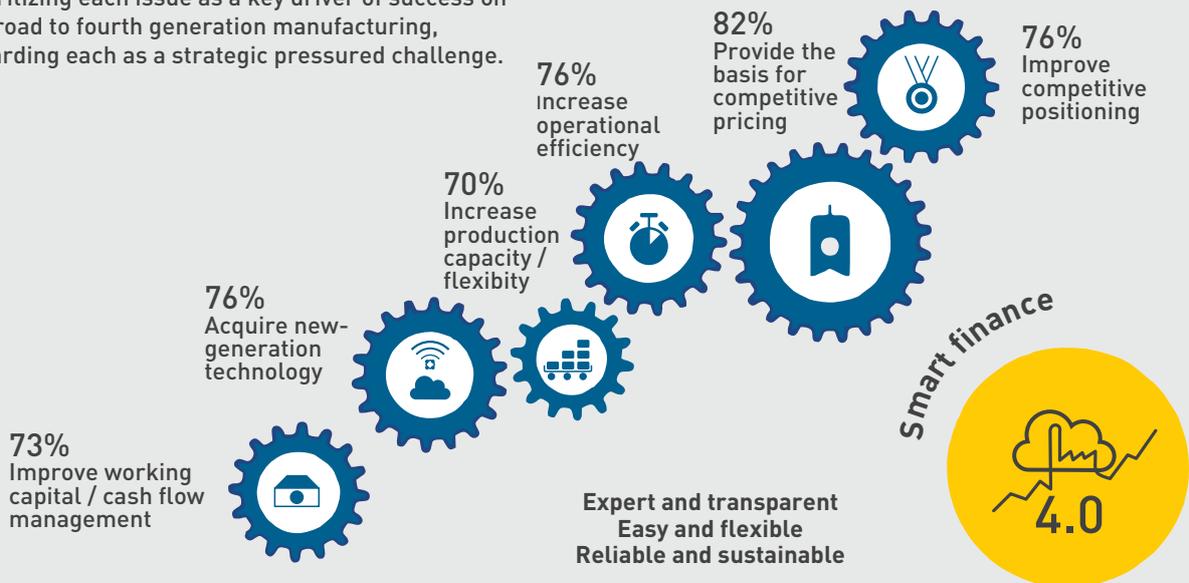
To read more, visit www.siemens.com/investing-in-sucess
Source: Siemens Financial Services 2016

HOW FACTORIES BECOME SMART

One of the fundamentals of Industry 4.0 is the concept of a 'Smart Factory'. Simply put it is the use of technology and automation to improve the supply chain, processes and operations of plants, factories and other manufacturing facilities thus reducing costs and increasing efficiency.

The reduced production downtime and increased ability to predict and adjust to changes can create huge competitive advantage in the marketplace.

Historically, situations in which machines have made decisions have been linear and based on a defined set of rules, such as controlling a valve or turning a pump on and off. A smart factory though, can integrate data from system-wide physical, operational, and human assets to drive manufacturing, maintenance, inventory tracking, digitization of operations and other types of activities across the entire plant. Basically, transforming the factory from a passive assembly line to a self-correcting system that uses real-time data to make changes to itself. The result is a fully automated, 'smart', and agile system.

Finally, the term 'Smart Factory" also suggests an integration of shop floor decisions and insights with the broader enterprise through an interconnected IT/OT landscape. This can fundamentally change manufacturing processes as we know them by connecting factories across various locations.

Smart factories operate within the four walls of the factory, but they could also connect to a global network of similar production systems, analyse data across geographies through the cloud and make intelligent decisions without human interfacing. The possibilities are immense.

KEY ASPECTS OF SMART FACTORIES

01. Interoperability and Integration

According to McKinsey Interoperability is necessary to create 40% of the potential value that can be generated by the Internet of Things in various settings. Smart factories require the underlying processes and materials to be connected to generate the data necessary to make real-time decisions. In a truly smart factory, assets are fitted with smart sensors so systems can continuously pull data sets from both new and traditional sources; ensuring data is constantly updated and reflects current conditions.

02. Automation and Optimization

Integration of data from operations and business systems, as well as from suppliers and customers, enables a holistic view of upstream and downstream supply chain processes, driving greater overall supply network efficiency. A smart factory allows operations to be executed with minimal manual intervention and high reliability. The automated workflows, synchronization of assets, improved tracking and scheduling, and optimized energy consumption are inherent in a smart factory and can increase production and reduce costs.

03. Big Data Analytics

The ability of the smart factory to predict future outcomes based on historical and real-time data analytics can improve quality, and prevent safety issues. In a proactive system, employees and systems can anticipate and act before issues or challenges arise, rather than simply reacting to them after they occur. This includes identifying anomalies, restocking and replenishing inventory, identifying and addressing quality issues, and monitoring safety and maintenance concerns.

04. Decentralization and Flexibility

This allows smart factories to adapt to schedule and product changes with minimal intervention. Advanced smart factories can also self-configure the equipment and material flows depending on the product being built and schedule changes, and then see the impact of those changes in real time.

Fig 04: 15 Components of the smart factory of the future

| SUPPLIERS | MANUFACTURING | CUSTOMERS |

Software

1 Smart Supply network
Transparency over supplier inventories and vehicle logistics allows for automatic and optimized supply decisions

2 Next-gen manufacturng systems
Manufacturing systems make automated and smart decisions (e.g. production scheduling) offer intelligent machine applications, seamless engineering integration and allow for remote visualization, monitoring control and alerts

3 Cloud storage/ processing
Data storage and application processing on secure cloud servers

4 Data analytics
Advanced decision algorithms & real-time analytics

5 Cyber security
Encpted data and protection mechanism against Cyber threats

15 Responsive manufacturing
Individual manufacturing step sare designed for customer interaction so that products can be tailor-made for customers

Shopfloor

6 Intellig. sensors/actors
Sensors deeply integrated in machines wirelessly stream data and have an own analytics engine (edge analytics)

7 Cyber physical systems
Interconnected systems and social machines control physical entities

8 Smart maintenance
Machine maintenance becomes integrated (autonomous) aided by predictive algorithms and remote assistance systems

9 Mobile workforce
Workers are equipped with mobile devices and augmented reality devices to process real-time information

10 Self-driving vehicles
Material is handed via autonomous vehicles and intelligent decisions transportation unites

11 Intelligent products
Products carry relevance information for machines to make decisions

12 Addictive manufacturing
3D printing allows for rapid prototyping and rapid spare part printing

13 Robotics
Use of flexible robots augments Intelligence, autonomous certain processes and creates new forms of worker-robot interactions

14 Advanced materials
New materials much as nano-materials as well as integratedcomputational materials engineering (ICME)

IoT-related

Not IoT-related

IMPLICATIONS FOR INDIAN MANUFACTURING

Manufacturing companies in the world today rely heavily on the electronics and IT revolution of the late 19th century to stay competitive. Led by cutting edge R&D, the very companies that sustained and emerged as engineering and software leaders in the IT revolution are now building technology platforms that allow for greater application across the value chain. It will be imperative for Indian manufacturing to keep pace with developments across the global technology spectrum in order to stay cost efficient and retain competitive advantage, in a swiftly changing world.

A. Leading companies are increasingly transitioning from being IoT customers to being IoT providers

General Electric, for example, released Predix, an end-to-end IoT industrial operating system designed to help GE customers' machines run more efficiently, in 2015. Other companies are focusing on a specific layer and making lateral innovations, as Microsoft has done with its Azure Suite. IBM, Cisco, SAP, and other industry leaders are providing specific platforms as well, and allowing companies to build and deploy their own applications. Device makers, such as Bosch and Intel, are offering hardware and complementary operating systems to provide customers with more comprehensive solutions.

B. All major players have developed capabilities and are consolidating their expertise to work with each other

Siemens, with its MindSphere cloud platform, has been aggressively pursuing a comprehensive end-to-end 'Smart' strategy for manufacturing solutions. In 2016 the company tied up with IBM to integrate MindSphere with IBM's deep-analytics platform Watson.

Information Technology giant Apple and Industrial giant GE, for instance signed an agreement in October 2017 to allow iOS integration across GE's Predix industrial software. Apple predicts this will give industrial operators more insight and visibility into the performance of their equipment and operations right from their iPhone or iPad, leading to faster repair times and less overall downtime. In addition to intelligent equipment monitoring this also enables developers to build on both platforms to produce a new set of industrial applications. According to Flannery, Chairman and CEO, GE "Our customers increasingly need to arm their workforces through mobility. Working together, GE and Apple are giving industrial companies access to powerful apps that help them tap into the predictive data and analytics of Predix right on their iPhone or iPad."

C. Even more cutting-edge technology is around the corner

On the other end of the technology spectrum, research on Artificial Intelligence is also at the tipping point of possibilities. September 2016 saw the unprecedented Partnership on AI – a consortium focused on establishing best practices for artificial intelligence systems, founded by members Amazon, Facebook, Google, DeepMind, Microsoft, and IBM (Apple joined in 2017). All these technology giants have been and will continue to invest heavily in R&D to explore the application of AI, anticipating huge untapped market potential.

Microsoft has been sharply focused on building AI tools on its Azure stack cloud computing platform to make it easy for independent developers to create AI enabled applications. On the heels of the GE and Apple collaboration, Microsoft was quick to announce their partnership with Amazon to create accessible Artificial Intelligence across Amazon Web Services (AWS). This deep-learning system (similar to Google's TensorFlow) is open-source for developers. It aims to combine training algorithms and neural network models to help those who may not specialize in AI, build and run machine learning models for their apps and services. IBM is already building on Watson's deep-analytics to create AI based tools. Along with Google's open source platform, this could mean an entirely new pace of development and deployment of AI technology across the world.

Meanwhile Google Brain, Google's AI research project, has advanced so much that it now, as co-founder Sergey Brin puts it, "touches every single one of our main projects, ranging from search to photos to ads ... to everything we do". According to Brin, AI is the natural continuation of the industrialization of the past 200 years. At the world economic forum in Jan 2017, he further exclaimed that he was "shocked by the level of ambition surrounding the possibilities of where machine learning could take us."

D. The economic opportunity is huge

Back in 2015, McKinsey & Company predicted, "If policy makers and businesses get it right, linking the physical and digital worlds could generate up to USD 11.1 trillion a year in economic value by 2025." Of this figure, McKinsey estimated approximately USD 1.2 to 3.7 trillion would be generated by IoT applications across factories - transforming these industrial plants into completely networked complex hubs.

Fig 05: Predicted economic impact of the IoT by 2025.

The Internet of Things offers a potential economic impact of $4 trillion to $11 trillion a year in 2025.

NINE SETTINGS WHERE VALUE MAY ACCRUE

SIZE IN 2025, $ TRILLION1

Factories- eg, operations management, predictive maintenance — 1.3-3.7

Cities- eg. public safety and health, traffic control, resource management — 0.9-1.6

Human- eg. monitoring and managing illness, improving welleness — 0.2-1.6

Retail- eg. self-checkout, layout optimization, smart customer-relationship management — 0.4-1.2

Outside- eg. logistics routing, autonomous (self-driving) vehicles, navigation — 0.6-0.9

Work sites- eg. operations management, equipment maintenance, health and safety — 0.2-0.9

Vehicles- eg. condition-based maintenance, reduced insurace — 0.2-0.7

Homes- eg. energy management, safety and security, chore automation — 0.2-0.3

Offices- eg. organizational redesign and worker monitoring, augmented reality for training — 0.1-0.2

■ Low estimate
■ High estimate

Total $4 trillion-$11 trillion

1Adjusted to 2015 dollars; for sized applications only: includes consumer surplus. Numbers do not sum to total, because of rounding.

McKinsey&Company | Source: McKinsey Global Institute analysis

According to McKinsey, all standardized production environments, especially factories will be one of the largest sources of value from the adoption of the IoT. Value will arise from productivity improvements, including 10 to 20 percent energy savings and 10 to 25 percent potential improvement in labour efficiency. Improvements in equipment maintenance, inventory optimization, and worker health and safety are further sources of value. Custom production environments, such as mines, oil and gas extraction sites, and construction sites could see overall improvements in operations from IoT applications worth more than $470 billion per year in 2025. Another major source of value (potentially more than $360 billion per year) according to Mckinsey will be improved equipment maintenance.

E. Developed economies are already convinced of the market opportunity and are embracing futuristic technologies

The UK: With Brexit looming on the horizon and many economists predicting a potentially grim future for the United Kingdom, the country is looking at ways it can mitigate the damage. One of those ways involves applying futuristic technologies and modernizing the manufacturing sector. In October 2017, the "Industrial Digitalisation Review," a UK government commissioned review on industrial digitalization, suggested that the UK could create $600 billion and 175,000 new jobs by adopting Industry 4.0 technology.

The USA: Similarly in a recent survey of 537 manufacturing executives, conducted by The Economist's Intelligence Unit in July 2017, the overwhelming understanding was that most American manufacturers have recognized the need for industrial transformation and are already taking action. According to their findings nearly 63% of companies have already or are in the process of transforming the way they do business. Interestingly, 58% of those implementing transformation strategies report increasing operational efficiency as the most common initiative for change, followed closely by creating new products and services. Over two in five (44%) have implemented at least one 'smart' initiative identified by the survey, such as improving marketing and brand differentiation or extracting greater value from data.

> The resulting disruptions of Industry 4.0 allow for great potential and possibilities. However, it will be the first movers, the game changers and the innovators that will shape the direction and reap the most benefits of the impending sea-change.

Fig 06: World Bank and GE predict the Industrial Internet Opportunity to be $32.3 trillion.

Global GDP ~$70 Trillion

Developing Economics $29 Trillion

Advanced Economics $41 Trillion

Industrial Economy $10.1 Trillion

Non-Industrial Economy $10.1 Trillion

Industrial Economy $3.7 Trillion

Non-Industrial Economy $3.1 Trillion

Other $14.3 Trillion

Other $23.1 Trillion

Transportation $2.2 Trillion	
Healthcare $1.2 Trillion	
Other Industrial $5.3 Trillion	
Manufacturing $5.5 Trillion	
Manufacturing $6.3 Trillion	
Other Industrial $3.6 Trillion	
Transportation $2.4 Trillion	
Healthcare $5.3 Trillion	

Industrial Internet opportunity ($32.3 Trillion) 46% share of global economy today

Source: World Bank, 2011 and General Electric

case
studies

AceMicromatic Manufacturing Intelligence
Technologies Pvt. Ltd.

Ace Micromatic
Group

**BUILD IN INDIA –
SELL TO THE WORLD**

A FOCUSED STRATEGY

Ace Micromatic, the largest machine tools conglomerate in the country has been growing at a steady pace over three decades. The company employs 3000+ professionals and produces a third of all machine tools in the country, and has a loyal customer base. As a b2b supplier to manufacturing industries with a presence across all sectors and segments, almost 60% of its business arises directly and indirectly from clients, which are usually small and medium-sized enterprises (Tier II and Tier III companies largely).

The group is well structured, with each company dedicated towards pursuing excellence in its chosen area. Some companies are product companies while others are service based. ACE Designers is dedicated towards Turning, AMS for Milling, MGTL for Grinding, Micromatic Machine Tools for sales and service, Pragati Automation for Turrets and ATCs, and AmiT for Industry 4.0 and IoT solutions. By creating separate entities, the group has made sure that every aspect of its business gets due attention and a healthy synergy amongst them, facilitating cross-learning and rapid growth, making the group a leading machine tool builder in India.

The group has 17 manufacturing plants, 13 in Bangalore, two at Dobbaspet and two in Ghaziabad with a current annual capacity of 7,500 machine units – Turning, Machining and Grinding. By 2020 the company is confident of achieving 10,000 units annually. This translates to a CAGR of at least 15% till 2020. To achieve these goals Ace Micromatic has a clear growth map in place.

1: It is increasing its international market through exports. Currently exports account for 10% of the company's turnover but the plan is to increase this to 15% in the next few years. The company has increased its market presence in several countries and now operates across Asia, Australia, Middle East, North & South America and Europe.

2: It is increasing capacity. In 2013 Ace Micromatic invested approximately Rs 100cr to set up a foundry for captive consumption at a 10-acre facility at Minnapura, India, with plans to increase capacity to 10,000 machines by 2020. This has been up and running since January 2016, at 40-42 percent.

3: It is planning to specialise in bigger castings of one tonne and above. The castings business is expected to create a new stream of revenue and enhance the export profile.

4: As a group, Ace Micromatic invests about 2-3% of its turnover in R&D, with a department for development at each factory. The company has plans to widen its product offerings and explore high-end machine tool building. This includes complex machining for aerospace, medical equipment and similar top-tier manufacturers.

HOME-GROWN PRODUCTION

A key driver for Ace Micromatic's competence is the indigenous nature of its product development and manufacturing. Over 80% of components are sourced and built in India with only the computer system, drive, ball screws and bearings imported. The imported parts constitute only 55% of the total cost of the machines. The raw material for machines is sourced from domestic foundries as well as the company's own foundry. According to TK Ramesh, Chief Executive Officer, Micromatic Machine Tools Pvt Ltd, "We continue to work on automation, robotics and gantry systems, with cost-effective solutions. We're focussed on providing Indian solutions that work for Indian SMEs." The company credits 70 to 80 % of its design and development activities to be customer demand driven.

Ace Micromatic has a history of designing computer controlled solutions for the Indian market that are manufactured in India. Back 1982, gauging the market demands for a CNC (computer numerical control) machine, the company's founding directors decided to begin local manufacturing of their prototype designs. In those days CNC machines were imported and the process included long government procedures and a 300% custom duty. The aim was to make affordable CNC machines for the local market without external support.

To date the company has no foreign collaboration or investment but has been exceedingly successful in developing products that are viable in the India market. Both AMS and ACE Designers have been recognised by the Department of Scientific and Industrial Research (DSIR).

INDUSTRY 4.0 LEVERS

10 TO 40% REDUCTION OF MAINTENANCE COST

20 TO 50% REDUCTION IN TIME TO MARKET

FORECASTING ACCURACY INCREASED TO 85%+

COSTS FOR QUALITY REDUCED BY 10 TO 20%

PRODUCTIVITY INCREASE OF 3 TO 5%

30 TO 50% REDUCTION OF TOTAL MACHINE DOWNTIME

45 TO 55% INCREASED PRODUCTIVITY IN TECHNICAL PROFESSIONS THROUGH AUTOMATION OF KNOWLEDGE WORK

COSTS FOR INVENTORY HOLDING DECREASED BY 20 TO 50%

VALUE DRIVERS

SERVICE/ AFTER SALES
- Predictive maintenance
- Remote maintenance
- Virtually guided self service

RESOURCE/ PROCESSES
- Smart energy consumption
- Intelligent lots
- Real time yield optimization

TIME TO MARKET
- Customer cocreation/open innovation
- Concurrent engineering
- Rapid experimentation & simulation

ASSET UTILIZATION
- Routing flexibility
- Machine flexibility
- Remote monitoring & control
- Predictive maintenance
- Augmented reality MRO

SUPPLY/DEMAND MATCHING
- Data-driven demand prediction
- Data-driven design to value

LABOUR
- Human-robot collaboration
- Remote monitoring and control
- Digital performance management
- Automation of knowledge work

QUALITY
- Statistical process control
- Advanced process control
- Digital quality management

INVENTORIES
- In-situ 3-D printing
- Real-Time supply Chain optimazation
- Batch size 1

Source: McKINSEY

CUSTOMER-CENTRIC, AFFORDABLE, ACCESSIBLE

Today the Ace Micromatic group nurtures ambitious plans to move up the value-curve by offering design driven 'Industry 4.0 'solutions to customers such as customised OEE (overall equipment efficiency) and real-time machine-monitoring. The solutions allow manufacturing companies to gain visibility into their shop operations up to a cycle.

Nearly 60% of its customers are SMEs with whom the group shares a close connection. For some of these small businesses Rs 15-20 lakhs investment on machines is a large outflow. The group prides itself on training and helping customers attain productivity through close relationships and hand-holding. As TK Ramesh points out, "Our success can be attributed to our collective ability to convert designs into making products cost effective. Looking back at the three decades of operation, we can confidently say that Micromatic played a key role in nurturing the SSI's & the SME's to adopt CNC technology and move towards global quality levels, through providing them with affordable CNC technology and close hand holding. I think it explains why we have the maximum share in the Indian CNC market".

The shift towards smart-manufacturing in India puts Ace Micromatic in a unique position to introduce 'Industry 4.0' technologies to its customer base and gives it a degree of first-mover advantage in the SME space.
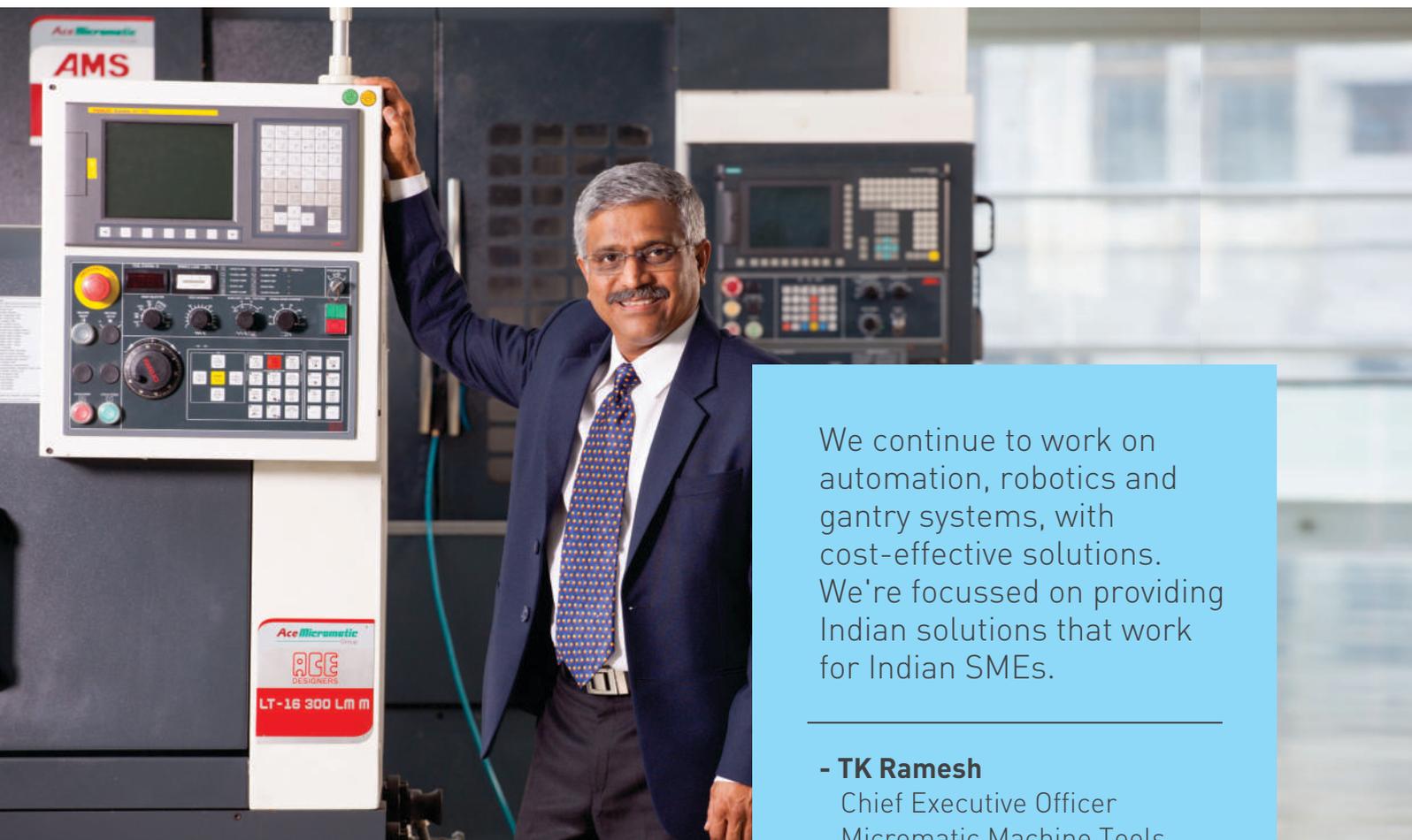
> We continue to work on automation, robotics and gantry systems, with cost-effective solutions. We're focussed on providing Indian solutions that work for Indian SMEs.

- TK Ramesh
  Chief Executive Officer
  Micromatic Machine Tools

INDUSTRY 4.0 - 4 STEP PROCESS

Vertical Value Chain

COMPANY

Sales

Product (R&D)

Planning

Purchasing

Manufacturuing

Logistics

Service

IT, Shared Services

Finance, Tax Legal

Horizontal Value Chain

SUPPLIERS   COMPANY   CUSTOMERS

Network of Suppliers

Manufacturing

Network of Customers

| 1 | Data Acquisition | 2 | Analytics & Alerts | 3 | Feedback & Workflows | 4 | Integrated Enterprises Systems |

CASE IN POINT: SPHOORTI MACHINE TOOLS

Sphoorti Machine Tools is an excellent example of Ace Micromatic's customer focus at work. The company is a small enterprise specializing in the manufacture of Tool Discs and Tool Holders. It began in manufacturing in 1996 with two Machining Centers, and over the years the company has undergone many stages of development to emerge as one of the India's leading manufacturers with 40% of sales exported globally.

The company however was facing a severe problem with data collection in the manufacturing process and their manual method was giving rise to various inconsistencies.

- There was a large time lag in collection and in some case the reporting took months

- The validity of their manual data was under question

- The suspected 'down-time' of machinery as perceived by the operator was an estimate and not based on actual measured specifics

In 2015, with the intent to meet the increased demand and lower overheads within existing capacity, Sphoorti made the calculated decision to apply real-time tracking of data to increase operational efficiency and shift towards more automated processes and data analytics. The problem was; Sphoorti had a varied manufacturing line with 21 machines from different manufacturers and different CNC controls makers (some were Siemens and some were Fanuc). Some of the machines were nearly 15 years old while others were recent purchases. Finding a solution to address these incompatibilities was crucial.

Sphoorti brought AmiT experts (AmiT is Ace Micromatics 'smart' solutions vertical. It aims to offer innovative technology solutions for

progressive organizations) to study their shop floor and suggest the possible solutions. After understanding the problem in detail, the team form AmiT identified two applications that would address the concerns. These were then evaluated for cost-benefit ratios with the eventual decision to upgrade data-tacking entirely to AmiT's TPM-Trak technology suite. It took a period of 6 months to deploy.

The results were immediate and surprising:

Sphoorti realised that its manual efficiency calculation of 84% was an optimistic projection at best. The actual OEE measured using TPM-Trak real-time data showed a marked difference dropping to a mere 58%.

Not only did the technology help get a realistic picture of the shop-floor, it also provided Sphoorti with automated reports allowing for better decision making and immense gains in productivity. TPM-Trak production reports were utilized to address production issues rather than worry about availability of data or its validity. As a result Sphoorti saved

20% of production loss hours just through managerial efficiencies.

Internal utilization of machines increased by almost 30% saving the company added costs of additional machines, manpower, land and consumables. They could now clearly & precisely know how management losses contributed to slowing production and lesser machine utilization.

Today Sphoorti installs TPM-Trak on all new machines on its shop-floor from day one and their production meetings are conducted using TPM-Trak dash-boards and reports. The company is now planning to go paperless by utilizing e-SHOPx, products from AmiT.

M Gunasekaran, plant manager at Sphoorti Machine Tools explains the benefits, "We are monitoring our total manufacturing efficiency through TPM-Trak. This includes program transfer without machine disturbance, verification, actual cycle time analysis, actual loading and unloading analysis, machine down time analysis on a daily and weekly basis, etc"

BORN, BRED & PERFECTED ON THE SHOP-FLOOR

TRACEABILITY

REAL-TIME OEE & PRODUCTION ANALYTICS

ASSEMBLY & CONVEYOR MONITORING

Industry 4.0 & Factory Iot

Optimize your Factory. Increase your profits!

PROCESS ENERGY MONITORING

e-SHOPx & WORK FLOW

VISUAL FACTORY & ANDON

MACHINECONNECT™

ONLINE INSPECTION& POKA YOKE

NEED BASED INNOVATION

As often explained by management, Ace Micromatic works on a model for innovation that is market need driven and customer cost conscious. The company has to, given the business model of its customers. Even as it moves up the value chain Ace Micromatics is not planning to lose sight of this by any means. For most of its customers automation is not the solution due to cost. Therefore, they are left with addressing only the non-productive cost, which cannot be controlled without adequate data. "We thought that there can be some level of smartness that can be built into the machines and TPM Trak emerged," Ramesh explains

(TPM Trak is Ace Micromatic's elite suite of products designed to provide Industry 4.0 solutions). Currently the group has deployed TPM Trak at hundreds of companies, most of whom are suppliers to OEM's claiming that customers have enjoyed productivity gains of 10 percent to 30 percent, ensuring very high operating efficiencies.

As the group innovates further to address the needs of SME's grappling with the Smart Manufacturing wave, it can have a significant part to play assisting a section of manufacturers that often get overlooked by top-end cutting-edge 'expensive' solutions.
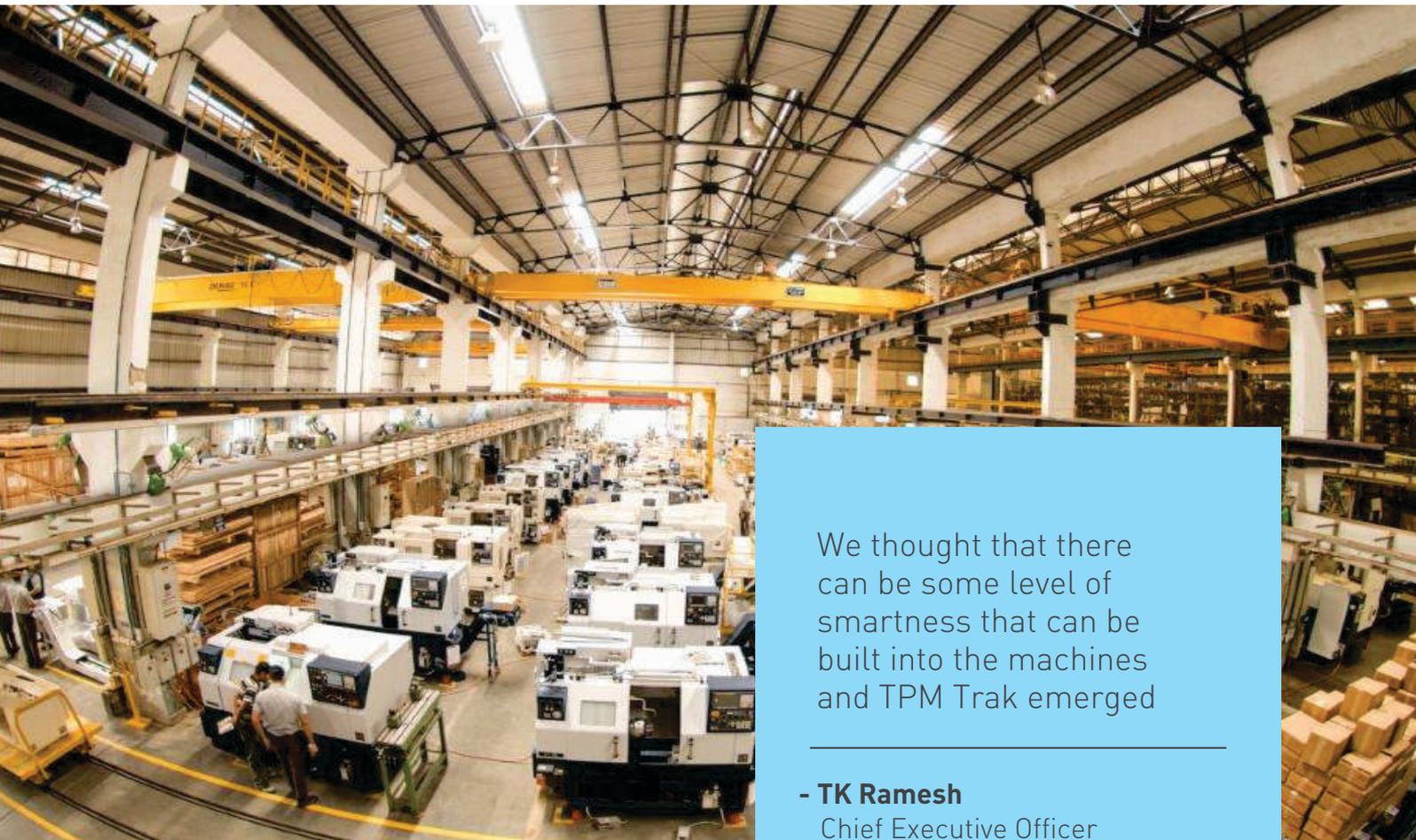
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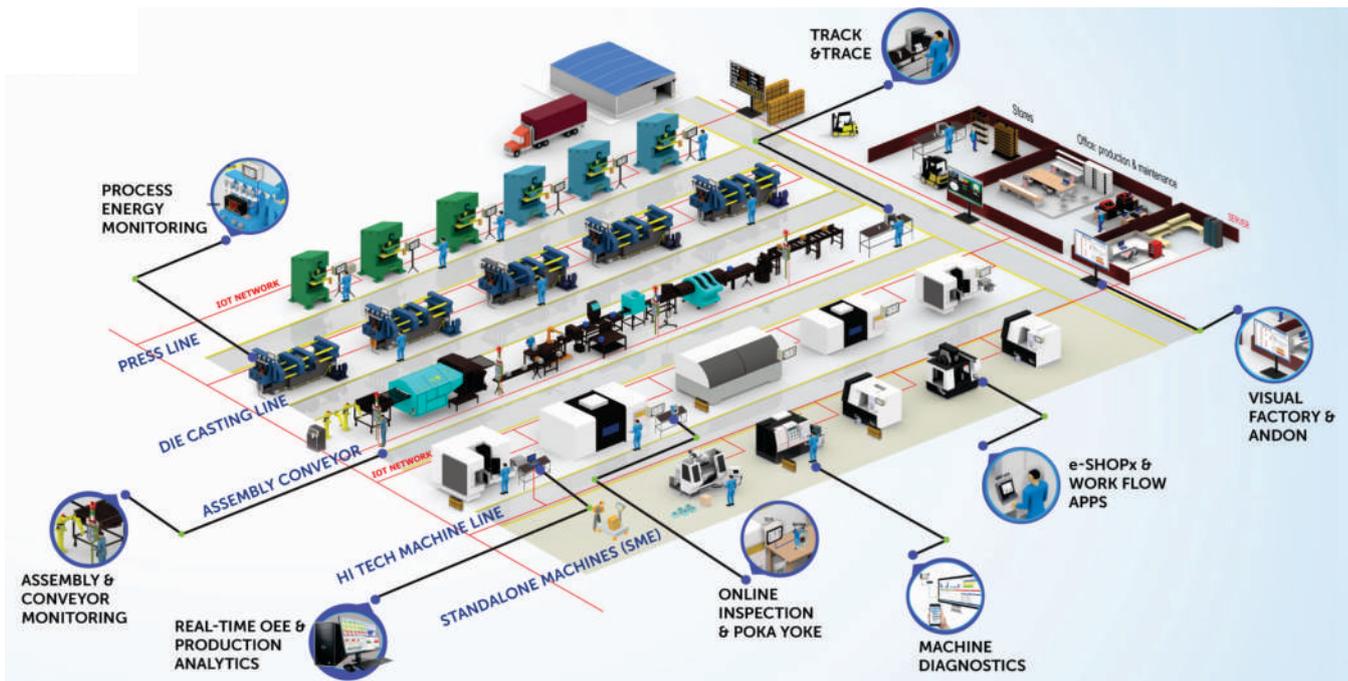
The INR 17bn, Ace Micromatic Group is India's largest machine tool conglomerate with a presence in several countries across Asia, Australia, Middle East, North & South America and Europe. Formed with the intent to provide its customers a one stop shop for all machining needs, the group specializes in the manufacturing of CNC controlled turning, milling and grinding machines along with subsystems such as tool turrets, ATC etc.

B&R India

CONSOLIDATED END-TO-END PRODUCTS FOR THE FUTURE

April, 2017, European, fortune 500 major, ABB, concludes its acquisition of B&R. It is a landmark move in aligning the expertise of both providers for the global Industry 4.0 market.

Strategically, it's probably the most important deal ABB has ever done.

"This combination is an once-in-a-lifetime opportunity. This transaction will close the historic gap within ABB's automation offering. This is a perfect fit and will make us the only industrial automation provider offering customers the entire spectrum of technology and software solutions around measurement, control, actuation, robotics, digitalization and electrification," states ABB, CEO, Ulrich Spiesshofer.

The acquisition creates a monolith with exciting synergies and expansive market reach across the technology spectrum and is indicative of Spiesshofer's global plans for the conglomerate. It is expected to increase ABB's sales in industrial automation to around $15 billion by adding B&R's annual sales of more than $600 million. This will be through reverse integrating ABB's digital offering, ABB Ability, with the simulation software expertise and advanced engineering tools of B&R. The combined entity boasts (1) an installed base of more than 70 million connected devices and 70,000 control systems (2) more than 3 million automated machines (3) 27,000 factory installations around the world.

But those are not the only advantages. Most significantly it closes the gap with Siemens and puts ABB more firmly ahead of industry competitors such as GE, Emerson, Schneider Electric, Honeywell and Rockwell Automation. "In the future, there are two major players in the world in this segment," Spiesshofer says, "Siemens is No. 1 in factory automation. We are No. 1 in process automation and now a key player in factory automation as well."

The race for market domination in the fourth industrial revolution just got tighter.

B&R - FAST GROWING INNOVATION LEADER

"Perfection in Automation" - since 1979

Key facts and figures

Solutions for machine and factory automation
Top 5 in PLC[1]/ IPC[2]/ servo motion

~4000 machine builder / OEM customers

>3 mn automated machines, ~27,000 plant installations

> $600 mn revenue FY 2015/16

CAGR ~11% since 1995

$75 mn, 12% EBIT FY 2015/16

>3,000 employees[3]; >500 application engineers
Active in 70 countries
Headquarters: Eggelsberg, Austria

Markets

- Plastics
- F&B
- Packaging
- Paper & printing
- Metals
- Textile machinery
- Automotive
- Others

Products

- PLC
- IPC/HMI[4]
- Servo Motion
- Other

Geography (top 3 countries per region)

- Europe: Germany, Austria, Italy
- AMEA: China, India, South Korea
- Americas: US, Canada, Brazil

[1]PLC: Programmable Logical Controller; [2]IPC: Industrial PC; [3]As of june 30, 2016; [4]HMI: Human Machine Interface; Note: Foreign exchange rate as of March 31,2017

INDIA IS A KEY MARKET FOR BOTH PLAYERS

B&R has been steadily growing its market in India, and as such, is critical in ABB's plans for the subcontinent as part of ABB's Next-level strategy. According to Sanjeev Sharma, Managing Director, ABB India, "Deeper customer engagement, expanding markets and the requisite technology footprint have resulted in leveraging opportunities in the domestic markets as well as accelerated making in India for the world. A keen customer focus and collaboration will remain the cornerstone of our navigation in a world of Energy and Fourth Industrial Revolution."

B&R meanwhile has established itself among the top three suppliers of automation solutions. In 2015 the Pune based company opened a new facility in Thane's industrial belt to cater to customers in and around Mumbai with the help of a complete team from sales, application, support and training. This expansion was a part of company's growth strategy for the Indian market and philosophy to be near the customers. In 2016 it announced its foray into process and factory automation business in India. The approach is simple, says PV Sivaram, Managing Director, B&R, "We work to provide a competitive advantage to our customers by using our global innovations and the ingenuity of Indian engineers."

Currently on the back of the acquisition the company is heavily investing in R&D, infrastructure and workforce expansion. India has also seen increased investment, with new training centers opening up in all of B&R's offices. This has been complemented by a new warehouse in Pune with a capacity of over 20,000 square meters. Sivaram points out the important role played by India in B&R's overall strategy, "The Indian economy is experiencing rapid growth, with the processing industry growing twice as fast as the GDP. Over the next few years, the share of Indian industrial goods on the global market will increase disproportionately and with it the demand for automation technology among India's machine manufacturers. We are ready to satisfy this demand."

SYNERGIES BETWEEN ABB - B&R
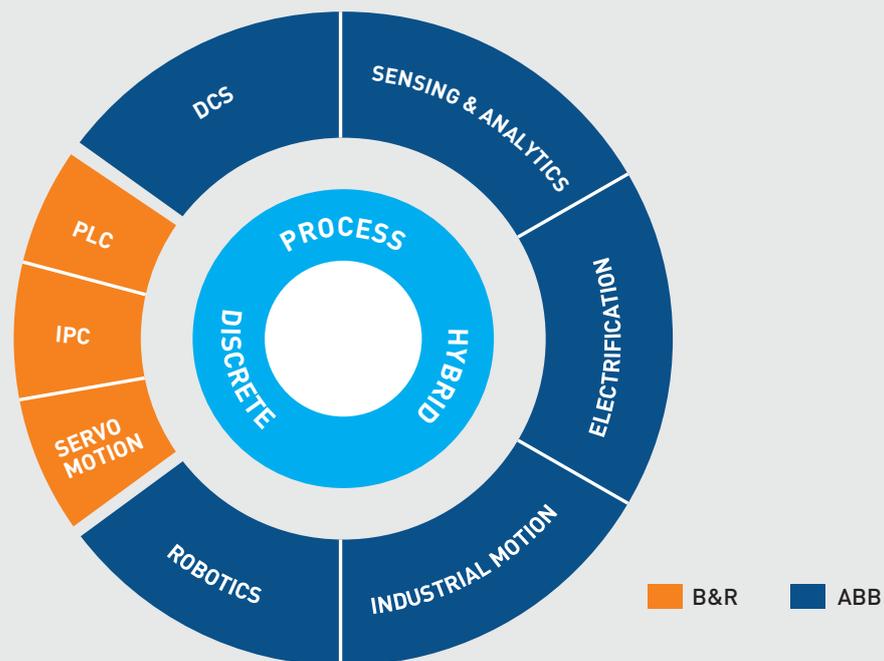
ATTRACTIVE MARKET SEGMENT

($ bn)

■ PLC / IPC[1] ■ Servo motion

CAGR
4 - 5 %

20

25

2017

2022
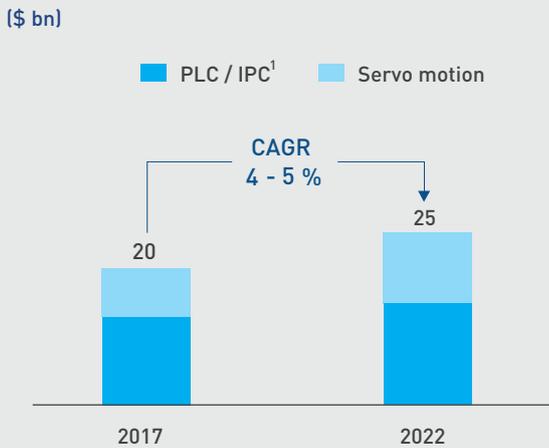
ATTRACTIVE TOP-LINE GROWTH OF B&R

($ mn)

>600

CAGR
~11%

70

95 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16
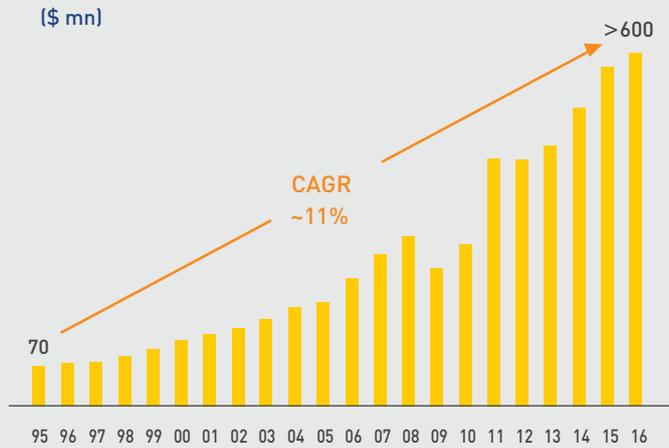
CASE IN POINT:
FOOD & BEVERAGE COMPANY IN INDIA

According to B&R its smart factory in the upper Austrian town of Eggelsberg has been fully networked since 2006 and is being upgraded all the time. B&R India operates as the Indian arm of the Austrian parent company and is completely synched with providing these Industry 4.0 solutions that are being developed at the Eggelsberg R&D centre.

One such niche product is APROL, which enables industrial users to make brownfield installations helping them leap towards smart factory effectiveness with improved Overall Equipment Efficiency (OEE), easier machine operation and maintenance. APROL is a process data acquisition solution that uses Linux as an operating system, which is open source providing a lowest total cost of ownership. It has an integrated firewall and provides data acquisition, energy monitoring and condition monitoring analyses and real-time reporting.

APROL was recently implemented at a domestic F&B company with excellent results.

According to B&R, some of the major challenges faced by the F&B manufacturer were –

1: the cost of investment of a new product line in order to cater to the rising consumer demands

2: legacy systems in the factories work that with individual machines, working independently on the shop floor

3: human errors in data collection and analyses

4: analysis is never real-time and operators are never able to diagnose the actual problem causing losses, breakdown and systems stoppages

After the implementation of APROL the company saw optimization in asset utilization through monitoring individual equipment and overall line efficiency. The entire system became customizable, scalable and secure. All errors were eliminated. Currently the F&B manufacturer is planning to roll out the solution across other production lines as well.

WHERE NEXT?

India is poised to be the focus of multinationals as they consolidate their market leadership and look towards developing countries for markets as well and cost effective production and R&D. This gives B&R an edge in the country with its internationally tested products and solutions. Also, as ABB integrates its acquisition across geographies B&R India will likely gain markets and customers for its Industry 4.0 solutions. A relatively niche product offering from B&R in the country may get repackaged or augmented for end-to-end solutions with ABB's expertise.

As Sivaram clarifies, "There are many drivers for the fourth Industrial Revolution. Firstly, the developed economies have exhausted the potential of mass production. Secondly, with the customers becoming more demanding, the number of product variants has become enormous. This is boosted by the breakdown of trade barriers – the customer and supplier could be situated anywhere. Hence, this is a good strategy for developed countries to tackle competition from places where the cost of labor is low."

BUSINESS VOLUME INDUSTRIAL AUTOMATION (PRODUCTS, SOFTWARE, SOLUTIONS, SERVICES)

~$15bn

Siemens | ABB + B&R | Emerson | GE | Schneider | Fanuc | Honeywell | Rockwell | Yaskawa | Yologawa | KukA
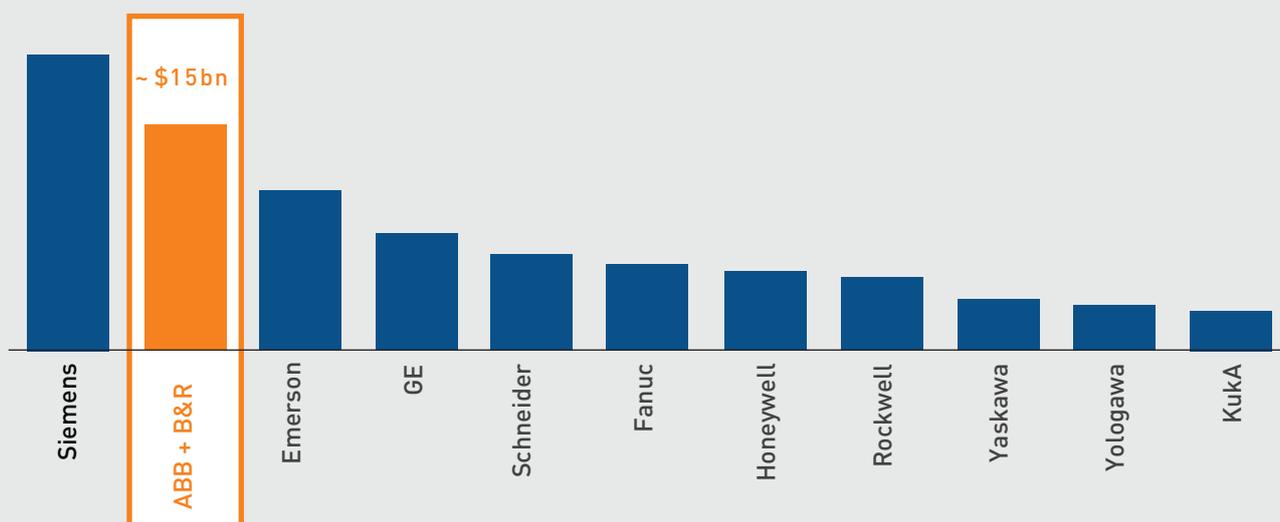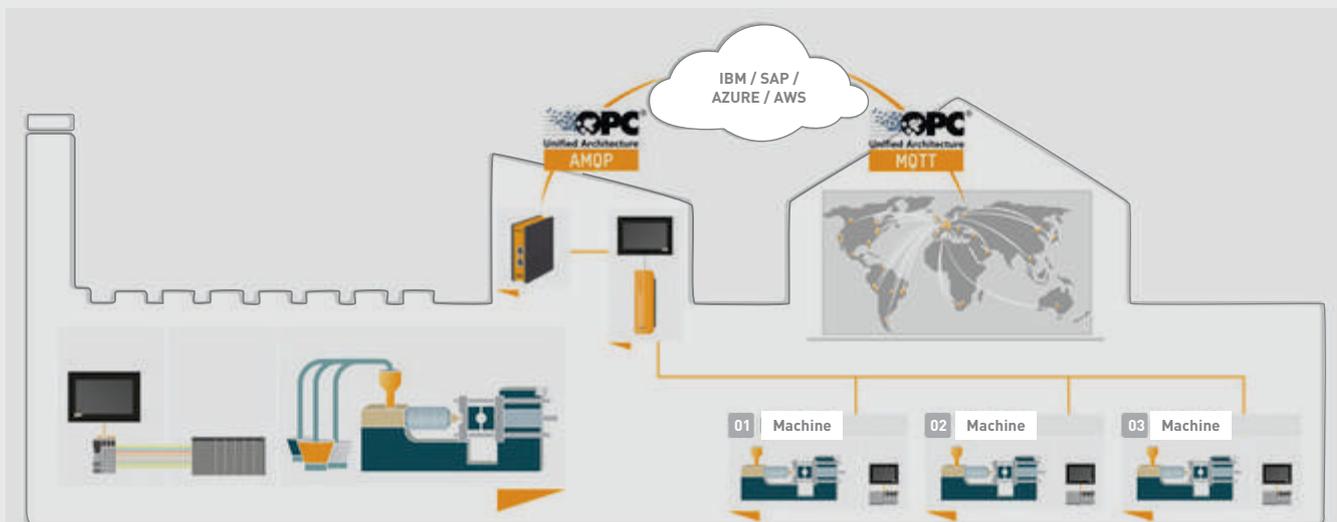
Founded in 1979, B&R Industrial Automation GmbH has its R&D and production headquarters in Eggelsberg, Austria. As a manufacturer of automation technology, the company specializes in machine and factory control systems, HMI and motion control. It has 190 offices across the globe with 3000 employees including about 1,000 R&D and application engineers. It operates across 70 countries, generating sales of more than $600 million (2015/16) in the $20 billion machine and factory automation market segment. B&R India is an 100% subsidiary of the Austrian company; with locations in Pune, Ahmadabad, Bangalore, Chennai, Coimbatore, Mumbai, and New Delhi.

ABB (ASEA Brown Boveri) is a Swiss multinational corporation headquartered in Zürich, Switzerland, operating mainly in robotics, power, heavy electrical equipments, and automation technology areas. It is ranked 286th in The World's Most Admired companies in the Fortune 500 global list of 2016. ABB has been a Global Fortune 500 company for 23 years. It is one of the largest engineering companies as well as one of the largest conglomerates in the world. ABB has operations in around 100 countries, with approximately 132,000 employees as of December 2016.

Bosch India

COLLABORATION, RE-VISION, CONNECTION AND INNOVATION
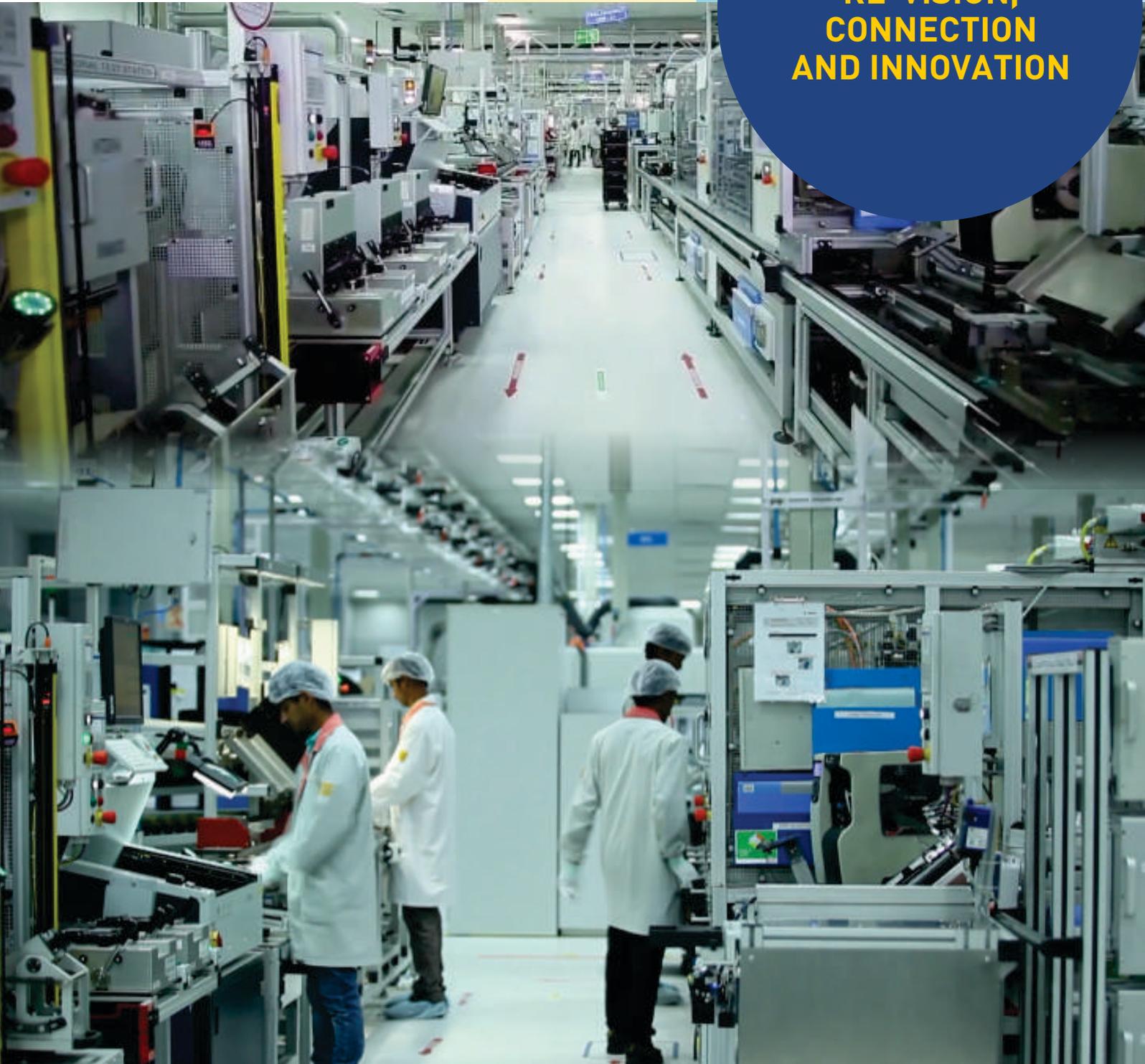
Fifteen manufacturing sites, seven R&D centres, and 31,000+ people employed, make Bosch one of the largest and oldest international companies present the country. Established in 1922 (as MICO), today the conglomerate has over 12 subsidiaries operating in India under the parent umbrella of Bosch India Limited. The German giant in engineering and technology solutions also has its largest development centres outside Germany in India.

Bosch has always had a keen focus on India in for its domestic market, manufacturing and high-end research and development. The company has grown on the back of great local demand for MICO engineering products in independent India's bourgeoning automotive sector. As a result the parent company and has gradually increased its stake over the years in the local subsidiary from 9% initially to the 70% it currently holds. In 2004 the company made plan to invest INR10bn in capacity building to increase manufacturing of CRS products for the automotive sector.

Following this in 2007, the organization consolidated all India operations under a geographic matrix structure that Bosch was rolling out across international operations. As part of the changes, the India operations had to undergo tremendous structural and process changes. The result was a greater integration among the group companies in India and greater integration with the global product divisions. The streamlined new businesses were better equipped to pursue R&D and develop diverse products for the Indian and global market. Now the focus is on Smart Manufacturing.

"Our journey has been a great learning curve. From predominantly being considered as an automobile component manufacturer to opening businesses and ensuring growth in other sectors, such as Energy and Security Solutions, to name a few. Currently, we have made headway from being an intelligent organization to a connected set-up. For Bosch India, transitioning to a connected era requires a change in mindset. The decision to become a smart and then eventually a connected company is not an option but an imperative for long-term success," says Soumitra Bhattacharya, Managing Director, Bosch Limited; President, Bosch Group, India.

Bosch is realizing Industry 4.0 at several of its plants worldwide

265
Manufacturing Plants

129
Years of legacy

over **100**
experts in industrial technology
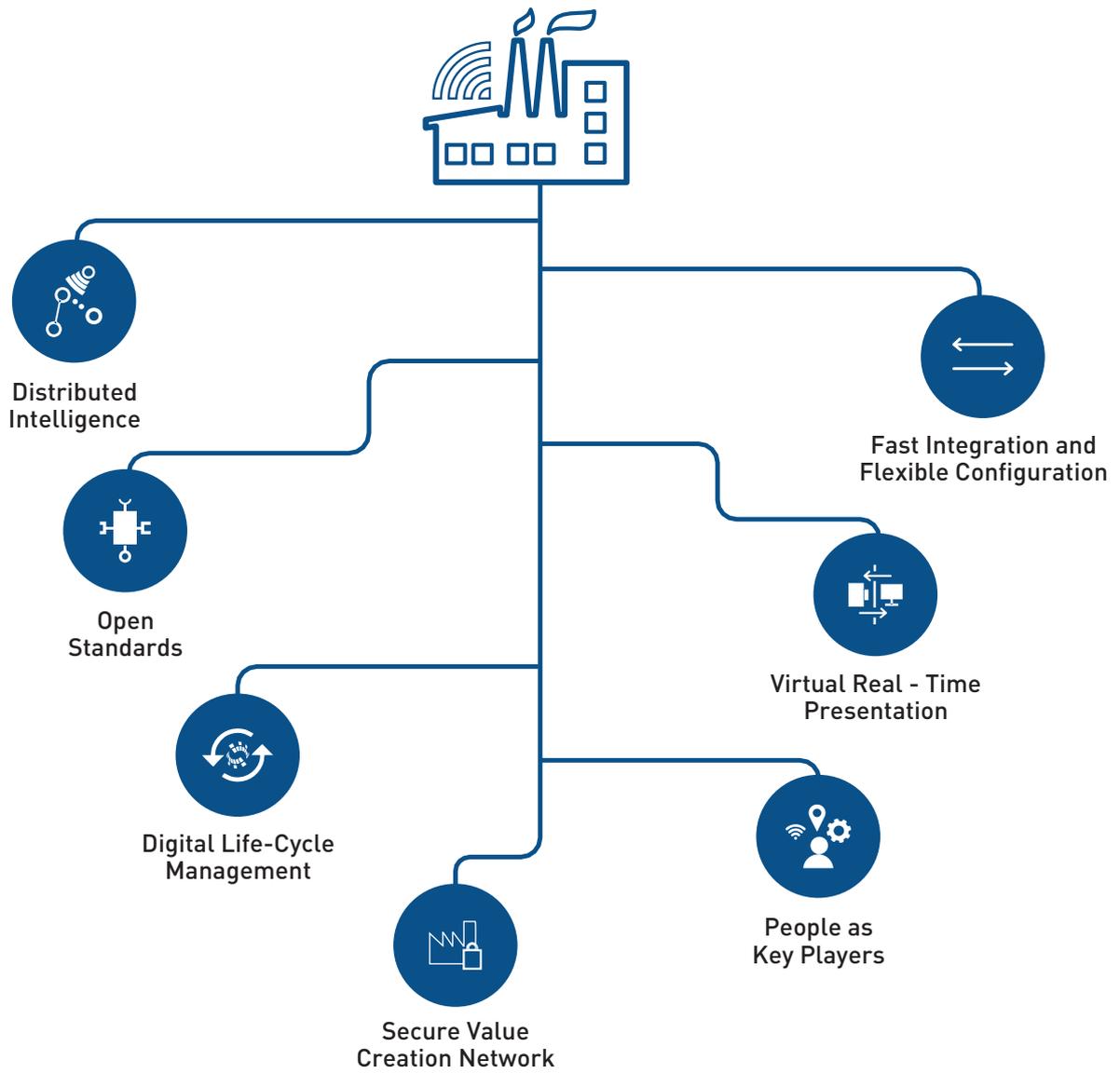
2018*

*Industry 4.0 implemented in all of the 14 manufacturing locations in India

INDUSTRY 4.0 - LIFE-CYCLE

Distributed
Intelligence

Open
Standards

Digital Life-Cycle
Management

Secure Value
Creation Network

Fast Integration and
Flexible Configuration

Virtual Real - Time
Presentation

People as
Key Players

> Our journey has been a great learning curve. From predominantly being considered as an automobile component manufacturer to opening businesses and ensuring growth in other sectors, such as Energy and Security Solutions, to name a few. Currently, we have made headway from being an intelligent organization to a connected set-up. For Bosch India, transitioning to a connected era requires a change in mindset. The decision to become a smart and then eventually a connected company is not an option but an imperative for long-term success

– Soumitra Bhattacharya
Managing Director
Bosch Limited; President, Bosch Group, India

AHEAD OF THE CURVE IN IT AND NOW IoT

Innovation especially in Information Technology has been a key area of Bosch's local operations. A small software center founded by Bosch India in 1998 has been incredibly successful. It was transformed into Robert Bosch Engineering and Business Solutions Limited (RBEI) in 2008, and is now a global provider of development services and IT solutions.

It is no wonder then that R&D has been the cornerstone for Bosch's success story in India. Of its 31,000+ workforce the company employs a whopping 18,500 people in areas relating to R&D. That is a long-term calculated bet on the engineering talent in the country and Bosch had ambitious plans to leverage this talent pool further - to capitalize on opportunities arising from the next industrial revolution and the IoT.

In fact, as early as 2014, the company invested Rs 1,200 crore in R&D to explore IoT offerings across automotive and other allied manufacturing businesses. It established the Research & Technology Centre in Bangalore, to this effect, to research Industry 4.0 applications. According to VK Viswanathan, Chairman, Board of Directors, Bosch Limited, "India has also gained some ground with respect to next generation technologies such as Internet of Things (IoT), Artificial Intelligence (AI) and Automation. The adoption and penetration of such technologies will fundamentally alter the way products and services are conceived, designed, manufactured, delivered, consumed and paid for. The winner will clearly be the one who is able to anticipate and be ready for such transformational disruption."

RESEARCH DRIVEN FORWARD THINKING

Bosch, indeed plans to be leading the charge towards Industry 4.0. Bosch's vision for 2020 entails that every product is connected via the Internet of Things (IoT). According to the group Smart manufacturing can improve India's productivity and optimize operations, apart from initiating and bringing about a structural reform in operations as it paves way for newer, agile and flexible business models. India's core pressure points in the manufacturing sector have been reducing cost, improving quality and process visibility, among others. It is precisely in these where Bosch is preparing to provide solutions.

"At Bosch India, we expect the future to be driven by key trends such as digitization, growing energy needs, urbanization and better ecological solutions." states Vijay Ratnaparkhe, managing director and president, Robert Bosch Engineering and Business Solutions. National initiatives, such as 'Make in India' and 'Digital India,' intend to build the competitiveness of India's core sectors, and Ratnaparkhe is of the firm belief that, "Digitization will improve India's competitiveness while also helping businesses move faster to market."

To this effect the group recently announced an investment of 1.2 billion Euros in the Asia-Pacific region. Of this nearly Rs 1,300 crore is directed towards the IoT space in India. Further, the company is also exploring the option of discovering new tech-based Indian startups to collaborate and invest in, which is a direct result of its DNA (Discover, Nurture and Align) strategy.

Bosch's product portfolio has by design focused on smarter devices that will take the lead in the future; including injection systems, sensors, semiconductors, refrigerators, washing machines and hammer drills. Currently, Robert Bosch Engineering and Business Solutions Private Limited offers this coveted home-grown capability to enterprises that want to capitalize on the opportunity of a "deviced world". Offerings span four key areas:

1) Business Innovation - Bosch sees itself not only as a service provider that can offer technical solutions in this new environment, but also as a development consultant for new business models. This capability comes from expertise in redefining many of Bosch's business models both new and disruptive.

2) Market - The "Internet of things" opens up an entirely new market segment that can be exploited to significant business advantage helping partners capitalise on opportunities. Their road-mapping strategy ensures that enterprises not only tap into newer frontiers of market potential, but fully exploit existing potential.

3) Competencies - Software and systems expertise, paired with industry knowledge and creativity, are core capabilities for the development of innovative solutions and business models. Deploying collaborative models like co-innovation and co-development, the team at Bosch tailors solutions that accentuate partner capabilities.

4) Technology - Internet technology both supports and drives this development. Embracing an open-source approach accelerates development and creates open standards and communities. It is this flexible, agile and scalable model that we infuse into our partner platforms.

SALE PERFORMANCE

Primary Segment

% of sales

Year	Automotive	Other
2012	89%	11%
2013	87%	13%
2015*	88%	12%
2015-2016**	86%	14%
2016-2017	85%	15%

■ Automotive ■ Other

Secondary Segment

% of sales

Year	Domestic	Export
2012	89%	11%
2013	88%	12%
2015*	88%	12%
2015-2016**	91%	9%
2016-2017	92%	8%

■ Domestic ■ Export
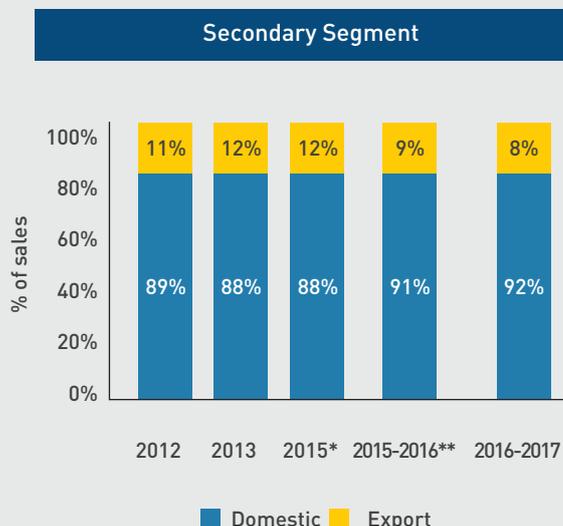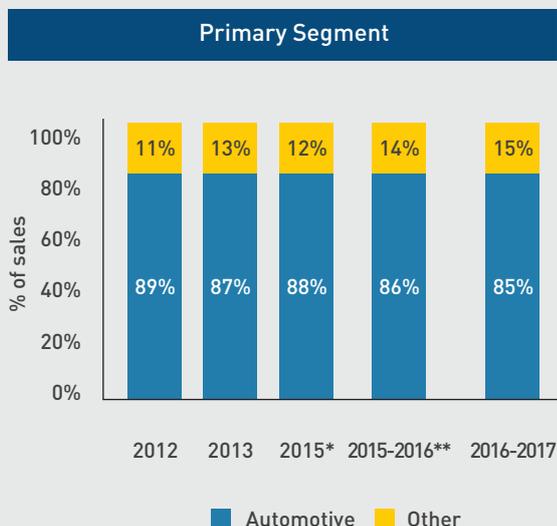
FLEXIBLE AND CUSTOMER-CENTRIC: CASES IN POINT

In November, 2016, Bosch India hosted a smart manufacturing conclave in Mumbai, primarily targeting customers, suppliers and other relevant stakeholders to showcase some of its 'Smart' manufacturing solutions to the industry including the APAS robotic arm and Augmented Reality/Virtual Reality demonstration. Some of the best examples of the innovations at Bosch are the ones that are tailor made for a diverse range of companies operating in various verticals.

01: In the consumer goods space, Bosch has partnered with one of India's leading air conditioning and commercial refrigeration company to create the complete blue print for its digital journey. This includes connecting its research and development, manufacturing, and customer experience through Industry 4.0 solutions. As part of the pilot project, the company will automate the entire production planning, apart from implementing condition monitoring for selected machines. Additionally, Bosch India will also enhance the company's customer experience through augmented reality showroom solutions.

02: For one of India's largest two-wheeler manufacturers Bosch India has identified areas, in the maintenance function that could further be improved. Bosch has proposed a solution that combines preventive maintenance and status dashboards, operator mobility solutions on tablets and mobile phones, and remote diagnostics including real time status and control. The dash board provides detailed information on the breakdown, such as name and description of the breakdown, location, date, time, duration, operator and shift details. The maintenance solution will allow operators flexibility and mobility solutions as they can access notifications on the go. The remote diagnostics tool enables analysis of breakdowns over the Intranet and the Internet.

CAPITAL EXPENDITURE

Capital expenditure percentage to sales

Capex(In Mio INR) ── Capex/sales(%)

Location-wise capital expenditure

- Bangalore — 28.4%
- Nashik — 22.3%
- Bidadi — 43.1%
- Chennai — 0.6%
- Gangaikondan — 0.3%
- Others — 5.4%
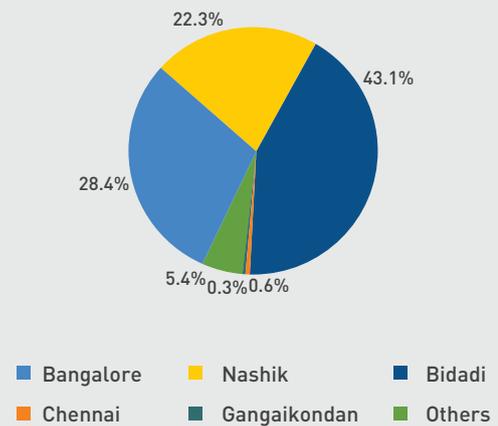
* 2015 represents fifteen months period starting from January 01, 2014 to March 31, 2015.
** Re-stated on account of sale of the Starter Motors and Generators business with effect from August 01, 2016 and adoption of Ind AS.

EXECUTION AND EFFICIENCY

Perhaps the best case to illustrate Bosch's capabilities, dedication and expertise in Industry 4.0 is its own widespread manufacturing network in India. In 2015, Dr Andreas Wolf, Joint Managing Director, Bosch Limited, made a decisive plan to roll out Industry 4.0 across all 18 plants. That was an ambitious and landmark decision. Fuelled by the idea of 'Lean Manufacturing', the work began across the factory network with the aim to connect every tool, machine, material, process, command and person.

"Automation coupled with connectivity can improve transparency, facilitate real-time data analysis and continuously improve quality and environmental performance. They should be able to strike the right balance between level of automation and the degree of human interface to limit excessive use of resources. This will help companies deliver top-quality products using clean technology"

Today, Pravin Pathak, Project Leader for Industry 4.0, and his team are working towards actualizing that goal with pay-offs guaranteed in merely two years. The focus is on areas such as digitalization of shop-floor management through virtual reality solutions, usage of machine-to-machine (M2M) connectivity, energy management, and implementation of manufacturing executing systems. As a result several legacy assembly lines have been restructured to achieve higher efficiency and increased productivity.

Mining and mobilizing this data is critical for Bosch India's move to smart manufacturing. For instance, a data mining and parametric modeling initiative resulted in 50 percent reduction in testing time for a single-cylinder PF51 pump at the Bangalore plant.

Another key development is the imminent 2019 shift to a state-of-the-art plant in Bidadi. The futuristic center will optimize space by 30 percent and streamline smart manufacturing in terms of production, connectivity and quality.

Similarly the MES Pro Master implementation at the Chakan plant (part of Bosch Chassis and Systems India Private Limited), has led to an increase in overall equipment effectiveness (OEE) by a significant amount thus solidifying its status as a benchmark for OEE productivity among plants with manual lines.

Pathak firmly believes that Bosch India is uniquely placed to turn the vision of a smart factory into reality because "The power of Industry 4.0 is more obvious than ever." Whether it's as simple as marking assets with radio-frequency identification (RFID) tags to reduce inventory by 30 percent or repurposing a complex integrated Transport Management System (iTMS) to manage elements of transportation like network design, monitoring, freight cost clearance, performance and analytics; the team at Bosch Limited is making this transition dynamic and profitable.

The Bosch Group is a leading global supplier of technology and services. It employs roughly 390,000 associates worldwide (as of December 31, 2016) and generated sales of 73.1 billion euros in 2016. Its operations are divided into four business sectors: Mobility Solutions, Industrial Technology, Consumer Goods, and Energy and Building Technology. The Bosch Group comprises Robert Bosch GmbH and its roughly 440 subsidiaries and regional companies in some 60 countries. Including sales and service partners, Bosch's global manufacturing and sales network covers some 150 countries. The basis for the company's future growth is its innovative strength. Bosch employs 55,800 associates in research and development at roughly 118 locations across the globe. Robert Bosch GmbH along with its subsidiary holds 70.49 percent stake in Bosch Limited India.

IBM

IBM India

**LEADING
THE CHANGE
IN COGNITIVE
COMPUTING**

IBM opened its first Indian offices in Mumbai and Delhi in 1951 and is now widely spread across the country. The multinational employs 130,000 people in India, which is a staggering one-third of its total workforce across the world and operates several state-of-art research facilities that cater to both local and global demand for IT services.

India operations are the core of IBM's strength's in R&D, and they also make the technology giant globally competitive by keeping down its IT services costs. The technology services offered by its India operations span the entire range of IBM's businesses, from managing the diverse computing needs of global leaders, to performing cutting-edge research in futuristic technologies. "IBM India, in the truest sense, is a microcosm of IBM (global)," Vanitha Narayanan, Chairman of the company's Indian operations recently told the New York Times.

But with revenue models changing in the Information Technology space (IBM reported 21 quarters of declining revenues as of September 2017); criticism of off-shoring from the US government under the Trump era; and the distinct focus towards smart manufacturing in developing economies – IBM India is transforming its business model and seizing India as the next market for growth.

The potential in India is substantial – in 2016, IBM India reported revenues for the Indian IT services business were a 1/3rd of global exports. However, operating profit for Indian IT services exceeded exports by almost INR100cr.

According to Karan Bajwa, IBM's new, India-focused MD, there is a gold mine of data and services to be built around IT in India. "Only 20% of the data that lies with large enterprises is out. The rest remains inside and real power is sitting inside these companies," he said in an interview with the Economic Times. Sriram Raghavan, director of IBM Research in India further added, "Six years ago, 80-90% of research activities in India would be catering to global needs. Today,

at least 40% of our resources are focused on finding solutions for India."

IBM's revised local strategy is to leverage its core strengths in providing innovative solutions with cloud-computing, analytics and cognitive computing to stave off local and global competition. Bajwa is also clear that data analytics, cognitive computing and cloud technologies are not separate technologies that IBM can apply to each industry vertical. "We have to think differently. Every industry needs its own solutions" he insists. IBM is thus pursuing a customised solution model which offers businesses a mix of products that draw from the company's cutting-edge research on various new-age technologies.

It is not surprising then that IBM India plans on increasingly providing solutions across several industries as well. The focus is on manufacturing, retail, telecommunication, financial services, education, health, ecommerce, energy and utilities. Talking about the company's future Narayanan explained that she looks at India as a hub of affordable innovation, "I see tremendous opportunity for us to power India's digital transformation with our cognitive cloud platforms and deep industry expertise."

> Six years ago, 80-90% of research activities in India would be catering to global needs. Today, at least 40% of our resources are focused on finding solutions for India.
>
> **- Karan Bajwa**
> Managing Director
> IBM

THE ELEMENTARY OF WATSON

IBM's AI project Watson (a machine learning system, trained primarily by data as opposed to rules), is probably the company's best bet for leveraging its domain expertise in top-end Cognitive Technology services.

Watson started as a follow-up project to IBM DeepBlue, (a computer AI program that defeated world chess champion Gary Kasparov). In 2011, Watson was showcased to on the TV show Jeopardy. Using machine learning, statistical analysis and natural language processing the machine learning system was able to defeat human cognition. According to creator, David Ferruchi, "Watson was able to do what it did only because it was connecting to what humans are creating, and how they're sharing information. Humans are communicating digitally. They're writing down every thought they have. Not only are they communicating in different forms—they are also rating, ranking and regurgitating or re-describing in a variety of different ways. All that information that humans are creating for each other is the kind of information that Watson trains on."

According to IBM, as organizations work to make more data-driven decisions (2.5 billion gigabytes of data being created every single day) they need advanced systems that are able to analyse massive amounts data and deliver actionable insights within seconds. Watson backed systems can process volumes of unstructured data and can offer insights and decision making applications for a range of industries.

Currently Watson powers new consumer and enterprise services in the healthcare, financial services, retail and education markets. IBM has also made the technology accessible through IBM cloud and opened the platform to developers and entrepreneurs, enabling them to build and bring to market their own 'powered by Watson' applications.

As of July this year, IBM India claimed more than 1,000 Indian companies, were using Watson to draw insights from enormous amount of data collected through sensors placed on machines and devices. According to Harriet Green, GM, Watson, IoT, customer engagement and education, "India has exceeded our expectations in numbers. The speed to market in the Indian environment is fantastic. We are working with big brands, medium-sized companies and a phenomenal number of start-ups."

COGNITIVE SYSTEMS ARE CREATING A NEW PARTNERSHIP BETWEEN HUMANS AND TECHNOLOGY

HUMANS EXCEL AT:

COMMON SENSE

MORALS

IMAGINATION

COMPASSION

ABSTRACTION

DILEMMAS

DREAMING

GENERALIZATION
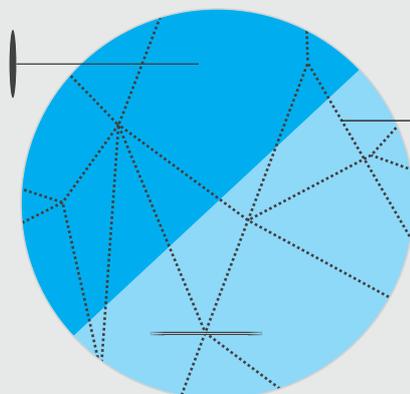
COGNITIVE SYSTEMS EXCEL AT:

LOCATING KNOWLEDGE

PATTERN IDENTIFICATION

NATURAL LANGUAGE

MACHINE LEARNING

ELIMINATE BIAS

ENDLESS CAPACITY

WATSON IS AN EVOLVING SET OF COGNITIVE CAPABILITIES

LANGUAGE				SPEECH	VISION	DATA INSIGHTS

Conversation

Document Conversion

Natural Language Classifier

Tone Analyzer

Speech to Text

Visual Recognition

Alchemy Data News

Alchemy Language

Language Translator

Retrieve & Rank

Personality Insights

Text to Speech

Tradeoff Analytics

CAN COGNITIVE COMPUTING REVOLUTIONIZE MANUFACTURING?

For IBM India this is a billion dollar question. The company believes as more factories and equipment are connected within the IoT, data volumes will only grow larger. Manufacturing will have to become cognitive to process, analyze, and optimize the information. Fuelled by the capabilities of Watson, IBM intends to impact manufacturing in three focused ways:

• Intelligent assets and equipment: utilizing connected sensors, analytics, and cognitive capabilities to sense, communicate and self-diagnose issues in order to optimize performance and reduce unnecessary downtime

• Cognitive processes and operations: analyzing a variety of information from workflows, context, process, and environment to drive quality, enhance operations and decision-making

• Smarter resources and optimization: combining various forms of data from individuals, location, usage, and expertise with cognitive insight to optimize and enhance resources such as labour, workforce, and energy

Alongside, it also plans on further developing local innovations that are globally applicable. A clear example of the company's range and versatility in this is the varied products it is developing, such as cognitive fashion, medical applications and precision agriculture, to name a few.

> India has exceeded our expectations in numbers. The speed to market in the Indian environment is fantastic. We are working with big brands, medium -sized companies and a phenomenal number of start-ups.
>
> - **Harriet Green**
>   GM, Watson
>   IBM

FASHION RETAIL SOLUTIONS FOR INDIAN COMPANIES

IBM India Research Labs has developed a set of capabilities that leverage deep image understanding and natural language technologies that they believe will transform online fashion retail. They allow a consumer to engage with a fashion portal and search for a product in a natural language or through a visual search. For a chosen product, the technology can further recommend accessories and help complete the look. Fashion houses are working with these technologies in identifying latest trends in the market

For example, at Vogue Women of the Year Awards, 2017, held to commemorate 10 years of Vogue in India, the company showcased Watson's cognition capabilities in a sari-gown created by designer Gaurav Gupta. IBM is banking on such innovations to help start-ups brand, develop and scale their businesses.

CASE IN POINT: FASHION MATRIX OVERSEAS

Fashion Matrix Overseas is a 14-year-old, garments manufacturing and exports organization that specializes in niche products for the Europe and US markets. The company is using IBM's advisory and cognitive solutions to create new brands and shift into the digital age.

Fashion Matrix Overseas' core competence is manufacturing bespoke garments for a limited market. It functioned as a traditional manufacturing export business with limited online presence and no established brands. In strategic bid to move up the value curve, the company tied-up with IBM for retail solutions.

IBM's expertise helped fashion matrix create an e-commerce site with cognitive search capabilities. IBM also provided a range of branding, market advisory and digital marketing services.

In January this year, Fashion Matrix Overseas launched its eco-friendly digital fabrics facility in Bangalore. Here, the state-of-the-art production technology supplied by Kornit Digital integrates with IBM's cognitive solutions to digitally enhance the product offerings. The front-end website managed by IBM presents customers with options in fabric,

style and printing and allows specific customizations including size and length of material etc. It not only serves retail customers, but can cater to the B2B garment market in India and abroad.

Fashion Matrix is a great example for small and medium enterprises in India that are looking for innovative solutions in order to upgrade their existing facilities and link with an AI driven digital platform.

HOW DO COGNITIVE SYSTEMS WORK?

UNDERSTAND
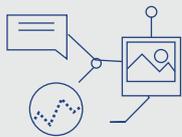
Cognitive systems understand imagery, language and other unstructured data like humans do.

REASON

They can reason, grasp underlying concepts, form hypotheses, and infer and extract ideas.

LEARN

With each data point, interaction and outcome, they develop and sharpen expertise, so they never stop learning.

INTERACT

With abilities to see, talk and hear, cognitive systems interact with humans in a natural way.

IBM (International Business Machines Corporation) is an American multinational technology company headquartered in Armonk, New York, United States, with operations in over 170 countries. The company originated in 1911 as the Computing-Tabulating-Recording Company (CTR) and was renamed "International Business Machines" in 1924. IBM manufactures and markets computers hardware, middleware and software, and offers hosting and consulting services in areas ranging from mainframe computers to nanotechnology. IBM is also a major research organization, holding the record for most patents generated by a business (as of 2017) for 24 consecutive years. Inventions by IBM include the automated teller machine (ATM), the PC, the floppy disk, the hard disk drive, the magnetic stripe card, the relational database, the SQL programming language, the UPC barcode, and dynamic random-access memory (DRAM). IBM India is a subsidiary of the International business.

IFM Electronic India

MEASURING AND FORGING INTO FUTURE

With more than 6,000 employees in more than 70 countries worldwide IFM electronic gmbh is one of the leading manufacturers in the automation industry. In 1994 the family-owned company opened a branch in India, realizing the potential of the Indian economy early-on. The company claims to be a trusted brand for sensors and automation technology in India. It offers a wide range of "Made in Germany" products across various industry segments such as machine tools, F&B, automobile, steel, coal, mobiles etc.

CASE IN POINT: BHARAT FORGE

Bharat Forge (part of the Kalyani Group) is an Indian multinational, with a presence across ten manufacturing locations. It serves several sectors including automotive, power, oil and gas, construction, mining, rail, marine and aerospace. It is India's largest manufacturer and exporter of automotive components and the leading chassis component manufacturers in the world. A USD 2.5 billion conglomerate with 10,000+ global work force, Bharat Forge manufactures a wide range of high performance, safety components for automotive and non-automotive companies.

CHALLENGES

Some of the company's forging facilities at the Mundhawa Pune plant faced following challenges.

01: The forging press ram jam problem during operation. The problem had a number of reasons but the company didn't have any real time data to analyse the exact reason. The Maintenance team was wasting man hours and productivity tackling the problem.

02: There was a quality problem due to a heating process abnormality in the oil fired furnace, and the root causes of the problem were not being identified.

SOLUTION

Selecting the correct platform was a concern considering future expansion plans of the company and the size of Mundhawa plant. Bharat Forge enlisted IFM to solve the problem. IFM decided to apply 'IoT 4.0' concepts to monitor various parameters and provide predictive analysis and real time alerts for both problems that Bharat Forge was facing. IFM put their smart sensor to measure the following critical parameters of the forging press and the oil fired furnace (1) Total time of operation, (2) Combustion air temperature of furnace (3) Furnace oil pressure, temperature and flow.

The sensor deployed was IFM's I4.0 enabled IO-Link, which has the capability to send information directly to the database. The solution was used to monitor real time data and provide predictive analysis and intelligent alerts. As a result the compressed air pressure was being monitored on 20-40 millisecond scan rate before operation and after operation, at input and output side of valves. It also provided intelligent alerts to avoid future problems.

RESULTS

- Real-time monitoring and advance alerts ensured that the problems related to press ram jam were negligible after implementation of the sensor on the forging press line. Pre-implementation of IFM sensors, from Jan o June 2017 the forging press down-time due to ram jam problems was 83 hrs. Post implementation from July 2017-till date down time for ram jam is zero.

- Due to advance alerts there was immediate action on the shop-floor to address furnace related concerns as soon as they occurred.

Today Bharat Forge is looking to develop and implement smart manufacturing solutions across the company.

Moglix

AGILE BUSINESS MODEL TO CAPITALIZE ON DISRUPTIONS

Moglix is an internet start-up that is channeling opportunities arising from the disruptions presented by Industry 4.0. Interestingly, it is also an e-commerce procurement set-up that aims to connect B2B industrial products, suppliers and buyers across the globe. The core strengths of the company are its information technology expertise, which it extends to solve problems related to the digitization of supply-chain, as well as making companies GST compliant. This hybrid business model Moglix adopts has generated a slew of interest and investment.

The startup has gone through two rounds of funding and has raised around $18 million in funds. The most recent in July 2017, raised $12 million in funds. With the new injection of capital Moglix is looking to further strengthen its technology solutions in supply-chain solutions and facilitate geographical expansion. Headquartered in Singapore, it aims to launch in three more cities in India, (apart from its current presence in Noida, Gurgaon, Chennai, and Pune) and is currently working to set up its facilities in Gujarat, Karnataka, etc.

In 2016, Moglix was part of a SAP start-up studio program and started working closely with SAP on driving digital acceleration within manufacturing companies. The company realised that manufacturing industries most commonly have SAP and Oracle as ERPs to process internal procurement approval. Moglix software, built on similar ERP systems easily aligns with existing platforms with respect to SLA (sales level agreement), tax compliance and payments compliance.

With these solutions Moglix intends to serve manufacturing companies that have a turnover of $15.5mn (INR 100 Cr) to $1.5 Bn (INR 10,000 Cr), which is a chunk of the Indian manufacturing sector.

For its online portal it currently has more than 200,000 stock keeping units (SKUs) listed on its platform and claims to have over 2,000 brands across 28+ categories.

COMPREHENSIVE SUPPLY CHAIN SOLUTIONS

Moglix Marketplace

- Vendor consolidation platform
- Integrated with SAP/ ERP
- Product master, Pricing synchronized
- Enables real-time ordering, tracking for all Non-BOM products

Moglix Vendor platform

- 1-stop Catalog engine
- Complete Inventory and Order management
- 2000+ Brands
- 2L+ SKUs

Moglix GST compliance software

- Online Self Serve platform
- SME Buying workflow integration (Group buying and approval workflow)

Moglix MRO Buyer terminal – vendor consolidation

- PO - GRN - Pay - Tax transaction engine
- SCP certified
- White-labeled

Moglix Supplier platform and Catalog management

- GST compliance software for filing GST returns
- Real-time invoice reconciliation between buyers and sellers

B2B OPPORTUNIST

Moglix specializes in B2B procurement of industrial products such as MRO, Fasteners and Industrial Electricals. Its aim is to be the largest technology platform where demand and supply can be matched through price discovery and product availability. Founded in August 2015, the company has witnessing quick growth and has partnered with 1000+ manufacturers and distributors across India, China and other Asian countries.

"B2B ecommerce is actually one of the oldest tech verticals in the US. After roaming in different markets, I realised that, in most markets, B2B commerce has remained largely offline with low adoption of tech and that digitisation of the market is happening everywhere almost simultaneously, specifically in emerging countries such as India", explains Founder and CEO, Rahul Garg.

Garg, is clear on the market opportunity, "According to a recent industry report, the global B2B e-commerce market is estimated to reach $7 trillion by 2020, as it's twice as big as B2C market. We are making strides to harness the potential of the market in India and other Asian countries."

IoT OPPORTUNIST

Moglix stands out as one of the few players operating in the industry 4.0 scenario in India that is not an established engineering stalwart developing applicable advanced solution for digitization. Instead the business has anticipated certain growth areas and is pushing its core expertise to get first mover traction on the back of Industry 4.0 adoption in India. According to management, even though the manufacturing industry is worth $300 billion, just two to three percent of manufacturers currently use software to manage their supply chains, making it one of the least digitized industries in India.

"Moglix strongly believes that the unorganised supply chain in India can only be solved with a technology-first mindset," Garg states. "Globally, top manufacturers have evolved towards adoption of technology for procurement and sales but Indian manufacturers have been slow to adopt technology, leading to process inefficiencies and limited marketing exposure," he adds.

WORKING TOWARDS CREATING DIGITAL AND ORGANIZED SUPPLY-CHAIN IN THE COUNTRY

FRAGMENTED SUPPLIERS/ BRANDS — 1000+

POOR QUALITY OF DATA — 90% POOR

INVENTORY NOT OPTIMIZED — 30% EXCESS

ALTERNATE PRODUCTS — 10% HIGHER PRICE

GST COMPLIANCE — 18% TAX LOSS

PURCHASE PROCESS IS CURRENTLY OFFLINE

Current Process

| MANUAL | NON RECONCILABLE |
| DISCONNECTED | NON-GST COMPLAINT |

Need of the Hour

| AUTOMATED | RECONCILABLE |
| CONNECTED | GST COMPLIANT |
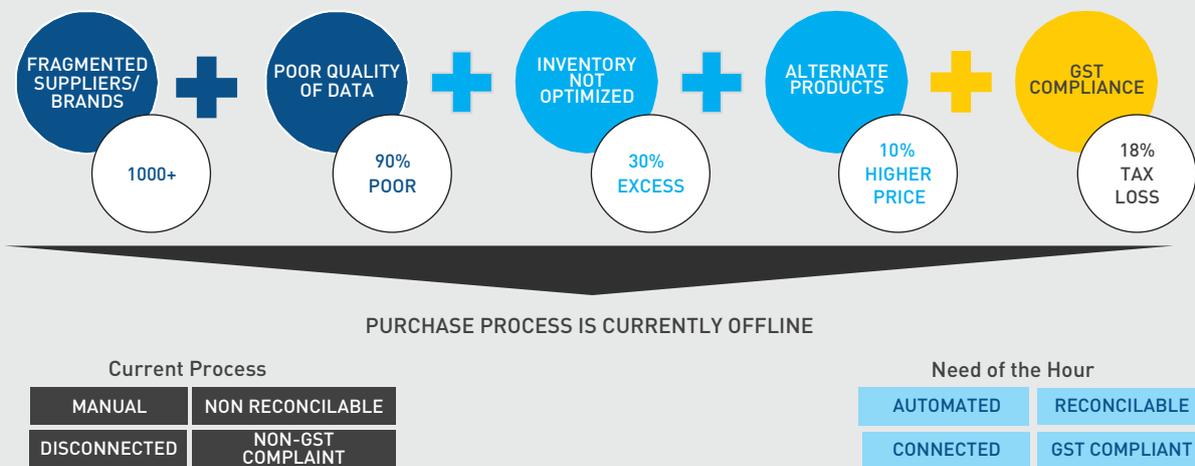
GST OPPORTUNIST

The organized online buying market in the Indian manufacturing industry is miniscule. Supplies have always been procured offline and the traditional way of doing things is unorganized, thus hindering SMEs and other businesses from automating the supply chain vertical. Initially it was difficult for Moglix to change traditional mindsets.

The Indian government's drive in November 2016 towards demonetization firmly created opportunities for Moglix to capitalize on especially by trying to encourage a cashless economy and to get more people to open bank accounts and make digital payments. As Garg explains, it has boiled down to, "B2B

ecommerce will happen. And I don't know how to do it, so please help me".

India's recently implemented Goods and Services Tax, also means that manufacturers have to digitize in a hurry, because they are now required to file indirect taxes (which include service and sales tax) online. Swiftly assessing the business opportunity Moglix developed GreenGST in June 2017 as a SaaS product. This is a system that helps manufacturers keep track of deadlines and make sure all the vendors in their supply chain are compliant with GST norms. "GreenGST automates the new taxing regulations and payments compliances for our existing clients in one seamless platform," Garg adds.

CASE IN POINT: UNO MINDA, 100% INTEGRATED SUPPLY CHAIN

The Uno Minda Group is a INR 4000+ cr automotive components manufacturer supplying to all major Indian and International OEMs such as Hero Honda, Maruti Suzuki etc. The group has 11 group companies, 12 subsidiaries, 3 Japanese joint venture companies and 2 associate companies. The group's 30+ manufacturing plants are spread across India.

The company however was experiencing problems in dealing with its 2000+ vendors as the communication with them was primarily manual. To solve their problem, Moglix automated their procurement processes by deploying a vendor portal that could be integrated with SAP. After few months of deployment, Moglix estimates that late deliveries will be reduced by 50% and the productivity of their sourcing managers will be improved by 30%. "Uno Minda has taken a step towards transforming their supply chain which is at the heart of a manufacturing organization," says Garg.

The Uno Minda group also proactively realised that post GST regime, if a vendor's ledger mismatched with theirs, their Input tax credit which is typically 18% to 28% of the working capital will be unnecessarily blocked in the system. With GST coming in, this was the perfect time for them to streamline and digitize the entire procurement interaction with their vendors.

THE CHALLENGES WERE CONSIDERABLE

Uno Minda Group has 30+ manufacturing plants and 2000+ suppliers across India. The interaction between vendors and individual buyers was offline and happening through means of email, phone calls and other modes leading to excessive manual effort, loss of information in transition and incorrect information being exchanged at times. Due to this there were multiple cases where a vendor had sent products which were received in short

PROCESS COVERED BY VENDOR PORTAL

Master Data	Contract Management

BUYERS.MINDA.COM

PR	RFQ	PO	ASN	E-Invoice/Recon	GRN	Return	Payment	Store Inventory

TAX

Quote	PO	ASN	E-Invoice/Recon	GRN	Return	Payment	BI/Analytics

SUPPLIERS.MINDA.COM
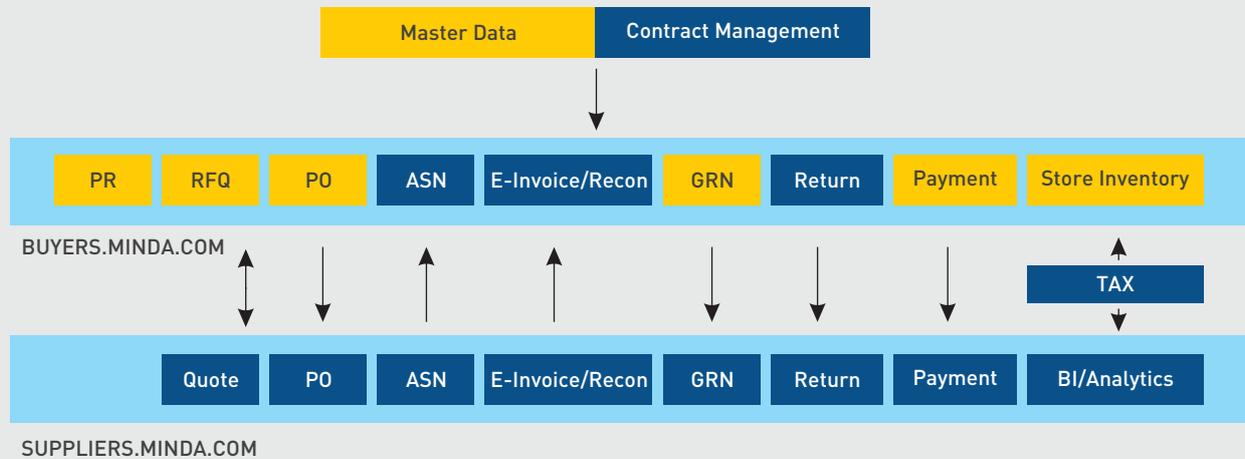
quantity or rejected. But this information reached the vendor only once payment was reflected and the vendor was unable to take any counter-measure. This also led to mismatch in ledgers leading to delayed reconciliations and a very high effort by Uno Minda's finance team and at the vendor's end.

THE SOLUTION WAS CUSTOM MADE

Moglix deployed a P2P platform and a Vendor portal at Uno Minda, for technology enabled procurement and to allow the company to take business decisions based on advanced analytics. The portal ensured seamless communication between vendors and users without any need of manual intervention. The platform deployed on SAP's SCP platform ensured that there was no mismatch of invoices through creation of an Advance Shipment notification and will also ensure increased transparency and visibility in the system.

THE FOLLOWING METHODOLOGY WAS USED

01: Key success metrics were set along with the time frame within which the solution should be able to deliver results

Key success metrics	Objective	Targets	Expected Time frame after the deployment of the solution
Value of procurement handled/full time Buyers	Reduce Cost	Increase	8-10 Months
% time spent on deliveries & Vendor queries Months	Improve man hour productivity	Reduction	2-3
Days of inventory (MRO)	Reduce Cost	Reduction	4-6 Months
Average Fulfillment Rate	Supplier Management	~100%	4-6 Months

02: Based on this the scope of work was defined by Moglix keeping the following aspect in mind - the solution should be able to improve the efficiency of the system. To achieve these objectives, it was very important that thousands of vendors of Uno Minda adopt this solution and start using this product. For this it was important the product should have simplified UIs and workflows so that adoption becomes easier.

03: Basis the scope of work defined, the Moglix team divided the entire product into 6 modules to ensure seamless creation and implementation across the board.

Once implemented the benefits were immediately tangible: -

1. Material forecasting: vendors had the visibility of delivery schedules of the next 5-8 months based on SAP MRP and therefore they could plan forward

2. Purchase order and Schedules: A supplier could now see the schedules or purchase orders against which he had to send the products. If there were any changes in schedules it was updated on a real time basis, and they were able to adjust their production accordingly.

3. Shipment creation and tracking (ASN generation): A vendor is now allowed to send only the quantity of the material for which schedules are open. Before dispatching the products physically vendor has to create an Advance Shipment Notification (ASN) where it is ensured that vendor is sending only those products for which purchase order/ schedule is open.

4. Invoice Reconciliation: Vendor's invoice value necessarily needs to match to Uno Minda's purchase order. If there is any discrepancy in value, taxation, quantity, freight, amortization or any other charges, the system doesn't allow ASN generation. Hence, the problem of invoice mismatches is taken care at the source before the material is dispatched.

5. As soon as the material reaches Uno Minda's plant Gate entry, the same is reflected in SAP using bar code printed on ASN on real time basis saving a lot of manual effort of user at Uno Minda group and comforting the vendor that the material has reached safely and entered into Uno Minda's system.

6. GRN and short quantities: If there was any discrepancy in terms of Short quantity received, GRN rejections, Line rejections etc., the same was shown to the vendor on his platform in real time and vendor was expected to take counter measure immediately.

7. Rejections and quality problem reports: quality and line rejections reports are available to the vendor for corrective actions.

8. Payments: vendors can see payment ledger and payment advice including debit and credit notes.

9. Worker efficiency and impact: Employees that were involved in the transactional activities of following up on invoices moved to strategic roles such as Cost Reduction, Quality Improvement : How to improve the quality and genuineness of the products

Advanced Analytics: Uno Minda's quality department can also now monitor vendor's quality performance closely and make him file Quality Problem Reports (QPR) and Corrective and Preventive action (CAPA) on the portal. The reports are used as a basis to decide vendor ratings and allocation of Share of Business (SOB) to the vendor.

According to Manish Gupta, Head of Products at Moglix "Moglix's procure to pay solution is a perfect example of how technology can bring in supply chain efficiencies between a buyer and vendor. It provides more time to the sourcing managers to take strategic decisions and focus on initiatives such as lean inventory, cost reductions and vendor consolidation - thereby impacting the bottom-line of the organization positively."

Rockwell Automation India

FUTURE-ENABLING TECHNOLOGIES

Order Pick Time
01:14:38

Order Pick Time
00:05:15

Order Pick Time
002:09:27

Order Pick Time
15:14:03

Rockwell India, is a fully owned subsidiary of USA based, Rockwell Automation, one of the world's largest companies dedicated to industrial automation and information. Striving to make its customers more productive and the world more sustainable, the company's flagship Allen-Bradley and Rockwell Software brands are recognized for innovation and excellence. Primarily operating in architecture and software and the control products and solutions space, the company employs about 22,000 people globally and serves customers in more than 80 countries.

Operating at the very high-end of the technology spectrum the company specialises in industry 4.0 solutions and offers a Smart, Safe, Sustainable Manufacturing approach that aims to help customers replace disparate silos of technology with an integrated, information-enabled plant and supply network – the Integrated Architecture™ system.

Solutions based on the Rockwell Automation Integrated Architecture are designed to:

01: Enable Plant-Wide Optimization: This helps customers reap more productivity and efficiency from the automation investments throughout all stages of the plant lifecycle. The architecture is designed for continuous improvement and enables unprecedented levels of visibility and flexibility so customers can quickly adjust to market demands and maximize the return on assets.

02: Boost Machine Builder Performance: This helps customer reduce time-to-market and sharpen their focus on innovation. Rockwell's flexible, scalable automation solutions are designed to lower the total Cost to Design, Develop and Deliver machines and improve overall performance.

03: Drive Sustainable Production: This helps make operations cleaner, safer and more resource-efficient, so customers can increase competitiveness and overcome the rising costs of energy, raw materials and lost worker productivity.

CASE IN POINT: TATA MOTORS MIGRATES TO A NEW MES WITH NEGLIGIBLE DOWNTIME

The Tata Motors passenger vehicle plant in Pune, India, manufactures the Zest, Bolt, Indica and a variety of other models in multiple variants. In 2011, plant managers and engineers recognized that their 6-year-old Manufacturing Execution System needed an upgrade. The existing system was beginning to show early symptoms of ageing.

CHALLENGES

"We were facing system availability issues stemming from sporadic server failures," explains Satarupa Roy Sarkar of Tata Motors, IT "If these continued or became worse, it would prove difficult to meet high availability expectations of users."

Consistent quality was another initiative the Tata Motors team wanted to support. They needed an MES system with automated, real-time, information-sharing capabilities through quality gates. "If a defect is detected, corrective actions need to be taken quickly," said Satarupa. "We needed this to happen more quickly with automated alerts and traceable communications."

To improve the speed of interlinked quality related communication, system based feedback and feed forward mechanisms were implemented. This would help faster actions to support achievements of quality benchmarks.

"We realized we needed to have a revamp of the entire MES," explains Jagdish Belwal, Chief Information Officer for Tata Motors. "When we went for this upgrade, we also treated it as an opportunity to do business process re-engineering. Besides improving production performance, we wanted to standardize applications, processes and technology with two sister plants, both of which were greenfields."

Tata Motors already used FactoryTalk ProductionCentre (FTPC) software in its two newer plants. Based on their successes with the state-of-the-art MES, the team decided to changeover to FTPC in the Pune plant as well.

By transitioning to the FactoryTalk system, the team knew they could strengthen operational consistencies and provide visibility for decision support within the Pune plant. This would further help in Tata Motors becoming a Connected Enterprise by integrating technology across all three plants and standardizing communications, applications and processes.

Normally a transition of the magnitude required at Pune – including server installations, network redundancies and application switch-overs for six assembly-line shops and 93 functions – would have resulted in a major

shutdown. However, the Tata Motors team and its technology partners Rockwell decided to overcome this challenge and go live while the plant was running – with little or no downtime and minimal effect on production.

The 20-plus-member transition team included application partners from Tata Technologies Limited, IT infrastructure-support providers from Tata Consultancy Services, systems integrators from MESTECH Services, and technology experts from Rockwell Automation and the business IT team of Tata Motors.

SOLUTION

The first step in the planning process was to understand the capabilities that were needed in the new MES. To do so, consultations were held with all internal stakeholders in the Pune plant – including top managers from engineering, the assembly line shops, quality control and overall plant operations.

With that wish list in hand, the team went to work on the MES migration, but they quickly discovered the brownfield conversion would be more complicated than expected. "We started with the simple assumption that when a system

FACTORY TALK, ASSET CENTRE

ARCHIVE & DISASTER RECOVERY

- Centrally manage versions of programs, files & folders
- Automate backup of automation assets
- Generate detailed difference detection reports of assets

AUDIT

- Track user actions who did What, When, Where?
- Produce ad-hoc reports associating users, assets, and programs to paint a full picture
- Automate the reporting process via email

SECURITY

- Restrict viewing of artifacts
- Prevent unauthorized access to make changes
- Prevent unauthorized users from creating new versions

EXTENSIBILITY

- Ability extent and add support for 3rd party devices
- Web client available to track assets from a mobile device
- Prevent unauthorized users from creating new versions

CONFIGURATION & CALIBRATION

- Support for Process Device Configuration using FDT-DTM technology
- Paperless management of instrument calibration data

> When we went for this upgrade, we also treated it as an opportunity to do business process re-engineering. Besides improving production performance, we wanted to standardize applications, processes and technology with two sister plants, both of which were greenfields.

- Jagdish Belwal
Chief Information Officer
Tata Motors

is working and is visible to all, we didn't need to define the necessary checks and balances in-depth," Belwal said. "We soon found out that we had underestimated the amount of customization that the existing MES had undergone in last 6 years."

So the team focused on identifying requirements, including those that had been built into the older MES over the years. After developing and extensively testing of the manufacturing scenario, the team was ready to tackle the challenge of a live transition to the new MES. This required an innovative approach. The team built data bridges between the old and the new system that could run parallel during the migration process.

The data captured by one system was transferred via a data bridge to the other system. The progressive migration approach meant that if any failure occurred during transition, the development team could switch back and forth between the two systems without affecting production.

"The transition took one and a half months," Satarupa exclaims, "We went shop by shop, function by function. We proceeded very carefully, because our primary goal was to avoid downtime."

RESULTS

The final outcome of the exercise was a complete up-gradation of the factory floor and resulted in a number of benefits.

Complete migration to a 'connected enterprise' was achieved with a downtime of just 0.1 percent, and without any loss in production. "We had a total of two hours and 45 minutes of downtime out of about 1,600 hours, that the shops were running. And that downtime was planned into the process with the manufacturing team, so we could keep normal production levels."

Since the completion of the project in fall 2013, the new system is being monitored and measured. Rather than relying on each shop to handle its own operating documentation, the MES software systematically collects and sorts

millions of data points, and turns them into actionable information.

Satarupa explained the alarm escalation process using the FactoryTalk system. "As soon as a defect is detected at a quality gate, an alarm is issued through the gate and depending on the defect category, messages are sent to the supervisors and managers through the system. Prompt corrective and preventive actions are taken.

Tata Motors IT team also need to spend less time developing and deploying new applications with the FactoryTalk system. With the new system, they don't have to go to each station to deploy the same application or write the same code again and again.

Besides reducing manual processing, the new MES connects the plant to the enterprise, opening the door to a multitude of production and efficiency gains. For example, data formats, modeling and design approach are all unified among the three sites.

"Adopting the Rockwell Automation solution has helped to standardize our MES landscape," Belwal says. Now that Tata Motors have harmonized its technologies across three manufacturing plants, they are evaluating the potential to implement Rockwell solutions in other plants as well.

> Adopting the Rockwell Automation solution has helped to standardize our MES landscape
>
> **- Jagdish Belwal**
> Chief Information Officer
> Tata Motors

TWO SEGMENTS - ONE BUSINESS

Fy'15 Total Sales - $6.38

Architecture & Software $2.7B

Products 68%

Solution 22%

Services 10%

Control Products & Solutions $3.6B
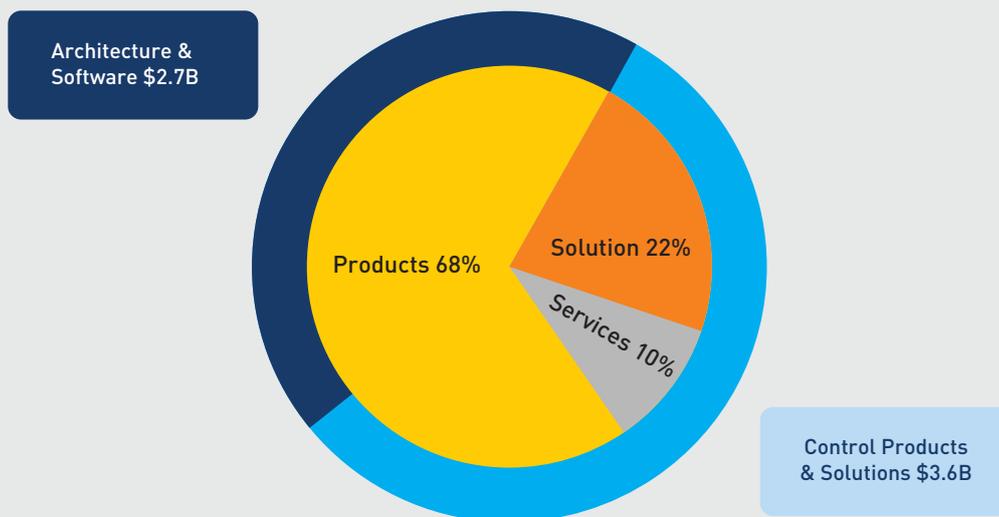
Broad portfolio of products, solutions and services

INTEGRATED CONTROL AND INFORMATION...

Scalable Computing
(Control, Edge, Cloud)

Information Management
& Analytics

Multi-discipline
Control & Information

Mobility &
Visualization

Smart
Assets

Secure Network
Infrastructure
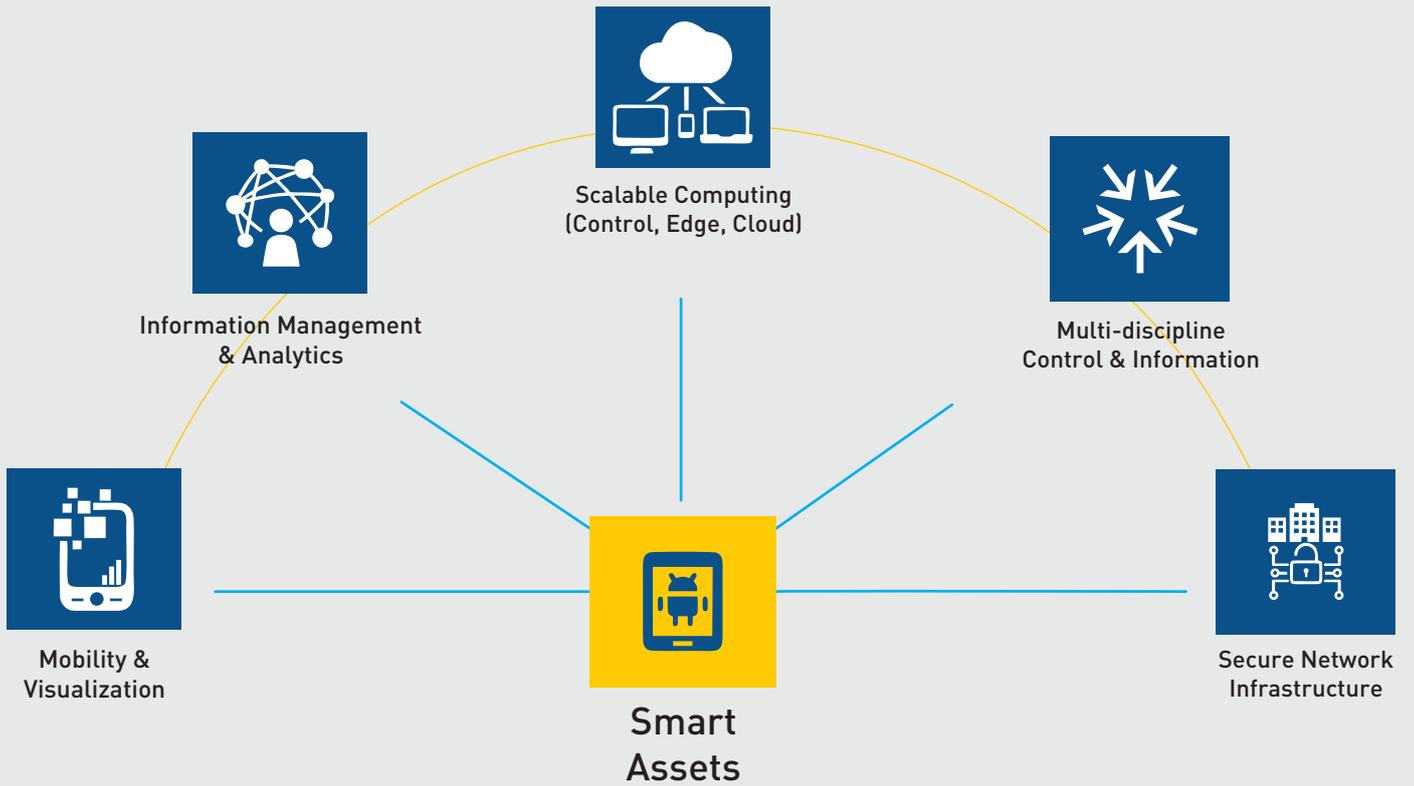
... ENABLING THE CONNECTED ENTERPRISE

SIEMENS
Ingenuity for life

Siemens India

**DRIVING
END-TO-END DIGITAL
TRANSFORMATION
ACROSS INDUSTRY**

A STRATEGIC FOCUS ON SMART MANUFACTURING

Siemens India launched its first digital factory in the country by re-inventing a 40 year old switchgear factory in its Kalwa Factory Complex Navi Mumbai. The factory that once used to manufacture industrial control products for the local market has been transformed into a highly efficient digital factory, on the back of Siemens technology platforms, catering to local and global demand for low-voltage switchgears.

Re-inventing the switchgear factory at Kalwa is integral to Siemens strategy for manufacturing excellence in the country. Preceded only by facilities in Germany and China, this is the third of Siemens globally benchmarked factories across the world that boasts end-to-end digitalization across the value chain. Sunil Mathur, Managing Director and Chief Executive Officer, Siemens Limited, explains, "The need for localizing global products and adapting them to the local conditions has been the priority at Siemens in India. Digitalization will help us engage with our customers and industry suppliers across the complete value chain. A key element in this evolution is an improved technological prowess and a world-class product manufacturing plant. The technical and engineering effort required to transform this 40-year-old manufacturing facility is a true showcase for Indian enterprises who wish to follow the path towards digitalization."

The Kalwa plant can now manufacture over 5 million devices annually, with just around 350 people. Products at the facility communicate with machines and all processes are optimised for IT control, resulting in a minimal failure rate.

A key element in this evolution is an improved technological prowess and a world-class product manufacturing plant.

The low-voltage switchgear factory has achieved end-to-end digitalisation across its value chain through Product Lifecycle Management software such as NX and Teamcenter, Totally Integrated Automation (TIA) Portal and manufacturing execution system. These solutions enable design of products, tools and equipment, master data management, automation, process simulation and product traceability. Apart from the above, the business process has also been digitalised into a paperless system from order entry to finished product packaging.

Machines interface with each other seamlessly resulting in an ultra efficient production line which produces 1 product every nine seconds. In addition to planning and setting up the factory, huge emphasis has also been given to the skilling of the employees in this era of digitalisation. Relevant and practical training modules have been implemented over the last two years.

The factory is being held-up by the company as a standard for the considerable productivity enhancements digitalization provides, (especially for small and medium-sized manufacturing units in India) while simultaneously showcasing Siemens digital product portfolio for the same.

The point is the model works, exceptionally.

> The need for localizing global products and adapting them to the local conditions has been the priority at Siemens in India. Digitalization will help us engage with our customers and industry suppliers across the complete value chain.
>
> **- Sunil Mathur**
>   MD & CEO
>   Siemens

Smart Manufacturing is the only way to address all challenges in one go for manufacturing

Reducing the time to market
- Shorter innovation cycles
- More complex products
- Larger data volumes

- Product and production integrated

Enhancing flexibility
- Individualized mass production
- Volatile markets
- High productivity

- Flexible production

Increasing Quality
- Closed loop quality processes
- Traceability and integrated genealogy

- Full process transparency

Increasing efficiency
- Asset & Resource efficiency as key competitive factors

- Optimized production resources

BROWNFIELD EXPANSION ON THE BACK OF DIGITAL INTEGRATION

The Kalwa switchgear factory is a feat of engineering and technical effort that is visibly generating very tangible results such as flexibility, efficiency, and improved quality. Consider this;

- Before digitalization the factory had the capacity to produce 77 variants of switchgears manufactured across 3 separate production lines. Today it has a single integrated digitally controlled production line that can manufacture more than 180 variants of the product with ease.

- Initially at every 21 seconds a product was getting manufactured on 3 different lines. Today despite the increased product specifications and variations the cycle time has dropped to just 9 seconds per product on a single line.

- The quality testing parameters have also increased threefold from 22 testing parameters to 68 at the current facility improving overall standards.

- Human resources have been deployed optimally. Today the Kalwa plant manufactures over 5 million devices annually, with just around 350 people.

All this has been achieved through a comprehensive overhaul of the traditional process by introducing digital solutions across the value chain and vertically integrating business processes. Factory floor decisions are made by digital-machines, systems that manage the production line and do not necessarily require human input. Business processes have been digitalised into a paperless system from order entry to finished product packaging. Precision metrics have been enhanced through sensors and data analytics. All of these clear examples of smart manufacturing in action. Karlheinz Kaul, CEO – Control Products, Digital Factory, Siemens AG (Munich, Germany-based parent company of Siemens Limited) is very clear that this transformation is the only way to improve and upgrade products manufactured in the country, "The SIRIUS range of switchgear products that will be manufactured here requires a very high degree of precision and quality at global standards that can be achieved only through digitalization."

The ingenuity of the Kalwa facility works on many levels. It showcases Siemens expertise in applying smart manufacturing across both engineering software and hardware. It is a case in point of Siemens global software engineering solutions, being deployed in a developing economy to make local manufacturing digital and globally competitive. It puts Siemens in front of the pack in terms of smart solutions for Industry 4.0 in India.

Integrating and digitalizing the entire value chain reduces time from concept to realization.

Third party applications
Cloud-based, open IoT operating system: MindSphere

1 Product Design	2 Production Planning	3 Production Engineering	4 Production Execution	5 Services

Collaboration platform: Teamcenter

Suppliers and logistics

| Teamcenter • NX CAD • NX CAE • NX MCD | • Teamcenter • Technomatix (Process Simulate) | • Teamcenter • TIA Portal | • Teamcenter • SIMATIC IT • SIMATIC, SINAMICS, SINUMERIK, SIRIUS, RFID, Sensors | • Teamcenter • MindSphere • IT security • Data-driven services, Predictive Maintenance |

Dated: 08th Sept, 2017 Siemens Ltd.

PRODUCT AND PROCESS INNOVATION

There are four crucial building blocks for Siemens' digitalization strategy that the company deploys at Kalwa. These vertically integrated digital solutions allow for great customization and innovations in both process and product design. They also attempt to address all aspects of Industry 4.0 that a manufacturing company will face in the shift towards digitalization.

01: Applying Product Lifecycle Management software platform during the initial design phase. PLM software falls under digital factory, which is one of the eight divisions within Siemens. The entire idea behind PLM is to have everything captured in a virtual environment so that the companies do not put too much time and effort in trials, validation and prototype refinement. This ensures design is right first time and changes and testing is carried out at the concept level before execution on the factory floor. PLM basically allows for virtual simulation of equipment design electro-mechanically, including the logic programs that control the manufacturing process. The simulation creates a digital representation of the real product, into which individual components of different designs can be inserted and tested at every stage of the development chain. Modifications can be made and innovative products can be designed as a result.

Siemens is convinced this allows for new products to reach the market much sooner. Explaining the digitalization approach to manufacturing in an interview with a business publication, Mathur says, "We are able to help our customers develop a 'digital twin'. You design the factory on a computer using our software. Design the factory, design the machines. You can even design how those machines look like, what functionalities you want in them, the workflow and the work process, the throughput of the products and you cost the whole thing"

02: The Kalwa facility operates on a Totally Integrated Automation (TIA) Portal which is part of Siemens core portfolio of offerings. TIA allows for automation services from digital planning and integrated engineering to transparent operation. It shortens time to market, increases the productivity through additional diagnostics and energy management functions, and offers broader flexibility by connecting to the management level. TIA largely benefits all system integrators, machine builders as well as plant operators.

03: Using a Manufacturing Execution System (MES). According to Siemens this is crucial to guarantee robust production system. An MES (such as Siemens' SIMATIC IT) provides real-
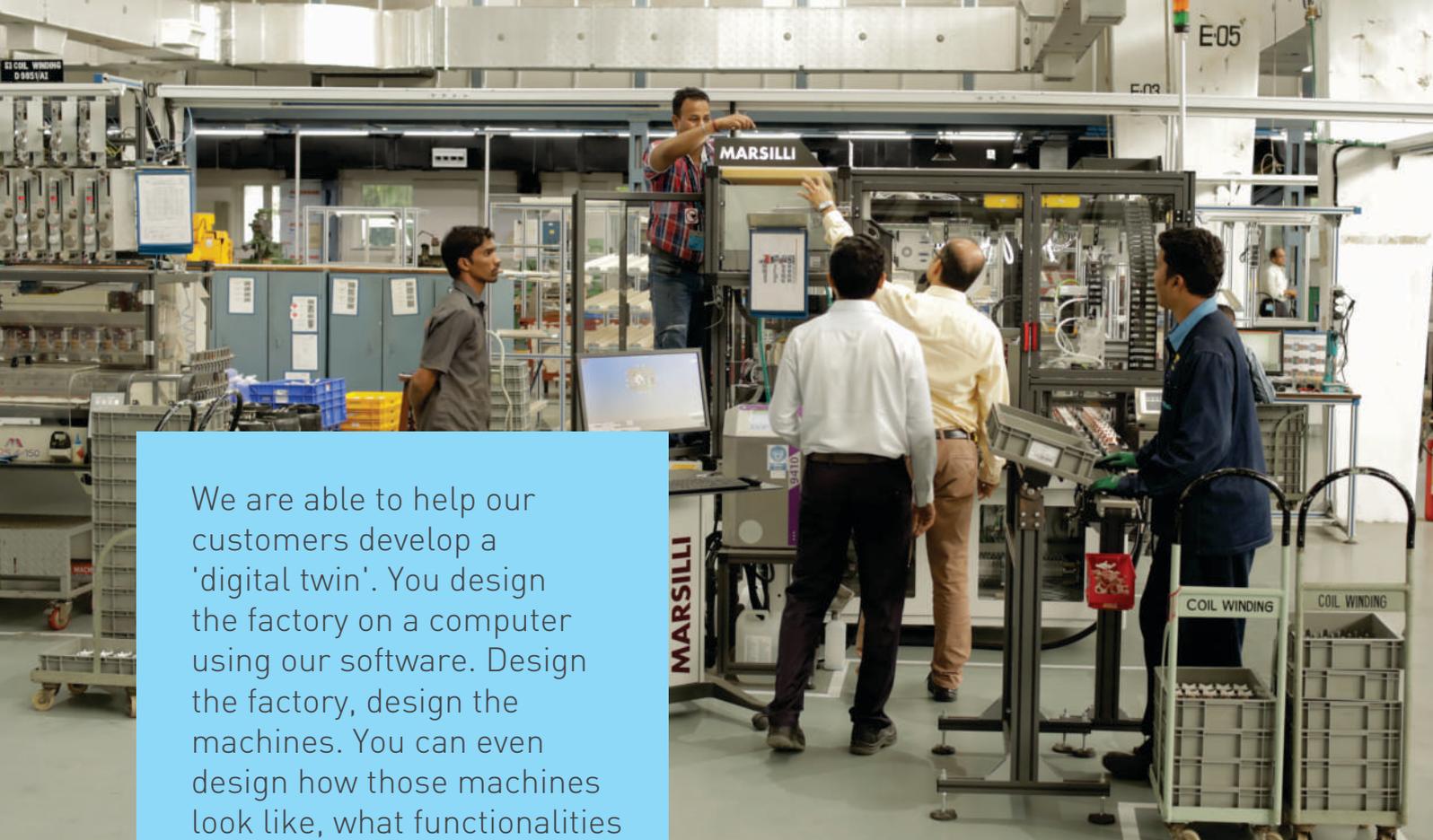
We are able to help our customers develop a 'digital twin'. You design the factory on a computer using our software. Design the factory, design the machines. You can even design how those machines look like, what functionalities you want in them, the workflow and the work process, the throughput of the products and you cost the whole thing

- Joe Kaeser
President and CEO
Siemens AG

time evaluation capabilities and drives performance efficiency. It helps synchronize manufacturing operations and business processes with complex supply chains, ensuring quality and production optimization across all facilities - even those operating in other countries.

04: Finally, the new MindSphere (IoT) open-source cloud platform, (which Siemens AG is now rolling out companywide) enables improvements in the performance of industrial systems by recording and analyzing large quantities of production data and allows companies to leverage this data to achieve new insights. MindSphere provides an economical and scalable cloud platform as a PaaS (platform as a service) solution for the development of applications. It allows for futuristic data-based services from Siemens and third-party providers in fields such as predictive maintenance, energy data management and resource optimization. The cutting-edge-tech could also for example, pave the way for completely new business models as it adapts across industries.

HUMAN RESOURCE MANAGEMENT IS IMPERATIVE

Inducting new-age-tech into a developing economy, however, comes with its own set of human resource development concerns. The worry of blue collar workers and engineering skill-sets being replaced by mechanical and IT driven systems is a pressing issue for labour in a developing country. Siemens is dealing with this in a strategic manner by up-skilling talent.

In addition to planning and setting up the factory, emphasis is also being given to the skilling of employees in digitalisation technologies so they can operate in the smart factory environment. The company has set up training centres, not only in Siemens Kalwa, but also in Gujarat, Jharkhand and Karnataka to skill people in association with state governments, training nearly than 25,000 people till date. These centres teach students globally-benchmarked technical education curriculum with core focus on Industry 4.0 and Industrial Internet of Things (IIOT) infrastructure , using Siemens software and hardware, for product design and validation (simulation), advanced manufacturing, automation, mechatronics, CNC, process instrumentation, computer-integrated manufacturing and rapid prototyping. Students learn NX, Tecnomatix and Teamcenter along with production automation through programmable logic controllers and induction motors. The idea is to offset the decline in the labour force by shifting skills towards operation of a digital software platform.
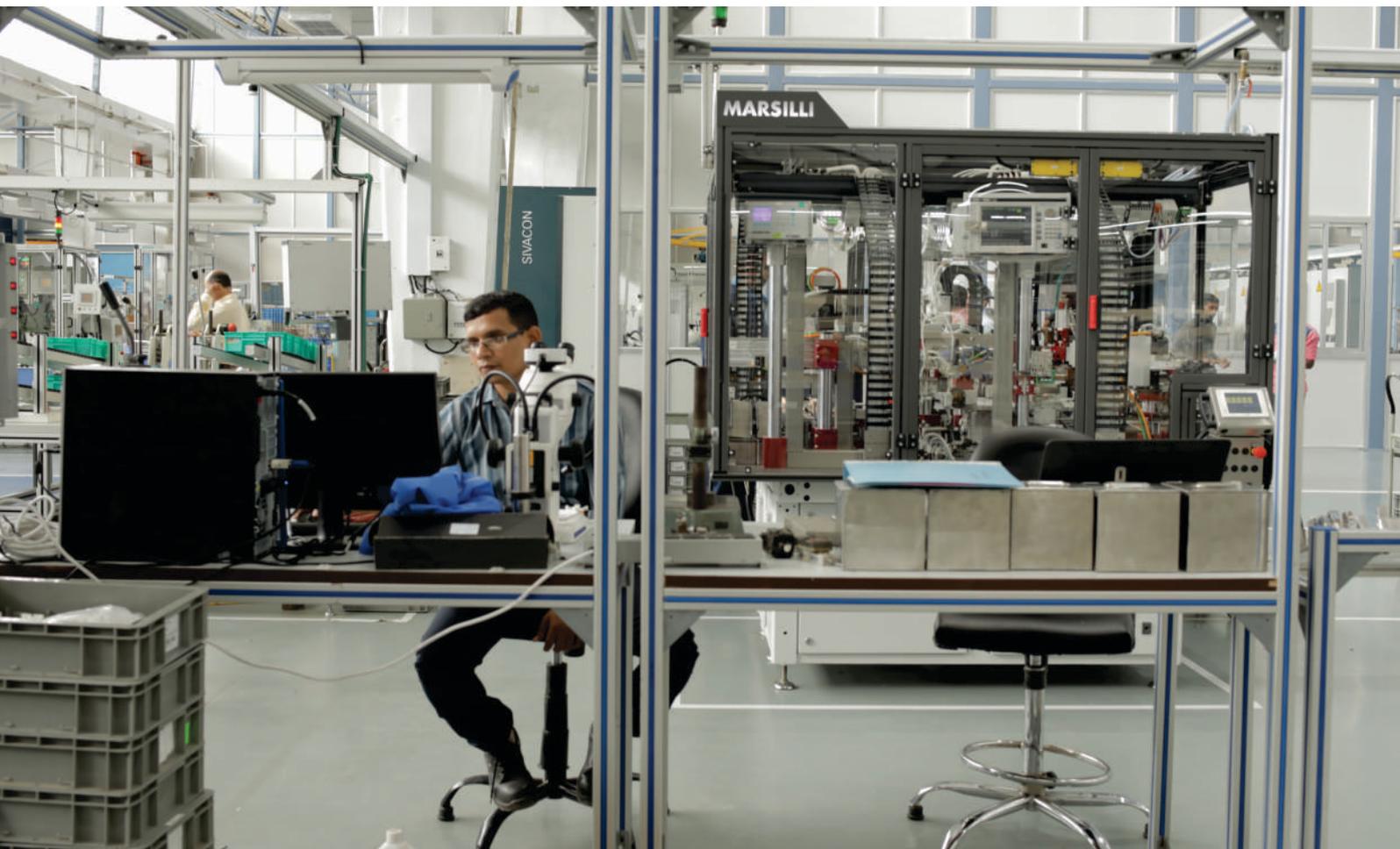
INDIA AND THE DIGITAL DIVIDEND

Digitalization offers the greatest growth potential for Siemens AG and the parent company has continuously and strategically expanded its digitalization portfolio in recent years. India and other developing markets provide the perfect consumer base for its products. In 2016, sales of Siemen AG's software rose to €3.3 billion, and sales of digital services to €1 billion – an increase of twelve percent compared to 2015.

Siemens India in turn is also in a transformation mode. From its conventional engineering products and services, the company is moving towards a total technology and digital solution provider across all its verticals, hoping to tap both Greenfield and Brownfield projects in India that are upgrading to Industry 4.0. It is also looking to invest further in manufacturing and increase its 22-factory base in the country.

Siemens India's growth strategy for India is completely aligned with the government's 'Make in India' objective to increase the manufacturing sectors' contribution to GDP from 15 percent to 20 percent. "That translates into around $700 billion additional contribution to GDP over a period of 8-10 years, assuming a GDP growth rate of 7-8 per cent," Mathur told The Economic Times in May this year. "The capex required to generate this contribution of manufacturing to GDP would be around $1.5 to 2 trillion. No other country is looking at such big numbers. And because there is no other market anywhere else, the world will start looking at India to bring in manufacturing and sell here. And when this manufacturing plan materializes, we will look at huge exports and start competing with other countries. And other countries are competing in digitalization. Siemens has an edge in digital technology."

Siemens Limited focuses on the areas of electrification, automation and digitalization. It is one of the leading producers of technologies for combined cycle turbines for power generation; power transmission and distribution solutions; infrastructure solutions for Smart Cities and transportation; automation and software solutions for industry. Siemens Limited, in which Siemens AG holds 75% of the capital, is the flagship listed company of Siemens AG in India. As of September 30, 2016, Siemens Limited had Revenue of INR 108,089 million and 9,580 employees. Further information is available on the Internet at www.siemens.co.in.

Siemens AG (Berlin and Munich) is a global technology powerhouse that has stood for engineering excellence, innovation, quality, reliability and internationality for 170 years. The company is active around the globe, focusing on the areas of electrification, automation and digitalization. One of the world's largest producers of energy-efficient, resource-saving technologies, Siemens is a leading supplier of efficient power generation and power transmission solutions and a pioneer in infrastructure solutions as well as automation, drive and software solutions for industry. The company is also a leading provider of medical imaging equipment – such as computed tomography and magnetic resonance imaging systems – and a leader in laboratory diagnostics as well as clinical IT. In fiscal 2017, which ended on September 30, 2017, Siemens generated revenue of €83.0 billion and net income of €6.2 billion. At the end of September 2017, the company had around 372,000 employees worldwide. Further information is available on the Internet at www.siemens.com.

key
takeaways

smart factories

Ace Micromatic

revolution

Systems **B&R** integrated **industry 4.0** **IBM**

interface

data **India** data **Siemens** accessible

sustainability

sensors

management performance

developing economies **IFM Electronics**

Smart Manufacturing

Moglix Strategy **Bosch** Solutions

industrial revolution **IoT**

Technology integrated

Rockwell

As globalization, collaboration, technological evolution, and the fourth industrial revolution drive business and manufacturing in the world there will be a **transformation from legacy, antiquated manufacturing techniques to what is called 'Smart manufacturing'**. Competition and lowering of trade barriers will level out the playing field as companies continue to adopt next generation technologies across the value chain in order to remain relevant and competitive in an ever evolving eco-system.

This **convergence of information technology (IT) and operations technology (OT)** is pervasive and transformative. It will change how companies engage with customers, how they empower their employees, how they optimize their operations, and how they transform their products and the business models around them.

A portion of the Indian manufacturing industry continues to be low value and high volume focusing on commodity products and utilizing low cost and low skilled labor. Small scales and margins have discouraged investments in technology to boost productivity and quality in manufacturing. The Indian industry is also very low in terms of automation adoption. Technology will continue to evolve, providing lower costs and more robust data analytics. In most organizations, especially those in developing economies such as India, taking advantage of the IoT opportunity will require leaders to truly embrace **data-driven decision making in a secure environment**.

Industry 4.0 offers many opportunities as digitalization and advanced technologies transform the Indian manufacturing sector. These changes add to the traditional business pressures but also offer unprecedented opportunities. Industry 4.0 focuses on the **end-to-end digitization** of all physical assets and integration into digital ecosystems with value chain partners encompassing a broad spectrum of technologies.

New product development and optimizing existing products and services are potential areas of growth for analytics in manufacturing. Industry 4.0 is revolutionizing the **use of analytics and manufacturing intelligence,** setting the foundation for greater control, better manufacturing, and operations planning, better logistics and more efficient maintenance of production assets and machinery. By better orchestrating these strategic areas, manufacturers are going to be able to attain levels of accuracy and responsiveness to customers not achievable before.

On the shop-floor a convergence of technologies can help traditional systems in factories to become informed, measured, automated and connected. This will allow for (1) Interoperability of connected equipment, allowing people, products and processes to talk to each other in real-time enabled by the Internet of Things. (2) Informed decision making with volumes of real-time data and analytics. (3) Autonomous decision making through

'intelligent' machines and sensors that do not require a human interface to make decisions. (4) Augment reality and simulations increasing efficacy through predictive modeling of the factory process (5) Supply-chain solutions and customer integration to create end-to-end connectivity.

High levels of cost reduction are expected across the series of industry sectors. By relying on integrated planning & scheduling across manufacturing centers, making full use of the data captured by sensors monitoring machine reliability and performance, and tracking asset utilization more effectively, the cost reductions manufacturers expect to achieve are attainable. Forward-thinking manufacturers are piloting machine learning applications and algorithms to interpret asset-level reliability and performance data, leading to more accurate asset-level predictive maintenance and repair schedules.

Optimizing production will be a key advantage. A Smart Factory containing intelligent devices that are able to self-optimize and correct themselves in real-time will lead to almost zero down-time for machinery. Being able to utilize production constantly and consistently will profit both large companies and SME's.

Creating a flexible market that is customer-oriented will help meet the population's needs fast and smoothly. It will also destroy the gap between the manufacturer and the customer. Communication will take place between both directly. Manufacturers won't have to communicate internally (in companies and factories) and externally (to customers). This integrates the production and delivery processes.

Workers will need to acquire a new set of skills. This may help employment rates go up but it will also alienate a big section of workers. For companies **up-skilling is crucial**. Given the technological revolution under way and the arrival of sophisticated new forms of automation, it is inevitable that manufacturers will face new pressures to secure talent with the necessary skills and competencies to succeed. **Re-skilling current employees can be the most effective strategy** to develop talent for a successful transformation. Other aspects include collaborating with industry partners, supporting internal training and collaborating with educational institutions.

Customer privacy and organizational data privacy will always be critical areas of concerns in an interconnected industry as companies collect and analyze large volumes of data. Companies that haven't shared their data in the past will have to work their way to a more transparent environment. In almost all settings, IoT systems raise questions about data security and privacy. This online integration could give room to security breaches and data leaks. It is the most challenging aspect of implementing Industry 4.0 techniques in any manufacturing eco-system.

Industry 4.0 is definitely revolutionary and we are just on the precipice. Technology and innovations will continue to pressure global manufacturers to adapt and **re-think their entire business models** as the rate of change accelerates. The economic rewards are immense; however, there are still many challenges that need to be tackled systematically to ensure a smooth transition. This needs to be the focus of large corporations, governments and institutions - **to create an eco-system that facilitates the transition**.

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CII

Confederation of Indian Industry

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the development of India, partnering industry, Government, and civil society, through advisory and consultative processes.

CII is a non-government, not-for-profit, industry-led and industry-managed organization, playing a proactive role in India's development process. Founded in 1895, India's premier business association has over 8,500 members, from the private as well as public sectors, including SMEs and MNCs, and an indirect membership of over 200,000 enterprises from around 250 national and regional sectoral industry bodies.

CII charts change by working closely with Government on policy issues, interfacing with thought leaders, and enhancing efficiency, competitiveness and business opportunities for industry through a range of specialized services and strategic global linkages. It also provides a platform for consensus-building and networking on key issues.

Extending its agenda beyond business, CII assists industry to identify and execute corporate citizenship programmes. Partnerships with civil society organizations carry forward corporate initiatives for integrated and inclusive development across diverse domains including affirmative action, healthcare, education, livelihood, diversity management, skill development, empowerment of women, and water, to name a few.

As a developmental institution working towards India's overall growth with a special focus on India@75 in 2022, the CII theme for 2017-18, **India@75: Inclusive. Ahead. Responsible** emphasizes Industry's role in partnering Government to accelerate India's growth and development. The focus will be on key enablers such as job creation; skill development and training; affirmative action; women parity; new models of development; sustainability; corporate social responsibility, governance and transparency.

With 67 offices, including 9 Centres of Excellence, in India, and 11 overseas offices in Australia, Bahrain, China, Egypt, France, Germany, Iran, Singapore, South Africa, UK, and USA, as well as institutional partnerships with 344 counterpart organizations in 129 countries, CII serves as a reference point for Indian industry and the international business community.

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