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Welcome to this special edition of EM, on the occasion of its 10th Anniversary – reflecting the past, celebrating the present and shaping the future. The issue again comes packed with insightful articles, thought-provoking conversations and interesting stories on new technologies. I am happy to reiterate here that EM continues to keep pace with new developments in the manufacturing sector, attuned to the changing focus of the readers, making it invaluable to engineers looking to utilise this useful information for their efficient manufacturing operations and to managers in pursuit of suitable growth-driven strategies for their business. Our heartiest thanks to those who supported us in our journey to success – our advertisers and contributors, advisory board members, partners, and most importantly our readers.

Talking about the contents of this issue, you will find a very fascinating Viewpoint feature, this time, on the topic – Manufacturing: Past & future – where industry leaders and experts have contributed their interesting views on the changes observed in the manufacturing sector in the last ten years in terms of workforce, technology, customer demands & market dynamics, the key learnings from the transition and what lies in store in the next ten years. Do have a look! The Industry Focus discusses new technology applications in the automotive manufacturing, while the other articles cover technology stories in the areas of industrial bearings, AR/VR, CNC programming tools, renewable energy, etc.

Hope you will find this edition informative and stimulating so as to help you keep moving forward! Please do write to us with your comments and feedback.

Shaping the future!

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For EM Magazine’s 10th anniversary edition, ten industry experts share their views on the changes they have seen the manufacturing industry undergo in the last 10 years & where they envision the industry to be in the next 10 years, in terms of workforce, technology, customer demand & market dynamics and supply chain.

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One of the most important puzzles in the minds of manufacturing leaders today is – how to create an organisation (product/offers, facilities & capable people) which can have long-term competitive advantages. This has become more relevant in the current world where changes are rapid & too many, and one does not know what is going to hit & when.

While it may be relatively simple to scan the environment & come out with a competitive business proposal, the difficult part is – how to change & align with rapidly changing environments. Success is not only based on your ability to change or align with the environment, but it is the ability to maintain a speed of change, preferably ahead of your competition. It’s not the absolute numbers but your relative position with others which matters.

We are used to common answers for success, it was ‘productivity & efficiency’ when I entered the industry during 80s, then ‘quality’ became the buzzword for success; everybody talked about inspection to quality control to quality assurance and to TQM. After that, answer for every question was Six Sigma, BIQ, continual improvement & lean using TPS/TPM, etc. Currently it’s all about digitisation, Industry 4.0, smart factory, connected factory, etc. All the above mentioned are enablers which will change with time & needs to be implemented. However, the bigger picture which needs to be kept in mind is that enabler should not become objective but should help us to achieve objectives which are price, quality & time, that have not changed.

Similarly, leaders believe – to remain ahead & competitive the answer is ‘innovation’ and more than that it is ‘disruptive innovation’. It is important to have disruptive innovation to leapfrog, but advantages may not last long. Two reasons, first – others will copy fast, and second – the environment may change totally. It is important for organisations to improve every day more than their competitors to maintain an edge. Both disruptive innovation & small improvements are important for long term results.

The important question is how do we have that?

I still remember when we were in engineering colleges, we were taught ‘Time Motion Study (work of Taylor & Gilbreth)’ and all discussions revolved around improving efficiency & establishing employee productivity standards. The main point was how to use four limbs of a person to get the best output. Then, had a chance to learn from teachings of Philip B. Crosby during my tenure with Toyota, it taught me how we can get brain of employees to innovate i.e. share & implement ideas (Kaizen), however small the improvement maybe, but collectively it can make a huge difference, and can help raise morale for the team. Now, what I have learnt during my journey with M&M is that employees have heart too, when you get their heart & brain together to play with a clear purpose then you can create unbeatable teams. Such teams will align with the organisational goal, work with a purpose of excelling and are highly motivated to overcome challenges.

To conclude, it is all about creating winning teams where employees work for purpose and are supported with product/offerings which are ahead of market trends & equipped with current equipment, processes and best practices as enablers. Capability to win, is both, a science & an art. Science is easy to learn but art of winning is imbibed in an organisational culture; which makes it difficult to replicate.
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Godrej & Boyce receives Green Buildings - Excellence Award

Godrej & Boyce recently created a new benchmark in the field of ‘Performance Monitoring’ of energy & water systems in buildings as the ‘Plant–13 Annexe Building’, a part of the company’s Vikhroli campus in Mumbai, is the recipient of the ‘IGBC Performance Challenge 2019 for Green Buildings - Excellence Award’. The award celebrates operational efficiency of green certified buildings. Plant-13 Annexe building has been excelled by showcasing consistency in performance. Out of the 150 nominations, 50 were shortlisted for final evaluation out of which 15 projects have been awarded. Speaking on the occasion, George Menezes, COO, Godrej Electrical & Electronics, adhered, “Godrej has been at the forefront of the Green Building Movement right from 2004, when we set up the CII – Sohrabji Godrej Green Business Centre. We continue to lead the industry in this space, testimony of which is our Plant-13 Annexe Building, which also has the distinction of being the first ‘Net Zero Building’ in the country under IGBC’s Rating System.”

ACMA unveils centre of excellence in Sonipat

Automotive Component Manufacturers Association of India (ACMA), unveiled two state-of-the-art labs, a Mechatronics lab and a Design lab. The two labs were opened for use by ACMA members at its Centre of Excellence (ACoE) – Saksham, located in the IIT-Delhi campus in Sonipat. With an idea of remaining competitive and relevant to customers, Deepak Jain, President, ACMA mentioned, “Set-up at a total cost of ₹4.5 crore, the Mechatronics lab is focused on imparting skills in the domain of automation and modular production systems (MPS) while the Design lab aims to enable auto component MSMEs for designing and developing new products”. Jain went on to add, “Whilst the Centre of Excellence, in the short-term would be used for skilling and capability building, our long-term vision is that the shared resources at the Centre be used by the industry for co-development of products and creating intellectual property.”

DMG MORI holds production launch ceremony for the CMX 600 Vi at LMW

DMG MORI recently held a production launch ceremony for the CMX 600 Vi vertical machining centre on Oct 29, 2019 at Lakshmi Machine Works (LMW) in Coimbatore, India. At the ceremony, Dr Masahiko Mori, President, DMG MORI and Sanjay Jayavarthanavelu, CMD, LMW, extended greetings and cut the ribbon with the guests. DMG MORI will begin manufacturing the CMX 600 Vi in India where the demand for machine tools is expected to grow. The machine, specialised for Indian customers, is manufactured at the LMW’s factory with an initial production volume of 10 units a month. The production volume will be increased in stages. The CMX 600 Vi features include wide work envelope, high rigidity, high-performance spindle, and workability, maintainability and reliability.

DMG MORI is one of the largest manufacturers of turning centres, machining centres, multi-axis turning centres and grinders in the world, with its global headquarters in Japan.

LMW is a leading manufacturer of textile machinery and machine tools in India. It began its partnership with DMG MORI about 30 years ago. Currently, LMW’s machine tool division provides lathes, milling machines and turn-mill machines as well as automation solutions. Through local production, DMG MORI strives to enhance services in India and deliver products with shorter lead times.
Bharat Forge’s Baba Kalyani bestowed upon ‘Order of the Rising Sun’

Bharat Forge’s CMD Baba Kalyani has been bestowed upon the Order of the Rising Sun, Gold and Silver Star by the government of Japan. He is one of the foreign recipients of this year’s Autumn Decorations for his contribution to strengthen Japan and India relations in the economic field. Kalyani is a renowned international businessman and also holds the position of co-chairman of Japan–India Business leader’s Forum. He has been actively contributing to the forum by leading the discussions and preparing the reports to address the economic issues. Speaking on the occasion, Kalyani said, “I am immensely proud and honoured to receive the Decorations – Order of the Rising Sun and earnestly grateful to the Japanese government for this recognition.” The Order of the Rising Sun was established by Emperor Meiji in 1875 and is the Japanese government’s second highest national honour.

Siemens signs MoUs on decarbonisation

Siemens recently signed a Memorandum of Understanding (MoU) with NTPC to identify, evaluate and set up reference use cases of hydrogen sector-coupling for various upstream and downstream applications. The collaboration is aimed at developing innovative technologies, solutions and techniques to reduce the dependence on Hydrocarbons in India. The company signed a separate MoU with TERI for collaboration on technologies to support the energy transition in India, including sector-coupling. Among the objectives of the MoU with TERI is realising the research and technology development projects to enable energy transitions across the electricity, transport and industrial sectors. Discussing the challenges in today’s global ecosystem, Sunil Mathur, MD & CEO, Siemens, asserted, “One of the most important challenges today is the decarbonisation of the global ecosystem. We take great pride in collaborating with NTPC and TERI as we believe technology will be a key contributor towards creating a carbon neutral society in India. This is also a huge step towards the sustainable development of existing and future power systems enabling efficiency, flexibility and sustainability.”

QuEST Global hosts QuEST Ingenium in Hyderabad

QuEST Global recently hosted innovative project ideas from engineering students across India and the United Kingdom at their annual applied engineering contest, ‘Ingenium’ in Hyderabad. The projects were judged on the basis of innovation, relevance to industry and society, and marketability by the jury consisting of industry experts from GE Power, Medtronic, MAN Truck & Bus India and QuEST Global. The project ideas submitted by aspiring engineers were around solving the various challenges around digital transformation and Industry 4.0. The winners will be entitled to a jackpot of exciting prizes, including a visit to the Bombardier Transportation facility in Derby, UK, along with a cash prize and an opportunity to work with the company. After successful completion of Ingenium in Japan and the UK and discussing the future plans, Dr Ajay Prabhu, COO, QuEST Global, elucidated, “We are planning to launch Ingenium in the key global markets where we operate from and build regional talent pool in various regions and improve the industry academia connect. By taking Ingenium globally, we aim at encouraging engineering students from across the globe to solve complex engineering problems in the society and across various industries.”

Mitsui, TECO to set up EV plant in India

Mitsui & Co recently announced that it is planning to invest USD 14 mn to set up a manufacturing facility for electric vehicle (EV) motors in India in partnership with Taiwanese motor manufacturer TECO Electric & Machinery Co. The new plant, which would come up in Bengaluru, is expected to commence full production by the end of next year with an installed capacity of around 1.10 lakh motors per year. The investment on the plant is being made by a joint venture (JV), TEMICO, set up in April 2018 by Mitsui (40%) and TECO (60%) to pursue the development, manufacturing, and sales of EV motors and EV powertrains globally. The plant being one of the EV ventures in India, Shinichiro Omachi, MD, Mitsui & Co India, informed, “The plant will create 200 jobs and will contribute to the growth of India’s EV industry, local manufacturing and reducing air pollution.”
CII organised Automotive Industry 4.0 Summit in Gurugram

CII recently organised the Automotive Industry 4.0 Summit in Gurugram, India. A CII-Roland Berger Report titled ‘Automotive Industry 4.0: Intelligent. Connected. Automated’ was released at the summit that was attended by over 350 senior delegates, comprising the who’s who of the automotive industry, including OEMs, technology providers, auto component manufacturers amongst others.

As per Sunita Duggal, Hon’ble Member of Parliament (Lok Sabha-Sirsa), Gurugram is not only the auto hub but has also emerged as the core of IT Industry of North India. She added that the Government of India is committed towards creating an enabling manufacturing ecosystem from the industry as well as the end-users’ point of view. Also, she emphasised, “The NITI Aayog, with its National Strategy for Artificial Intelligence and the Department of Heavy Industry, with its initiative SAMARTH Udyog Bharat 4.0 is working towards inculcating Industry 4.0 practices across sectors.” As sitting MP from Sirsa Lok Sabha Constituency, she also urged the industry members to invest and develop industry clusters in Sirsa to reap benefits of tax exemptions as it falls in the C & D category blocks under the Industrial and Enterprise Promotion Policy of Haryana.

Stressing further on the importance of advancements in the manufacturing sector on nation-building, Rajiv Gandhi, Summit Chairman & Senior Executive Director – Production, Maruti Suzuki India, said that the role of Industry 4.0 becomes even more relevant in context of the current uncertainties and challenges being faced by the Indian automotive industry. “In order to realise the dream of achieving a 5 trillion economy by 2035, we need to be fore-runners in infusing elements of a modern outlook in our industries and leverage our technology to create quality and global standard products, keeping the environmental sentiments intact,” he emphasised.

Speaking on the occasion, Hisahiro Nishimoto, Director – FAID, Mitsubishi Electric India, informed, “After experiencing good growth in various industrial verticals with our robot products, Mitsubishi is in the process of introducing new Servo product series and CC-Link IE TSN Network in the Indian market”. He also mentioned about the recently organised e-Factory Alliance Partner Meet to announce association with 20 IT companies to offer valuable services for OT and IT integration in manufacturing facilities.

Discussing his views from the stage, Anuj Munjal, Chairman, CII Haryana State Council & Executive Director, Munjal Auto Industries, mentioned that CII is working for disseminating information about Industry 4.0 across regions in the country for creating wider awareness among end-users on the immense potential of Industry 4.0, which will ultimately lead to higher demand for newer services and sustainability of the automotive industry beyond the influx of technology disruptors.

Also, present at the juncture, Sunjay Kapur, Vice-Chairman, CII Haryana State Council & Chairman, SONA Comstar, highlighted, “With our inherent strength in ICT, India can leapfrog to the next generation of manufacturing and free up time for workers across the supply chain, along with the development of more efficient equipment.”
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“There is a lot of scope for Indian manufacturers to adopt leading technologies”

…mentions Rajiv Bajaj, Managing Director, India & SEA, Stratasys, in his interview with Anvita Pillai. In this conversation, Bajaj provides insight on the latest technology adopted by Stratasys, the measures to be taken for upskilling, scope for 3D Printing in India and more. Excerpts…

Stratasys has been spearheading the automotive industry with innovative 3D Printing technologies. What are your latest technology solutions that will continue to give you an edge over competitors and how?

Stratasys is a 30-year legacy pioneer in 3D Printing, and we have been leading conversations in the industry with our primary technologies, i.e. Fused Deposition Modelling (FDM) and Polyjet. From automotive to aerospace to medical and other fields, these technologies are universally applicable. Lately, keeping in mind the requirements of the industry and what customers expect from 3D Printing, we have invested in a technology called high-speed sintering. In addition to our existing portfolio, this is a new technology that we will be offering to our customers.

How is Stratasys working towards ensuring availability of better capabilities to automotive manufacturers in the areas of product realism and product performance? How about skill upgradation in this area?

Product realism & product performance are two distinct fields – both equally important. In product realism, designers try to achieve the complete function, look and colour in the ideation stage. Our 3D printers achieve complete product realism because of technologies like pantone matching. In terms of product performance, there are a lot of parameters that need to be considered, such as, the manufacturing methodology, approach chosen for designing, etc. We try to deliver final products that are superior in quality and in line with the benchmarks that companies expect. With respect to upskilling, we have our machines installed in most IITs, NITs and private engineering colleges, which are being used for various projects, helping students learn traditional manufacturing along with technologies like AM, thereby preparing them for the industry. Last year, we also signed up with NTTF, Bangalore, to launch India’s first additive manufacturing certification course. This training program is designed to help students to learn new technologies in 3D Printing and make them future industry ready.

3D Printing technologies have been lacking in producing the required colour and transparency to mimic the final product. What measures are adopted by your company to overcome this problem?

Stratasys is the only 3D Printing company which is pantone certified. As a result, we can match the requirements of companies like Audi for their tail lamp manufacturing and also that of many consumer goods companies that we work with; ensuring that 3D Printing is an integral part of their design process.

India is still picking up pace in adopting 3D Printing, AM and other such technologies. Where do you think India is falling back and what steps can be undertaken to accelerate the adoption?

Comparative studies reveal that in Asia, the adoption of 3D Printing in India stands at 3 per cent compared to China (35 per cent) and Japan (30 per cent). It essentially means – there is a lot of scope for Indian manufacturers to adopt leading technologies that have been implemented worldwide in various industries such as automotive, aerospace, etc. and give products an edge in terms of global competitiveness. The earliest areas of adoption of 3D Printing is in the design departments of products that are being developed, and in some of the manufacturing applications where one aims to replicate the jigs-fixtures & quality parameters with 3D Printing.

What is the growth potential for Stratasys in India in the near future, according to you?

As I mentioned, India is still an under-penetrated geography in terms of technology adoption. If you look at global automotive companies, their adoption levels of similar technologies are much higher when compared to Indian companies who still use only a select set of available technologies. Taking into consideration the growth trajectory of the industry, despite the slowdown that the country is facing, we believe that there will be high double-digit growth in countries like India and South-East Asia in the coming years. ☐
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Ather Energy invented India’s first smart electric scooter. What was the idea behind building this scooter and what were the challenges that you came across during this period?

We began Ather in 2013 with the belief that the future of mobility is electric and connected. We wanted to build a product line which would be unique, in design as well as owner experience. The major challenges we faced were around the absence of a vendor base to help with building the vehicle or the components that went in. This led us to develop in-house capabilities and today, a majority of the components that go in the vehicle are designed and developed by us.

With the government announcing ‘National Electric Mobility Mission Plan (NEMMP) 2020,’ do you think India is ready for a full-fledged adoption of EV and will NEMMP give a boost to the sales of smart electric vehicle?

NEMMP 2020 was unveiled to address the issues India has been facing in energy security, pollution and development of manufacturing capabilities in the energy domain. Under the plan, there will be a major transition to electric vehicles by 2030; the FAME I & II scheme will drive localisation, technological development, demand creation through increased incentives to manufacturers and investment in developing the charging infrastructure. These measures will encourage automakers with serious intent to manufacture high-performance automobile and pave way to an increased adoption of EVs. We believe, the wide popularity of two wheelers and its large market share will drive the shift to smart electric vehicles in India and it will be driven by the rising demand from consumers. Progressive measures that are being introduced by the government for developing EV ecosystem include – a long-term outlook for electrification of mobility, increased investment in the industry and direct fiscal benefits like FAME-II, reduced GST, etc., which will make EVs more affordable and attractive to end-consumers.

What sets Ather electric scooters apart from other similar electric two-wheeler making companies/competitors?

We at Ather have designed new innovative ways to disrupt the industry. We are using technology and intelligence to provide a holistic and delightful experience to our customers, right from pre-purchase to a hassle-free post-purchase experience. We have introduced the first of its kind business model in the two-wheeler industry – an ecosystem of differentiated experience, whether it’s the flagship Ather One subscription plan, the leasing plan, experience centres, the doorstep service model, customer support, consumer experience or the after-sales service.

What are some of your major achievements till date?

We have assembled one of the largest R&D cells for EVs in the country and are a vertically integrated company with 51 patent applications and 11 international ones. We recently raised $51 mn; this funding will help us in ramping up production and scale across major cities in the country. We are already present in two cities – Bengaluru and Chennai and have set up 50 charging points at 40 locations and a first of its kind Ather Experience Center across the two cities. We have also received recognition for our efforts, awards for the products we have built, and the response that we receive from our customer base continues to inspire us to take on new challenges.

What is your venture’s long-term and short-term goals?

We are developing the entire EV ecosystem from manufacturing a smart vehicle to setting up the charging infrastructure. Ather Grid, our charging infrastructure, with both public and private charging options, will be open to all electric vehicles with the aim of encouraging adoption and providing a hassle-free charging experience for everyone. We will be expanding into major cities across the country starting with Hyderabad, Pune, Delhi and Mumbai. We aim at extending our charging infrastructure network with 6500 EV charging points to 30 cities by 2023.

“The future of mobility is electric & connected”

...mentions Tarun Mehta, Co-founder, Ather Energy, in his conversation with Anvita Pillai. Mehta divulges the inspiration behind building India’s first smart electric scooter, his opinion on the adoption of EVs in India, their major achievements and the future of Ather. Excerpts...
The EMAG Group is one of the few manufacturing system suppliers that cover the entire process chain – from soft to hard machining. Access to a wide range of technologies (turning, drilling, milling, gear cutting, grinding, laser welding, ECM/PECM machining, induction hardening and automation) allows EMAG to implement complete process chains, not only for the manufacture of gear box, engine and chassis components, but also for components in the non-automotive sector including oil field, power generation, aerospace and large equipment.
When it comes to understanding how a leader should be, Alan Mulally is an epitome role model to learn from. Mulally saving Ford from multibillion-dollar losses to bringing in five consecutive years of profits, not only envisaged him as a corporate leader but also established him as a compelling leader. According to him, a turnaround does not just intend an executive at the top of their strategy, but it’s also about figuring out a way to align the vision of the company with the employees and ensuring they feel encouraged in their jobs. If people are optimistic, they will willingly take the essential steps to turn things around. He deems – positive leadership is conveying the idea that there is always a way forward and reinforcing the concept that everyone is a part of the team and everyone’s contribution is respected. Mulally emphasises, “People want meaning. All of us want to know that we are doing great things, that we are touching a lot of people, and that what we are doing is something bigger than ourselves.”

The former CEO believes that being the best self, having the best team who focuses on what’s best for the organisation, having the best partnership that stays with one from win/lose to win/win, making the best investments and being the best citizen who makes a difference, is the key to building a world-class organisation.

Mulally, through his speeches, has firmly entrenched that leadership isn’t about telling people how to do their job or do their jobs for them; it is about working together. For him, leadership is not just about having a vision, it is about having a plan to implement it whilst ensuring everyone is involved. Mulally propagates, “Leadership is moving from ‘I’ to ‘we’ and ‘me’ to ‘service.”

An exemplary leader who brought Ford back to its roots, Mulally, through his leadership, has instilled that inspiring leaders are exceptional communicators who are passionate about their products, evangelise their brand at every opportunity and articulate a compelling vision with a healthy dose of optimism.

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Role of lubricants:
BOLSTERING ENERGY DEMANDS & SMOOTH WORK PROCESSES

As energy costs continue to soar rapidly, the total energy used translates into an instant concern for each company’s productivity. However, lubricants have an even greater influence on total energy utilised and play a pivotal role in simplifying manufacturing processes. In an exclusive interaction with Deepankar Banerjee, CEO, ExxonMobil Lubricants, and digging deep into the role of energy-efficient lubricants in manufacturing, the cover story explores how lubricants play a crucial role in terms of sustainable industrial operations, their role in manufacturing processes and the range of lubrication solutions offered by ExxonMobil™.
How has ExxonMobil™ evolved over the years?
ExxonMobil has been at the center-stage of the evolution of lubricants as an industrial solution. From finding the Vacuum Oil Company in 1866 to providing a lubrication solution for the first electric generating station, we have stood firm on quality. The ideology of applying the right oil at the right place and time has helped us introduce cutting-edge solutions, which are industry milestones. Our company has always developed lubricants that make high-performance engines and machinery reliable.

What is one of the key ways that the coolants and lubricants industry can bring about sustainable manufacturing, in the long-term? How can it be ensured that leaders in the industry have a commitment towards sustainability?
With the increasing population leading to a rise in the demand for energy, it is imperative to make industrial processes environment-friendly and sustainable. Industry leaders should adopt sustainability as a functioning part of the business model. One way to do so is, by adopting energy efficient lubricants. Mobil’s SHC™ Elite Series of lubricants are of exceptional performance, circulating gear and bearing oils designed to deliver improved oil drain interval and smooth operations.

What are the challenges the coolants and lubricants industry is facing today? How can those be overcome?
The industry is facing a dual challenge, which is to provide affordable and reliable energy while reducing its impact on the environment. However, regulatory policies and evolving technologies are helping address these challenges better. Consumer preferences, backed by the right lubricant technology, hold great potential in making industrial operations sustainable. We are well positioned to provide safe and effective energy solutions to meet future energy demands, while reducing environmental costs.

At what rate is the Indian coolants and lubricants market growing? What are the key drivers in the industry?
The commercial lubricants industry is expected to register a CAGR of 5.0 per cent by 2023. Some of the major factors that will boost the sector are infrastructural developments and the government’s push for cleaner energy solutions. Given this market scenario, the country will see an increased demand for energy efficient industrial lubricants and gear & compressor oil lubes to make industrial processes efficient, productive and sustainable.

How important is the Indian market for ExxonMobil lubricants globally? Can you share the company’s plans for India for the coming years?
The Indian lubricant market is the third largest market in the world behind U.S.A and China, which makes the sector in the country ripe with opportunities. This makes India a high growth region for us. We also lay enormous emphasis on R&D to develop the most effective products and maintenance solutions for our customers. Our scientists and engineers are presently working to develop technologies designed to produce energy in an increasingly safe and environmentally responsible manner.

For instance, to meet the energy demands of our consumers, we offer a wide range of synthetic lubricants. These lubricants can help companies amass energy savings by directly reducing electrical energy consumption or lowering friction and operating temperatures. Mobil SHC™ line of synthetic lubricants is designed to protect equipment operating under severe conditions, including loads and pressures & wide operating temperature ranges. We are also future ready to meet the upcoming BSVI demands and are making the transition to BSVI easier with our excellence in innovating state-of-the-art lubricants.

“We lay enormous emphasis on R&D to develop the most effective products”

…says Deepankar Banerjee, CEO, ExxonMobil Lubricants. He throws light on how industry leaders should adopt sustainability and energy efficiency as a functioning part of the business model, how consumer preferences, backed by the right lubricant technology, hold great potential in making industrial operations sustainable and how the industry is facing a dual challenge, which is to provide affordable and reliable energy while reducing its impact on the environment. Excerpts…
There is no doubt that lubrication is, in fact, an investment that generates a considerable business prospect. The demands of manufacturers and users for the performance of lubricants have amplified extensively, in search of continuous enhancement so as to bring down operating costs, raise dependability and diminish the requirement for repairs and maintenance. Also, energy supply is a relevant factor in a manufacturer’s cost structure, as dropping energy consumption directly improves a company’s bottom line. Here, energy efficient lubricants help in leading operations to satisfy energy needs.

Using energy efficient lubricants

With growing economies, rising GDP and improving living standards, the global energy demand will rise by 25 per cent by 2040. This demand is expected to come predominantly from China and India, where energy use will rise by 40 per cent. However, this surging demand for energy has created a challenge of ensuring access to affordable, reliable and clean energy solutions to minimise its impact on the environment.

To address these challenges, consumers need to reduce their environmental impact by switching to less carbon-intensive energy solutions. Industries should explore advance and energy efficient technologies and make it a crucial part of their business priorities. Therefore, energy efficient lubricants play a major role in making operations environment-friendly and sustaining energy demands of the future generations.

Mobil™ has a three-dimensional view that supplementing energy efficiency in industrial operations can enhance industrial productivity, maintain safe operating environment and minimise environmental footprint. To do so, Mobil offers a range of lubrication solutions, services and industry expertise to monitor energy efficiency in businesses. As per the CII report released in 2016, Mobil’s innovative products, such as, Mobil SHC™ 600 Series and Mobil DTE 10 Excel™ help industries achieve energy efficiency goals and reduced electrical energy consumption, improved operating temperature and reduced lubricant consumption.

Through the energy efficiency study conducted by ExxonMobil representatives, the company works closely with OEMs to explore how using synthetic lubricants can maximise energy efficiency. The study helps in reducing power related costs, reducing carbon footprint and extending oil life. Mobil engineers explain the theory and application of lubricants for energy efficiency benefits and also provide an engineering service report which gives recommendations to achieve sustainable operations and improve savings.

Ensuring sustainability through timely oil analysis

Lubricants play a crucial role when talking about sustainable industrial operations. Using the right oil at the right time and in the right place can minimise energy usage and directly lower costs. This makes timely oil analysis an important step to understand the overall performance of lubricants and machines. Mobil Serv™ Lubricant Analysis (MSLA) armed with the in-depth understanding of Mobil products brings a thorough knowledge of applications and equipment by working closely with original equipment manufacturers. MSLA enables companies to conduct the entire process virtually on their mobile or tablet device through scan-and-go oil sampling bottles. It provides informative reports on the condition of the customer’s equipment and lubricant, which has a direct impact on the energy efficiency factor of industrial operations.
After studying the performance of the oil, it is also important to study the oil drain interval to save energy and reduce additional costs. Under Mobil Serv™ energy efficiency monitoring services, Mobil engineers outline the potential benefits of oil drain optimisation with expert insights that are unique to machines and components. The engineers, along with OEMs, design and implement field validation protocols and conduct periodic reviews. This helps the consumer to identify equipment profile changes and set maintenance objectives to improve operations and energy efficiency goals.

While analysing the performance of lubricants is important, one also needs to factor in the need for inspecting gears and hydraulic systems to ensure seamless operations. Mobil’s gears and hydraulic systems inspection services encompass expert inspections of the condition of gears, bearings, lubricant systems, seals and housing of critical enclosed gear units, pump, valves and heat exchanges. The service helps in improving the life and performance of gear units and hydraulic systems. It also estimates the life of the equipment and the impact of recommendation on operations and maintenance to improve system reliability.

Lastly, it is important to remember that sustainable operations are performed in the right temperature. Therefore, organising regular thermography inspection of processes and condition of critical plant equipment can add on to the overall energy efficiency goals of the industry.

However, the role of lubricants is not just limited to introducing sustainability in industrial operations and enabling energy efficiency gains. It is as crucial for seamless work operations leading to higher productivity.

The industrial manufacturing sector is emerging as a crucial contributor to India’s growing economy, with the government encouraging the ‘Make in India’ initiative. By 2020, India is expected to become the fifth largest manufacturing country in the world, with its large pool of engineers, increasing purchase power parity and capabilities for innovation. The sector has the potential to reach $1 trillion by 2025 and become globally competitive in terms of its contribution to the economy. Nevertheless, as the industry evolves operational challenges, such as, downtime due to poor oil drain intervals and machine breakdowns, remain. To overcome these challenges and build world-class manufacturing facilities, using the right technology becomes imperative. However, while talking about increasing productivity and improved results, companies tend to focus on making their machines intelligent and hiring skilled labour. They overlook the role of lubricants as an important element for smooth functioning of equipments and increasing profitability of businesses.

Manufacturing industries often experience a breakdown of industrial operations due to increased friction, which causes heat resulting in the breakdown of equipment. Components, like bearings and gears can also disintegrate due to continuous frictional contact and poor lubrication. But every downtime
costs. It is an added expense on labour and inventory, which can have serious business impacts. This makes it important to ensure seamless functioning of industrial equipment. Using the right lubrication technology plays a major role in preventing heating and abrasion on the friction surface and keeping the machine running smoothly.

**Innovating with Mobil™**

Mobil lays enormous emphasis on R&D and works closely with leading equipment builders. By driving deep insights from equipment trends and industry requirements, Mobil engineers formulate and design technologically advanced lubricants for exceptional and balanced performance. The company also invests in programs to ensure the right kind of support structure, technology and application expertise to deliver advancing productivity, reliability and sustainability benefits to customers.

Mobil industrial lubricants and greases are designed to protect industrial equipment, enable seamless operations in high or low temperatures and provide longer lubrication intervals.

**Reducing maintenance efforts**

Hydraulic oil selection plays a big part in helping manage maintenance efforts and slows down equipment ageing. Hydraulic industrial equipment needs maintenance in terms of both, oil and the upgradation of the machine. As the oil oxidises with time, deposits are formed causing replacement of oil and filter. Moreover, often times, even valves, pumps and other parts of the machinery wear with age wherein the damaged components require replacement.

The recently launched Mobil DTE 20 Ultra Series for hydraulics and plastics industry is an example of Mobil’s outstanding technology, which helps reduce maintenance efforts. The lubricant lowers maintenance to reduce man-machine interaction and ensures zero breakdowns for less unscheduled downtime. It also provides outstanding deposit control for longer oil life and extends component life with its superior wear protection.

In addition to this, with two time oil life, it also supports environmental care by reduction in hydraulic oil consumption. Providing improved deposit control of 89.2 per cent for longer oil life and precision operations, the technology also delivers superior wear protection to extend component life. Extensive testing shows that it comes with better water handling and filter rating. According to Eaton 35VQ25 Test – an industrial test recognised for hydraulic-fluid qualification – the oil provides more than 72 per cent better wear protection.

**Lubrication – a necessity to strengthen energy requirements**

ExxonMobil provides a plethora of lubrication solutions & services and industry proficiency to observe energy productivity in businesses, while focusing hugely on R&D. Lubrication is a necessity to give a boost to energy demands, while using the correct lubricant technology helps with the machine running effortlessly. Using the right oil at the right time and in the right place can also bring down energy usage and costs. This helps comprehend the complete performance of lubricants.

*Courtesy: ExxonMobil Lubricants*
Problems like unplanned shutdown, overheating of electrical appliances and connections, insulation problems and harmful gas leakages can lead to major issues and bring an entire production to a standstill. To tackle these problems and to resolve them on time, FLIR brings a wide range of preventive maintenance solutions which help you identify problems before they arise or start to worsen. Include FLIR’s state-of-the-art gadgets in your regular preventive maintenance check-up and make your business operations hassle-free.

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What significant changes have you seen taking place in the industry in terms of workforce, technology, customer demands & market dynamics and supply chain in the past decade?

In the US, the power began to shift from producers to their customers in the 1980s. When supermarkets began to use barcode technology, the dynamics between food processors, food distributors and supermarkets shifted; giving the supermarkets much more power in negotiations. They could quickly tell which products were moving and which were not. This trend continued to accelerate to a point wherein, in today’s world more consumers directly have (but don’t yet effectively use) this power.

What would you say are the certain revolutionary technologies that have helped in the transformation of the industry?

New technologies are widely being adopted, but very few organisations have actually transformed. New technologies that are being rapidly adopted include – firstly, sensors. Sensors are becoming less costly and are being used more and more in manufacturing processes to reduce variability & to proactively respond to problems, before they become an issue. They are also being embedded in the products that companies sell permitting the manufacturing organisation, to expand into servicing its products in the field and to let customers know when devices need replacement before they fail. Secondly, Virtual Reality is likely to reshape many activities ranging from the way organisations train new employees to radically altering the way maintenance work gets done in fields servicing large equipment. Next, real-time helps gaining meaningful feedbacks and permits organisations to measure the right things to respond rapidly to issues on the manufacturing floor and in delivery and use of their products.

Decision making is becoming more decentralised as companies adopt ‘businesses within the big business’ (e.g. value stream focused on a core set of customers) giving people who do the actual work a more focused purpose for serving those customers. Big Data, analytics and mobile technologies are transforming the way we access data. Smart phones alone allow easy and quick access to information. Artificial Intelligence (AI) and Machine Learning (ML) are in the early stages of usage. One of the key learnings for builders of AI, is the need to have diversified teams doing the development. When you just use men or people of a single ethnic background to develop an algorithm, they are likely to miss many important considerations for successful deployment of these technologies (e.g. group of white males failing to take into account skin colour when developing facial recognition software).

Do you think the technologies like AI, Big Data, etc will have a big impact on the way things get done?

It is a big question if IoT, Big Data, etc will be the ERP of the next 10 to 20 years or if it will truly transform the way things get done. When software companies were selling early ERP systems in the late 1980s and into the 90s, they forecasted major changes in the way leaders managed the business, implying that it would give top management much more control. This is not exactly what has happened. I suspect, yes, these new technologies will have more of an impact, but it is too early to predict. Much of the impact will be determined by the way leaders lead. If they are not willing to change, then the impact of these technologies will be minimal.
What have been the key learnings during the last 10 years of transition in the industry? From these learnings, what steps do you think the industry should initiate and avoid in order to have a smooth transitioning into the next decade?

The transition is not likely to be smooth; some large companies are likely to be displaced. Companies in emerging economies have a great opportunity to enter and reshape the competitive landscape. I’d like to focus on ‘how’ these technologies get used. Will they be used to repress human freedom? Will they be used to reduce corruption (block chain can help here)? Or will these technologies lift people around the world?

A key element in most successful organisations, I’ve personally observed over the years, was leadership’s willingness to let go of control and let people at lower levels of the organisation make decisions. We should be focused on increasing the critical thinking skills of our work associates and for those of us in senior leadership roles.

Leadership should not feel threatened when associates question the status quo or when they suggest other ways to operate. The most successful organisations and countries moving forward in the future will be those who are inclusive, encouraging diversity and those willing to change the current state (way of operating) into something that is better. Rigid adherence to the status quo represses freedom, kills entrepreneurial spirit and encourage corrupt behaviours for those in power.

Would you like to share some examples/experiences that you have seen companies in the industry encounter in terms of the challenges in the areas mentioned above? How according to you has it helped the companies change for the better in the past 10 years?

Low cost labour is becoming less and less important and this is having a radical impact on countries that made this the primary value they were contributing to. Many companies are starting to use new technologies, for example, AGCO, a global manufacturer of agricultural equipment, is making extensive use of Google Glass on the manufacturing floor. Google Glass software can tell if the worker is very experienced and only needs high level work instructions or if it is a newer employee needing more detailed guidance. It also tracks if there were any quality issues in the past and will guide the wearer to avoid similar problems. The Virtual Reality software is being extensively used in automotive design. Designers no longer need to have physical models to test new design concepts. They can load images of actual roads and then test their design to see how it reacts to various road and weather conditions. Making learning much easier to get and when (if) they do finally create a physical model it will already have taken into account many of the variables.

What lies in store for the manufacturing industry in the next 10 years with respect to technology, workforce and customer demands & market dynamics? How should industry prepare & respond to it?

There have been tremendous technical changes over the last 10 years and the pace will continue to accelerate. The key to success lies in the ways these changes are implemented. Companies need to move beyond a mere ‘cost reduction’ perspective. Reducing costs is important, but cost reduction by itself will not be enough to remain competitive.

The key is to incorporate new technologies into the business strategies vs implementing siloed technical innovations that reduces costs but do not change relationships with customers. Automation will continue to eliminate low cost labour activities. It is also essential to change the relationship dynamics between employees and leaders. Companies need to employ people with higher skills and commit to further developing the critical thinking and actual work skills of associates over the course of their career. Successful global companies will return to a more holistic focus beyond ‘shareholder value’ taking into account employee development, reducing the impact of business on the environment (e.g. less resource utilisation with more output), and contributing to the health (financial and physical) of communities where the organisation operates.
With lean manufacturing, advanced technologies and now, digitalisation making its appearance, various industries have started taking actions to adapt to it and compete in the global market. To understand the current status of the industry, EM magazine’s 10th anniversary edition gathers observations of ten industrialists on the changes they have seen the manufacturing industry undergo in the last 10 years & their learnings, anticipations and where they envision the industry to be in the next 10 years, in terms of workforce, technology, customer demand & market dynamics and supply chain.

“Most crucial challenges will rise from dramatically changing market dynamics”

The manufacturing sector has truly transformed in the last decade. As evidence, let us look at some parameters. First is quality – there is a dramatic improvement in the quality of Indian products and among manufacturers, there are 27 companies that have won the coveted Deming Prize, recognised globally as a mark of world-class quality. Another area where one can see strong improvement is in the area of productivity; various awardees at national productivity championships have shown many innovative ways in which companies have enhanced productivity. The third area of transformation is in the creation of proper industry structure; we now have a reasonably well-patterned structure of OEMs, intermediate sub-assembly makers, component producers etc, constituting a minimum of four-tiered structure.

However, the most crucial challenges for the manufacturing sector will rise from dramatically changing market dynamics. Product lifecycles are shrinking and volumes are giving way to variety. There is no option but to mass customise. Is our manufacturing set up capable of handling it? If not, the future CapEx will have to ensure that we do have this flexibility. These transformative changes are wide and deep, requiring major rethinking of how we run a manufacturing enterprise.

It’s safe to say that the manufacturing world is changing very fast. It’s up to us – either we are in sync with it or we sink. But a decade ago, a similar existential situation prevailed on the ‘quality’ front, which the Indian industry overcame. I am confident that India’s manufacturing sector will overcome these challenges as well, by converting disruption into opportunities and not missing the bus when manufacturing shifts away from China.
“It’s high time to focus on skill development along with knowledge”

The Indian auto industry is now the fourth largest in the world with manufacturers including the Japanese, Korean, European, American & now the Chinese. The competition in the industry is very stiff and it has led to the survival of the fittest. Now, the quality of the product is not only compared by its specifications, but is driven by customer perceptions and the value it is adding to the customers. Offerings have become uniform; product life cycle has shortened, and customisation is on its peak.

Adoption of technologies like automation, robotics & data analytics has helped the industry to be agile, increase responsiveness and deliver in-built quality products to customers. Initially, to execute digitalisation across M&M manufacturing plant, we faced some internal challenges like IT infrastructure, equipment compatibility, skill gap, etc. Lot of investments had to be made for upgradation of IT infrastructure and similarly, latest controllers & sensors are installed in old machines to make them compatible for network connectivity.

For building future capabilities, like mechatronics, robotics, etc, all our manufacturing plants have a mechatronics lab to train our associates on the basics of automation and PLC programming. Along with this, we have partnered with institutions like IIT Bombay & TAACT for supporting us in this initiative. Now, manufacturing without sustainability cannot be imagined. It is important to develop a ready to change culture in the organisation & create an ecosystem which has the capability to adopt changes ahead of its competitors. We have implemented many pilot projects in Industry 4.0. It’s only a matter of scaling up and further building on the data gathered till now through intensive use of AI technology. This also includes giving equal importance to small Kaizens needed in the generation and implement it while involving associates. In the last few decades, the industry has witnessed many enablers which have come with time & need to be implemented. Now, its high time to focus on skill development along with knowledge.

“The whole organisation needs to embrace the change rather than denying it”

From labour driven to data driven – the past decade has seen manufacturing undergo a rapid transition –. Shop floors are getting a major overhaul to collect data and convert it into meaningful information, which helps the management to make informed decisions. The workforce is being trained to use more sophisticated technologies at various levels.

With the continual pressure to reduce costs, minimise wastage and maintain margins, there will now be an added increased pressure on cost reduction as the customers become more and more demanding. The challenge would be to include newer technological advancements into the shop floor, get the right people and maintain deadlines and to upgrade the vendors and the entire supply chain to keep up with the pace of change. With the introduction of AI, more insights will appear on the processes and more automation will come into the picture. The need for change will be far more evident than ever before. The whole organisation needs to embrace the change rather than denying it.

The industry needs to come together with educational institutions and initiate steps to make the human resource more competent to handle future challenges. Similarly, compatible industries should integrate to maximise their resources, set up training centres and pool resources to make themselves future ready. The future of the companies will not be defined just by the Human Resource (HR), but also by the Intelligent Capital (IC). That’s the main reason Milacron invests heavily in training programs to upskill the HR to IC. We have been able to learn various processes from different industries and modify it in order to suit the same to our industry. For example, the concept of flowline used in the automotive industry has been involved into building machines at our company, of course, with a little modification to suit the heavy machines.
“Modernisation will be linked to a clear cost benefit analysis”

The last ten years have been the defining years for manufacturing. It is the decade that saw China gallop into being a global powerhouse of manufacturing. The decade also saw the Chinese low cost advantages being eroded and newer low cost economies of Vietnam, Indonesia etc, emerge as significant players. India, on its part, continues to walk along a path that boasts of a young, educated and skilled workforce. The previous decade also saw an enhanced movement to digitise and automate operations. Indian plants are no exception, though the rate of adoption of digitisation, technology and automation has been selectively restricted by the availability of low cost skilled labour. Also, supply chain development and maturity has been triggered not only by the ever demanding automotive industry, but also by the plethora of shopping malls & e-commerce websites that make sure that demands from supply chains are always maintained at a stretch level.

As for the decade to come, with an increasing workforce that is relatively young and productive, Indian companies will continue to evaluate investments in technology, automation and digitisation etc, from the lens of cost benefit. This means that they will restrict investment to areas that justify the investment, which cannot be delivered by human skills, either due to volumes, quality or consistency thereof. This modernisation will be linked to a clear cost benefit analysis. Of course, the situation could be different if the rupee appreciates. But a further depreciation will lead to an even more selective basis for technology adoption.

We need to initiate steps that will see us owning global technologies and being a globally acclaimed manufacturer of capital goods in the core sector. Wishfully thinking, we need many Googles and Teslas emerging from India. Also, industry bodies must compel the government to make invention-friendly policies and incentivise those who patent the technologies that will have a long-term positive implication for India, by way of royalty/licenses.

“We need to encourage large scale investments in newer technologies”

Currently, the manufacturing in India constitutes only 15 to 18 per cent of the GDP. The Government of India is promoting industry-academia collaborations for rapid growth in R&D activities; central research laboratories are being activated to work with the industry to meet the demands, besides developing appropriate technology for use. All these will have an immense effect and the Indian manufacturing industry will soon catch up with the world in terms of technology, skilled manpower, meeting customer demands, as also meeting the challenges of the market demands. However, the need of the hour is to encourage large scale investments in the newer technologies and training of people at all levels. The industry, in turn, has to become lean, agile and technologically advanced by using the government facilities, scale up the production and look at the international market rather than focusing purely on the domestic market.

The world is seeing tremendous disruptions in every economic and manufacturing field. India has to bear this in mind, set aside monies from their operations to promote R&D, with encouragement given to the younger generation to experiment development of more and more disruptive technologies, which fortunately our children are quite capable of doing.

To understand the newer trends in the industry, we joined hands with Siemens in developing and supplying industrial automation products for all manners of manufacturing activities. We have developed and supplied various kinds of automated material handling systems as required by the foreign automobile industry by setting up their manufacturing plants in India. This has helped us to upgrade our knowledge base from being a simple solution provider to being the supplier of newer technological solutions to the manufacturing industry.
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“We are going to have more of a connected future”

We were first a low/medium production country. However, now the Indian manufacturers are looking at other markets. The purchasing power in the country is also on an increasing trend; because of this, people are looking for newer avenues and options, for which we need to improve our production and operation efficiency.

Earlier, in terms of products, we would sell whatever we produced. However, with the advancement of the internet and social media, the customer is more aware of what the global trend is and what is happening in the industry worldwide. Thus, as we progress further, we need to strengthen our feedback systems and based on that, our development process needs to be much faster. So, we need to have flexibility in our systems to cater to customer demands and have manufacturing technology that can cater to multiple products on the same line.

In terms of workforce, as we have seen the automation levels increasing in the past years, we are skilling up the workforce – we are making them ready to handle automation, because automation, too, needs to be handled and monitored by people. Therefore, if we compare, in the past 10 years, we have had people who are skilled in automation, robotics and many other technologies. Also, moving forward, this workforce needs to be skilled-up on a continual basis with the rapidly changing technology trends. So, we should be able to take care of our workforce and their skills, and imbibe a sense of security in them that, with changing times and automation, their jobs are secure. Additionally, in the next 10 years, we are going to have more of a connected future; we’ll be connected to the manufacturing workplace and that workplace will be connected to the customer. Furthermore, that customer will be connected to other customers and so on.

“Developing economies like India are the future markets of CNC controlled process automation”

The machine tool sector in India has been facing challenges of different nature, e.g. weakening auto sector, onslaught of e-vehicles, uncertain economic downturn, sluggish exports (the China-US standoff and Brexit) and the struggling MSME sector. Business models and technologies are now trying to offer remote and predictive maintenance, real-time condition monitoring, improved manufacturing processes and digitalisation and virtualisation of total production. But the future of shorter lead times and quality efficiency are yet to be achieved.

Machines need to become smart, highly automated and IoT ready. Developing economies like India are the future markets of CNC controlled process automation. Additive Manufacturing has the potential to boost the growth of the Indian engineering sector by offering light weight, cost effective and quick solutions to achieve concept validation. The advanced CNC functions of machines equipped with precision counting, measuring devices and self-adjusting control systems will be the preferred choice. Robotics could be the big thing in the next decade. It could replace operators in hazardous machining operations. With rapidly changing requirements of customers due to rapidly changing requirements of the end-users, the CNC application coupled with modular design could still be the saviour of our sector.

There are new challenges every day and our experience has taught us a lot. Properly trained technicians and operators are still an issue, but operator-friendly machines have always helped us to keep ahead. Conventional machines and equipment will remain a very important cog in the scheme of manufacturing things, and manufacturers making these will always remain in demand. India is a developing country with diverse needs and requirements. We have had the best of both; we made a smooth transition from producing low-cost automation modular units into CNC driven modular units. In this competitive world, there are many places where conventional wisdom has not conceded ground. In fact, combining both, we have given our customers a competitive edge.
“Investments in the manufacturing industry are on the rise”

The manufacturing industry has grown by leaps and bounds in the past ten years. From advances in IoT and Augmented Reality (AR) to growth in Virtual Reality (VR), the past few years have offered plenty of opportunities for manufacturers to digitally transform their operations. These technology innovations, which bring greater insights, were at the top of business wish lists. Automation in technology is one of the central, crucial elements of almost all manufacturing processes. Due to technological advancements and new inventions, automation has gained momentum in this sector. But these advancements also bring the requirement of more skilled labours in the market. My major learning during the past years has been that, it is imperative to change and keep pace with latest technological advancements. It is extremely important for any organisation to invest in training and skill development of people. In order to be in sync with the ever growing market, it is important to invest in R&D and innovation, which has become a consistent requirement now. Investments in the manufacturing industry are also on the rise, both in the domestic and foreign markets. Initiatives like ‘Make in India’ and the government’s major focus on this sector, aiming to make India a global manufacturing hub, will help this sector reach greater heights; this sector has definitely emerged as one of the high growth sectors in India.

India is an attractive hub for foreign investments in the manufacturing sector. Several companies are looking to establish their manufacturing base here. Cloud storage for wireless data, diode lasers for creating invisible seams, sensing, measurement and process control are the technologies that will have the greatest impact on factory environments. Industry 4.0, the fourth industrial revolution, is changing the dynamics of the manufacturing industry by providing manufacturers the opportunity to utilise advanced manufacturing capabilities and Information Technology (IT) throughout the product lifecycle.

“We may have to unlearn all that we learnt in the last decade”

The manufacturing industry has transformed significantly in terms of technology and customer expectations. Manufacturing has started talking in terms of ppm levels rather than percentage defectives. The choice available to customers has increased dramatically. All these changes have led to improved manufacturing processes.

Plus, the next decade is going to see a quantum jump in automation. In fact, the next decade is going to be driven by digitalisation; Industry 4.0 or smart manufacturing is going to be the driving force. This will lead to transparency in the supply chain. Besides, 3D Printing, AI and machine learning are going to mature in the next decade. These will create threats and opportunities to existing companies. New opportunities can also come for totally new industries based on biomechanical engineering. In the last decade, manufacturing industries have focused inwardly, catering to domestic markets. The next decade calls for a rethink and an outward-looking strategy to cater to the global market. Obviously, this will lead to even greater challenges.

But the biggest transition from the last decade to the next decade will be a change from being followers to becoming leaders. We may have to actually unlearn all that we learnt in the last decade. There is, unfortunately, no smooth transition; companies must be on the constant look out for newer technologies and business models that are likely to disrupt their current business – they must employ a young workforce and maybe even promote start-ups that could compete with their current business. Employing young, curious and energetic employees will be a necessity and not an option. Exposing their current workforce to new technologies and weeding out those who are unable to unlearn and relearn will be mandatory. What’s more, rules and regulations that have worked well in the last decade may have to be relooked at, especially the processes related to increments, promotions and rewards. Industries will have to look beyond their own industry and assimilate the best practices from other organisations.
“It is essential to manage inventory allying to market dynamics”

Focusing on people transformation while embracing disruptive change has been exhilarating and has brought unprecedented increase in productivity, whilst helping meet higher customer expectations. Introduction of cutting-edge technologies in machining/assembly, unmanned CNC machining centres & robotics have led to productivity increase by up to 2.5 times, and introduction of digital management on the shop floor has enabled shop floor leaders to focus on productivity improvement rather than people management. The industry is presently a mix of young and experienced people on the shop floor; it has led to having a highly lean and agile team, who can take on unprecedented challenges. Applications of innovative process engineering, assembly fixtures/tooling/jigs, have eliminated human fatigue and implemented higher safety standards.

The manufacturing industry has moved away from rigour of 100 per cent inspection to assurance with partnership of suppliers, supplier quality engineering, continuous process improvements and process audits resulting in a significant reduction in inspection costs. The gradual shift from preventive to predictive to prescriptive maintenance has led to an uninterrupted production flow. With the product shelf-life continually reducing, new products need to be introduced every two to three years compared to four to six years during the last decade, which is challenging. The other increasingly tough challenge is meeting product customisation requirements of customers, who have options, as competitors and are willing to go great lengths to serve. It is essential to manage inventory allying to the market dynamics – buy when prices are low and buy from the most economical source.

In order to have a smoother transitioning into the next decade, adapting to changes faster can lead to a significant increase in demands from customer. Exposure to new technologies like unmanned operations, robotics, process engineering capability and using semi-automation strategically is the need of the time. The effort of our organisation to create special task force to handle customer care, spare management and timely support to customers has increased customer satisfaction and consequently enhanced revenue. We have achieved exponential effect on efficiency due to our ERP system implementation and two years of effort in building synergy with several departments of ours. Operation-based system clocking and standard hours improvement have increased production by 2.5 times, while maintaining the same in human resources.

M G Hegde, Manufacturing Head, Makino India

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Reducing weight to increase the fuel economy of a vehicle is not a new concept. However, the topic of lightweighting has intensified as government regulation deadlines inch closer each day. Examining the regulations and the different options available for OEMs to achieve compliance, it’s easy to see why lightweighting is gaining in popularity.

A new standard in efficiency

Corporate Average Fuel Economy (CAFE) was enacted in 1975 with the purpose of reducing energy consumption by increasing the fuel economy of cars and light trucks. The National Highway Traffic Safety Administration (NHTSA) has recently set standards that will increase CAFE levels rapidly over the next several years, to improve the nation’s energy security and save consumers money at the pump.

The next major milestone by CAFE requires that automakers must deliver an average fuel economy across their passenger vehicle fleet of 54.5 miles per gallon by 2025. As an average, this requirement won’t mean that every car rolling off the assembly line must get 54.5 miles per gallon. CAFE is measured more generously than the numbers on the window sticker but increasing the CAFE standards does have a significant impact on the fuel economy of vehicles.
Many paths to explore

There are many different approaches to meet the upcoming fuel efficiency standards, including vehicle lightweighting, powertrain efficiency and electrification. OEMs typically use a combination of these three approaches (and a few others) to boost the fuel efficiency of their vehicles.

• **Vehicle lightweighting: lighter metals plastics composites**
  Vehicle lightweighting utilises different lightweight materials — including aluminium, magnesium, high-strength steel, plastics & carbon fibre – to replace components on a vehicle to reduce the total weight. A 10% weight reduction in a vehicle typically leads to a 6% to 7% increase in the fuel economy.
• **Powertrain efficiency:**
  Turbocharging smaller engines advanced controls
  New powertrain technologies can also lead to increases in fuel economy. OEMs are turbocharging smaller engines, adding friction-reduction measures throughout the engine and implementing advanced controls, such as, stop-start and regenerative braking systems.
• **Alternative energy:** Hybrids electric vehicles fuel cells
  Electrification of vehicles already exists in many forms and will continue to grow. They include conventional engines with supplemental electric motors, conventional hybrids, plug-in hybrids and fully electric vehicles.

The pragmatic choice

With all the different approaches available, OEMs are currently favouring lightweighting because of how relatively straightforward it can be. In its simplest form, lightweighting is basically just replacing existing parts on the vehicle with lighter versions of the parts that perform the same function. In contrast, powertrain technologies and electrification require large engineering investments, advanced vehicle controls and significant changes in the manufacturing process.

A new environmental philosophy

Producing more fuel-efficient vehicles conserves billions of barrels of oil, cuts carbon pollution, protects consumer choice and enables long-term planning for automakers. Over the lifetimes of the vehicles sold to the standards of model years 2017 to 2025, the CAFE program is projected to save approximately 4 billion barrels of oil and reduce Greenhouse Gas (GHG) emissions by 2 billion metric tons, with net benefits to society in the range of $326 billion to $451 billion. In addition, the use of recycled plastic and composite materials by the automotive industry has reduced waste. All these efforts combined will have a significant impact on the environmental footprint of new vehicles.

Why plastics & composites?

Although vehicle lightweighting is not a new concept, the materials and manufacturing processes involved in lightweighting applications are evolving. Cost reductions and advancements in materials are increasing the lightweighting opportunities within vehicles. Improved manufacturing techniques allow OEMs to push the limits and develop parts that were traditionally unfeasible. Plastics are already used in abundance within vehicles; they represent upwards of 50% of a typical vehicle’s volume, but as little as 10% of the vehicle’s weight. While plastics are abundant, many opportunities still exist for lightweighting utilising plastic and composite materials, due to the development of new materials and manufacturing processes.
There are more than 100 different types and grades of plastic used in an average vehicle. These are categorised by their appearance, resistance, rigidity, weight and cost. The three types that make up some 66% of the total plastics used in a car are polypropylene (32%), polyurethane (17%) and PVC (16%).

**Increasing strength and stiffness**

Plastics can also be reinforced with fibre materials for added strength and stiffness. This is commonly referred to as Fibre-Reinforced Polymer or Fibre-Reinforced Plastic (FRP). Fibre reinforcement generally comes in three basic forms: short fibre reinforcement, long fibre reinforcement and continuous fibre reinforcement.

Specifying the orientation of any of these reinforcing fibres can increase the strength and resistance to deformation of the polymer. Reinforced polymers are the strongest and most resistant to deforming forces when the polymer’s fibres are parallel to the force being exerted and are the weakest when the fibres are perpendicular. Compared to conventional steel, glass FRP composite systems can reduce mass by 25–30%, while carbon composite systems can reduce mass by 60–70%.

**Overmoulding**

Continuous fibre reinforcement offers the greatest strength and stiffness properties, but doesn’t lend itself to intricate shapes, ribs, bosses, bolt locations, etc. To address these shortcomings, fields like multi-material injection moulding or overmoulding technologies (where one material is moulded into another one) are rapidly expanding. In addition, overmoulding is an excellent method to produce lightweight, technical parts and can help reduce production and assembly costs. Wider application of overmoulding plastics components are helping to meet the demands of the automotive industry and leading to many new and more modern design features.

**Design advantages**

Utilising plastic and composite materials for designs offers more advantages than just the weight reduction of parts. Plastics and composites can also be shaped and formed into very complex shapes and designs that would otherwise be impossible. In addition, opportunities exist to reduce the actual number of components in a design down to a single plastic part. Such components minimise part failure within assemblies, reduce tooling and assembly costs, provide watertight seals if required and can increase sound absorption and safety properties.

A wide variety of plastic materials exist which exhibit a vast range of desirable properties. They can be made with different levels of transparency, flexibility (soft, flexible, or hard), and in almost any shape, size or colour. They can even be heat, chemical and corrosion resistant. They are excellent thermal and electrical insulators but can alternately be electrically and thermally conductive. It is this versatility that makes plastic materials extremely cost-effective in so many different applications. Plastics can be formed using a variety of manufacturing processes, such as injection moulding, compression moulding, microcellular injection moulding, etc. This flexibility in the manufacturing process allows plastics to satisfy a wide range of requirements.

**Simulation – key to successful manufacturing, testing and use**

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experience in designing metal parts, but they tend to lack experience in designing for advanced materials. Additionally, there is a new push to further lightweighting efforts into structural components. Simulation allows designers to fully explore different lightweighting opportunities and gain confidence in their designs before making costly tooling and manufacturing investments.

In order to investigate different lightweighting opportunities within automotive designs, simulation software is essential. Physical prototyping and testing are very costly, time consuming, limiting and generally not feasible due to the demands of the automotive industry. Proper simulation will help ensure the manufacturability of the part and optimise the manufacturing process.

Tools designed for advanced materials

In order to get accurate simulations of advanced materials (like composites), the simulation software application must understand the material properties driven by the manufacturing process. The designer must also be able to calculate the orientation of the fibres that result from the manufacturing process. Fibre orientations controls the strength of the part, so without accurate, as-manufactured material properties, the results from simulations will yield false information and provide little value to the engineer.

Multiphysics/multi-domain analysis for advanced materials

Working with advanced materials requires special simulation tools that make reliable predictions about the performance of a part. The construction of these materials causes them to behave very differently than traditional materials and requires specialised analysis tools. For example, when loads are placed on continuous fibre composite materials, different failure modes can result in matrix cracking, fibre breakage or crushing and delamination. Capturing all these failure modes concurrently within a simulation can be very important for correctly capturing the behaviour of the laminate.

Accurately predicting how a part constructed from advanced materials will perform in practice can require analysis in more than one domain. For example, combining thermal, vibration and composite analysis could be required to get accurate simulation results and predict a part’s behaviour in a particular scenario.

Reducing the computational burden

Setting up multiple simulation studies using different materials and design iterations places heavy demands on local computer resources. One may not even be able to utilise their computer during most simulation studies, and the problem becomes exponentially larger as one increase the number of different materials and design iterations.

In order to reduce the computational burden on the local computer, one needs flexible solving options to simulate where and how one wants to reduce the computational burden, based on the needs. Many professionals use their local resources to iterate and optimise their setup for an analysis. Then, when they are ready to kick off a longer, more computationally intensive simulation, they use the power of the cloud and free up local resources for other tasks. Autodesk offers software tools and capabilities to assist manufacturers with creating accurate simulations for their lightweighting initiatives.

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A futuristic roadmap for the auto industry

In the recent past, apart from the rising competition, factors such as digitalisation, superior safety and emission norms, ergonomics, alternative fuels, etc have been channelising the automotive industry to an altogether higher trajectory. Organisations, thus, are looking forward to streamline their systems and processes to meet and align themselves with this transformation. The article discusses how automotive manufacturing is developing with the emerging trends that are changing the sector and the challenges auto manufacturers encounter.

India has seen challenging times during the last year as the automotive sector has witnessed a big claw back in production and sales figures due to low demand sentiments across all vehicle segments. Having bounced back from the blues of demonetisation and GST, the auto industry registered a double-digit year-on-year growth of 14.2 per cent. But the bliss was short-lived, with the storm of trade wars and demand slowdown soon affecting this growth that declined to single digits in the middle of the year, leading to the scaling down of production, factory shutdowns and manpower rationalisation.

The revolution in automotive manufacturing

The government has put forward various incentives and schemes to prevent the sector tripping and reviving the industry sentiments. In fact, the slowdown has given the auto sector time that must be aptly utilised towards research and development so as to be able to devise and innovate cutting-edge solutions. Automotive manufacturing is currently facing what might be its most supreme revolution. This transformation is characterised by digitally-enabled integration of global product standards,
evolving alternate usage patterns and hi-tech services in the world of transportation. Technology-driven learnings have continuously been developing the approaches in how companies react to customer needs.

**Trends transforming the automotive industry**

Liberalisation has made both, international and Indian markets, progressively integrate, giving companies a means to enter new markets. Consumers now want products that meet their individual needs. However, with greater than before global competition, along with a strong emphasis on value and not on brand loyalty, clients usually are not hassled by the need for personalised products. As a result, automobile manufacturers have new challenging requests within their arena of action. There are many emerging trends which are changing the automotive industry:

- **Proliferation of electric vehicles**
  
  We have already entered the era of the next-gen mobility solutions that are not only sustainable but also clean. Over the last couple of years, India has witnessed a massive thrust towards the deployment of electric vehicles, both in private as well as public mobility domains. Few OEMs have already introduced their offerings to this effect, thereby spearheading the e-mobility revolution in this part of the world. Industry specialists and experts have predicted that in the long run, electric cars will prove to be more economical than their petrol and diesel counterparts. Next in line is putting the required ecosystem in place that will support the rapid deployment and running of e-vehicles. With these developments taking place at a fast pace, we are likely to see a lot more interesting things in the near future. The future of e-mobility looks quite promising and fairly super-charged as we keenly wait to see how far these evolving trends will develop.

- **Autonomous driving**
  
  This is certainly the most interesting development that will be ruling the automotive arena. However, self-driving vehicles are currently far and few on roads, as they are still being tested all over the world. Autonomous driving could rapidly catch up across markets. The alliance between these advanced technologies need to be acknowledged for this ideation. From reducing
mishaps caused due to fatigue to allowing drivers to be extra social with companion travellers, the welfares of this skill are abundant. Ever since Google started testing with autonomous driving, this has been the topic of discussion.

- **Connected vehicles**

  A lot of smart technologies have made their way into automobiles. Connected vehicles will have the ability to share particulars about driving situations such as sudden decelerating, speed, weather conditions and others. This is just the commencement of what we can mention as Vehicle to Vehicle Communication (V2V) – a technology that leverages Wi-Fi which will progressively turn out to be a common feature on every vehicle. This is why issues like car sensors, vehicle transmissions and wireless infrastructure have been a part of widespread conversations over the past few years.

- **Blockchain**

  The automotive industry has been seeing a lot of challenges over the last few years and one of these is the cumulative number of false part vendors. Blockchain is a possible technology that is being leveraged to check any black marketing. Eliminating the fake parts from the market can improve limpidity and effect in very well-organised evaluating policies. This technology can generate a precise, important decorum for the growing importance of supply chain. Blockchain is a progressing automotive inclination that is receiving a lot of positive welcome in the tech space.

- **3D Printing**

  3D Printing is a technology that has been slowly making inroads into almost every aspect of our lives, and the automotive sector is no exception to this. Presently, cars are being devised to endure three to five crashes and this will last seven to ten years. However, 3D Printing can help in developing a vehicle on a solid chassis with its exterior body devised for a single crash and replace just the outer body cost-efficiently, while retaining the chassis. This idea could revolutionise accident maintenance. Making it extremely cost-effective to develop things, 3D Printing is all set to revolutionise car designing and manufacturing.

**Challenges faced by auto manufacturers**

Today, the automobile industry remains extremely significant, and the small and medium-sized automobile manufacturers now play a vital role as well. Of course, like companies in all manufacturing sectors, auto manufacturers face unique challenges.

- **Sustainability**: Consumers are gradually getting worried about sustainability. Manufacturers, hence, need to create more eco-friendly cars and be more efficient in their systems and production processes.

- **Globalisation**: With new players entering the market, there is certainly going to be increased global competition; once again, most answers call for improved efficiencies, quality and customer delight.

- **Urbanisation**: Modern buyers have a different set of standards for their cars, many of which are connected to expansions. They include smaller vehicles, better maneuverability and enlarged fuel mileage.

- **Attracting talent**: As the automobile industry tends to change, the manufacturers will need to continue enticing the best and the liveliest talent to adapt to the times. People need to be trained and have specific knowledge about emerging trends. Industrialists must come up with a training department for every new ideation.

**Shaping the automotive industry**

Automobile players cannot forecast the prospect of the industry with confidence. They can still make plans to move now so as to shape the industry. The aim of the automotive sector in advanced countries like the USA, Germany, Japan and Korea is to grow sustainably, both in economic and environmental terms. New product and manufacturing technologies have to be joined, strategic mergers put in place and customer satisfaction enhanced by localisation and individualisation, while keeping prices at optimum levels.
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Bearing killers: Preventing common causes of bearing system damage

Bearing killers affect a wide variety of bearing types and leads to severe industrial crashing. It is essential for plant managers to understand how to monitor and avoid circumstances that damage bearings. In this edition, the first part of this article series helps gaining clarity on how inadequate lubrication and contamination can cause serious malfunctions and how one can avoid it.

Bearing killers are conditions that can cause damage to a bearing system and a premature end to its useful life. The four most common reasons for a bearing to not reach its maximum life are:

- Inadequate lubrication
- Contamination
- Overload
- Improper handling and installation

These conditions affect a wide variety of bearing types, including cylindrical, spherical, needle, tapered and ball designs. The consequences of bearing damage in industrial equipment can be significant, including injury to plant personnel, reduced operating efficiency, cost to repair or replace bearings or other components – such as housings or shafts – that may be damaged by malfunctioning bearings through vibration or high temperatures and unplanned equipment downtime.
Inadequate lubrication

Most of the bearing damages can be attributed to inadequate lubrication, which can be classified into eight basic categories: overfilling, underfilling, incorrect specification, mixing or incompatibility, incorrect lubrication systems and intervals, deteriorated grease or oil, water and debris contamination.

It is essential to work with OEMs and bearing supplier to specify the right lubricant amount, type, grade, supply system, replenishment cycle, viscosity and additives. Lubricants should be properly engineered for each bearing system based on history, loading, speeds, sealing systems, service conditions and expected life. Manufacturers or distributors should provide detailed recommendations on storage conditions, maximum shelf life, delivery systems, filtration levels and other precautions. Consultation is recommended if any conditions change during operations, even those that appear less significant.

Mixing different grades and brands of greases or oils can be disastrous. Lubricants must be completely compatible to function properly over time. Because of significant chemical differences in formulation (thickening agents, base oils, additives, etc), some lubricants cannot be mixed with the others.

Before changing a lubricant, always qualify compatibility with the lubricant suppliers. In some cases, special testing may be required; if you get the green light to proceed, allow for enough time to remove all old lubricants from the system. Also, it is a good time to review the condition of lines, connectors, distributors, pumps and seals and address corrective actions.

Once the lubricant has been selected and applied, always monitor it and the bearings for signs of trouble. A common method is periodic or continuous temperature monitoring. If bearings are operating at a temperature above 180° F degrees, the oil’s service life can decrease drastically, even with oxidation inhibitors. High operating temperatures may be caused by high ambient or process temperatures or by severe operating conditions that increase rolling contact friction. Conversely, very low ambient temperatures also challenge lubricants, causing it to thicken and potentially flow improperly. It helps to check with one’s bearing supplier for the acceptable range of operating temperatures.

If bearing lubrications are inadequate, the result may lead to damage. Damage varies greatly in appearance. Here are the four progressive levels of damage:

- **Discolouration** is a darkening of the metal that occurs when metal-to-metal contact results in excessive bearing temperature. In particular, look for discolouration of the races and the rollers. In mild cases, the discolouration is from the lubricant staining the bearing surfaces. In severe cases, the metal itself is discoloured from high heat.

- **Scoring or peeling** of any kind or degree is an indication of a serious lubrication related problem and requires immediate attention. One should look for marks cut into the metal or the metal peeling away.

- **Localised scoring** is due to localised high temperature, breakdown of lubricating film and direct mechanical contact of components. In tapered roller bearings, this might manifest as scoring of the large roller end and guiding rib of rings.

- **Total bearing lockup** may occur when high localised heat or cumulative wear produces major change to the original bearing geometry or mounted internal clearance; skewing of rollers, destruction of the cage, metal transfer, increased torque or power loss and complete bearing seizure (Figure 1) may occur.

If any of these conditions are observed, one should consult with a bearing service engineer to help diagnose the equipment, lubricant and bearing condition and to support damage root cause analysis. In most cases, the bearings will need to be repaired.
before they can be reinstalled and placed in operations again.

Contamination

Foreign particles are another common source of trouble in bearings. Even small amounts of minute foreign particles – dust, dirt, debris – can disrupt the oil film, resulting in damage to the bearing surface and reduced service life. Water is particularly damaging to lubricants. As little as 1 per cent water in grease or oil can have a significant impact on bearing life.

In guarding against contamination, seals are critical. First, it’s important to choose the proper seals. One should consult manufacturers to ensure a proper match between the seal and the application. The supplier would need to understand the equipment performance, assembly requirements, lubricant system, shaft orientation and other environmental factors. The type of seal, the materials that the seal is constructed from and how the seal is mounted are all vital.

Here are some general suggestions for selecting and maintaining seals:

• Using only seals suitable for the environmental and machine operating conditions
• Implementing external shields or procedures to avoid debris build-up on or around seals
• Routinely checking radial lip seal condition for flexibility, hardening or cracking and shaft contact
• Looking for signs of leakage and replacing damaged seals as soon as possible
• Avoiding purging excessive grease past lip seals. Seal lips can lose contact and effectiveness.
• Taking care when using water, steam or compressed air spray equipment for periodic external cleaning. Many rotating seals are not designed to resist steam or direct impingement of high-pressure sprays. It is very easy to damage the seal and force contaminants into otherwise clean equipment.

In addition, contamination can be reduced by following three best practices:

• When disassembling large equipment, one should avoid lifting with chains, wire rope or dirty slings that might score sealing surfaces
• If the rubbing surfaces are worn, one should resurface and grind them to original specifications for finish and diameter
• When foreign particles do contaminate bearings, they may cause a range of damage. Fine foreign material in the bearing, for example, can cause excessive abrasive wear. Sand, fine metal from grinding or machining and fine metal or carbides from gears will wear or lap the rolling elements and races. Abrasive wear also can affect other machine elements or accelerate seal wear, degrading performance. Improper initial cleaning of housings and parts, ineffective filtration or improper filter maintenance can allow abrasive particles to accumulate.

Hard particles rolling through the bearing may cause pitting and bruising of the rolling elements and races. Metal chips or large particles of dirt remaining after machining operation due to improperly cleaned housings can initiate early fatigue

Figure 2: Grooving
damage. Internal debris contamination causes include wear from gears, splines, seals, clutches, brakes, joints, housings not properly cleaned and damaged or spalled components. These hard particles travel within the lubrication through the bearing and eventually bruise the surfaces. Raised metal around the dents that act as surface-stress risers, causes premature spalling and reduces bearing life.

Grooving is caused by extremely heavy wear from chips or metal particles. These contaminants become wedged in the soft cage material and can cause grooves in the rolling elements (Figure 2). This condition results in improper rolling contact geometry and can reduce service life.

Etching or corrosion is one of the most serious problems encountered in bearings. The controlled surface finish on races and rolling elements makes them susceptible to corrosion damage from moisture and water, if not adequately protected. Etching is often caused by condensate collecting in the bearing housing due to temperature changes or improper storage conditions. Equipment left idle for significant periods can be susceptible to this type of damage, which is insidious and can quickly propagate to severe spalling damage.

Avoiding the premature end

The need to understand key causes of bearing damage — and how to prevent them — is urgent. One should take care to adequately lubricate and guard against contamination to protect the essential industrial components from damage, thereby increasing uptime, prolonging service life and increasing the financial health of operations. The subsequent edition will be throwing light on the measures manufacturers should adopt to avoid overloading, improper handling and installation of bearings to ensure smooth running of industrial operations. ☐

To be continued in the next issue...
Augmented Reality (AR) and Virtual Reality (VR) have become quite a jargon, making their way into a plethora of industries, and the manufacturing sector is no exception. While applications are still being developed, AR & VR are already presenting umpteen advantages to manufacturers. This article addresses how AR and VR impact manufacturing and how they can be put to the best use in the manufacturing sector.

It was just about two decades ago when Paul Milgram, a professor at the University of Toronto, introduced the idea of reality – a virtuality continuum to us. And we have travelled and raveled miles and dimensions in these few years. The human condition is based on evolution, and trending in the evolution is Augmented Reality (AR) and Virtual Reality (VR).

What really is AR? It is a technology that allows one to see the product in one’s relative surroundings. It superimposes a computer-generated image in one’s view of the real world, hence, giving a more enhanced version of reality. On the other hand, when it comes to VR, one can wear a VR headset and get immersed into a completely virtual world and interact in this virtual world the way one does in the real world.

Yes, it sounds like the future. But guess what? It is reality; it’s used everywhere around us – right from entertainment and gaming to healthcare to education to manufacturing. When it comes to the manufacturing and industrial sector, AR and VR technologies are coming in quietly and now taking over the industry. With so many miniscule parts and complicated assembly, it is becoming a power packed tool for the industry to use. Many large and small companies have built demos and proof of concept experiences to analyze the use of AR & VR, and now they are bullish on these technologies and integrating it in mainstream. Some of them have already started with it.

Here are a few ways in which AR and VR can be used in the manufacturing industry:

- **Assembly & quality control**
  Speed is the foundation of our time. There are hundreds and
Virtual Reality for training

thousands of small parts and tools, that when put together in the perfect manner, will get us the final product. Everything from smart phones to rockets has a set of assembly instructions. Manufacturing companies have been using paper manuals for assembly instructions. Being humans, assembly line workers tend to make mistakes in complex assemblies and the cost of re-assembling the product could be large.

Here, AR can assist employees in assembling the product with 100 per cent accuracy. Head-mounted AR headsets or tablets can be used to achieve this. This tends to change the entire dynamic of spending hours on figuring out which part goes where. AR helps get it right on the first try. Not only can AR provide reduced rate of errors in assembly but can also be useful in reducing paper work and help companies go green.

• AR and VR maintenance

Like assembly and quality control, maintenance too is an integral part in manufacturing. Currently, there are large maintenance manuals in a lot of places. These can take up a lot of time to read and to memorise. And who has that kind of time anymore? With the help of AR, companies can make this entire process a lot simpler.

Imagine one being able to see the status of the machine in front of them just with the help of a handheld gadget. With real-time super-imposed digital image, users can go through step-by-step information to repair the machine. If the user gets stuck at some point, he/she can go for a digital simulation on fixing the machine. Or he/she can opt for remote maintenance, where with the help of a handheld device, one can get assistance from the technical team sitting in an office. Few of the benefits of AR and VR in maintenance include reduced human errors, execution time and downtime and increased productivity and speed.

Virtual Reality for training

VR opens up a lot of doors when it comes to training individuals to operate the machinery and conduct processes. There is only so much that can be taught in manuals and presentations. VR gives one all the benefits of reality without the associated costs or dangers that might come with a trip to the plant in order to achieve the same goal. Companies can combine the classroom and on-the-job training in a virtual environment, where users learn about product/machinery and can immediately do hands-on training on a virtual 3D machines. Additional repetitions can be done, which is an important practice and builds a muscle memory to perform tasks fluently.

Furthermore, immediate managers can understand learning gaps and can give specific instructions to the users in order to get better at their work. While using virtual reality for training, productivity can significantly be boosted through every phase of the industrial development process – from initial design to assembly optimisation.

• Experiencing optimal product designs

Building a complex production machine has always been challenging. The design process, prototyping, identifying errors and then redesigning takes several iterations. Even a small error can make designers go through another iteration, which delays manufacturing, and in turn, delays go-to-market.

With VR, product design feasibility can be done to identify potential problems before the machine is built. Companies experience deeper insights into their designs and engineers interact with models, visualise design implications and collaborate closely with internal team members and with customers to avoid rework. This reduces the risk of delays and companies can experience faster time to market and optimal product designs.

• AR-VR’s role in sales and marketing

This brings us to our last point for manufacturing – sales and marketing. Whenever we buy a certain product, we want to go and experience it. But what if one could have the product in one’s space, without even having to get up?

With the help of AR and VR, we get to see small and large products, how they will fit in a customer’s space and their external & internal working. For example, let’s consider an elevator product; a user could see and choose the kind of elevator he/she wants. The user could place it in the area of their choice and also customise the external door type, material finish and internal panels, handle and lighting. He/she then gets to go inside the lift and experience it.

• Gamification and gameful design

This is the most integral part of designing VR and AR solutions – this can make or break the experience. Blending AR-VR with gamification and gameful design, users can perform better in a simulated environment, with increased memorability and get better at performing tasks. At the same time, it is important to note that gamification for a well-designed experience is not like loyalty marketing. Extrinsic motivations and reward schedules are effective in short-term engagement. When it comes to long-term engagement, intrinsic motivations play an important role in designing the best experience. A well-designed experience can really make tasks fun and enjoyable.

Bringing man and machine closer

AR and VR are reshaping the manufacturing domain. The manufacturing industry is a sector where the opportunities opened up by AR and VR are enticing plenty of enthusiasm. They can certainly lead to enhancement in safety, design function and performance, bringing man and machine closer.
Almost anyone who’s worked in a machine shop for any length of time has at some point attended a trade show or machine tool distributor’s open house. There they see canned demonstrations of CNC machines busily carving up chunks of brass, mild steel or aluminum into business card holders and tic-tac-toe games. While these giveaways are fun stuff, wouldn’t it be refreshing to see some real parts being machined, preferably from a difficult-to-machine material?

That’s what took place at the Okuma Winter Showcase, an annual event that the machine builder hosted for over 600 attendees. At the event, attendees were treated to more than two-dozen CNC machine tools under power, most of them making chips. But there was one demo that had a large number of show attendees talking, including those responsible for setting it up. “It was pretty cool to see, especially when one considers that we were cutting titanium, a very hard and difficult-to-machine material,” says Lee Johnston, Okuma Applications Engineer.

He was talking about CGTech’s Force, a physics-based NC program optimisation module that works within the company’s flagship VERICUT toolpath simulation software. Working with representatives from CGTech and Sandvik Coromant, Johnston programmed a Ti-6Al-4V titanium bracket being made for an aerospace customer and then, optimised its toolpaths with VERICUT Force.

“We had the same demo on two vises and ran them side-by-side, one with the standard program and one that was optimised,” said Johnston. “We reduced cycle time from an hour to just under 40 minutes, and you could also hear and see the difference in how the tools were cutting and tell that the optimised program was easier on the machine. This probably is the best thing to happen to programming since trochoidal toolpaths.”

Optimisation module tackles tough materials

The manufacturing industry depends profoundly on CNC machining replacing certain operations that once needed engineer operated equipment. This case study discusses CGTech’s Force, a physics-based NC program optimisation module, which has helped to significantly bring down cycle time and aided with better part quality and less wear and tear on CNC machine tools. It also further elaborates on how the module’s optimisation capabilities are proactive and how it has the ability to break up the NC code into smaller bites.
Calculate optimal feed rate

VERICUT Product Specialist, Pete Haas, explained that, Force works by analysing the NC toolpath, evaluating the changing cutting conditions and increasing or decreasing the feed rate to achieve the ideal chip thickness for any given material. Compared to CAM systems and online machining calculators, which attempts to determine average chip thickness and base the feed rate on that, Force calculates the optimal feed rate for every single line of machining code.

“As an example, think about driving to work each morning,” Haas said and continued, “You encounter straight sections, curves and sharp turns, and have to slow down or speed up depending on the road conditions. Machining also involves constantly changing conditions, but some CAM systems don’t account for this. They generate a single feed rate that may be too aggressive on tight turns and too slow on the straightaways. Force, on the other hand, uses physics to calculate cut-by-cut throughout the changing conditions and determine the optimal feed rates.”

The result, according to Haas, is greatly reduced cycle time, improved tool life, better part quality and less wear and tear on CNC machine tools. It works on any material and machine and can even be used on legacy programs.

Johnston wasn’t the only one surprised by Force’s capabilities. Even CGTech Technical Support Engineer, Chris Davala — someone with 20 years of experience as a machinist and programmer, who now works with VERICUT customers across the country — said the demo was an eye-opener. “To be honest, I was a little skeptical,” he said and went on, “This was my first hands-on experience with the product and it’s not that I didn’t have faith in the people who developed it, but there were some bold claims made about the potential gains. I can truly say that after seeing Force in action, it’s made a believer out of me.”

“As a tooling specialist, I am extremely impressed with how spot on the Force software is,” Richard Howard, MTS specialist, Sandvik Coromant (who worked alongside Davala and Johnston setting up the demo), further averred and continued, “CGTech has done an amazing job of optimising programs while taking into consideration tooling geometries and resulting loads. Anyone interested in higher efficiency and prolonging tool life should look into this.”

Make a top-notch machine tool perform even better

Anyone familiar with Okuma machine technology might consider Force unnecessary. That’s because the OSP control offers advanced features, such as, Machining Navi, SERVONAVI, Super-NURBS and adaptive machining technology. How can a third-party software package make a top-notch machine tool perform even better? There are several answers:

- Force has the ability to break up the NC code into smaller bites, adjusting feed rates to maximise chip thickness and keep it constant
- Its optimisation capabilities are proactive, not reactive. So, everyone knows what to expect before pushing the cycle start button.
- Performance issues are clearly identified up front and, the programmer can examine the Force Charts that illustrate projected cutting forces, chip thickness, feed rates, tool deflection and more
- For new materials, new machine tools and cutters or even new programmers, Force eliminates the guesswork that would otherwise occur

The result is an NC program that’s both safer and more predictable, with low risk of tool breakage or scrapped parts. Operators have more confidence. Lights-out machining is easier performed with confidence. Profit margins have improved. “And Force-optimised toolpaths save a great deal of time during roughing,” says Howard & adds “Parts are machined faster and cutting tools last longer.”

Complete utilisation

Haas summed it up by asserting, “Force charts provide NC programmers with useful information they never had before. They can quickly and easily visualise what’s happening cut-by-cut as the tool moves through the material, and it’s now possible to visualise excessive forces, inefficient cutting parameters, metal removal rate, power consumption, torque and tool deflection. Force charts also expose cutting condition improvement opportunities. With one click on the Force chart, the user is taken to the exact location in the program and to the graphical review window for further analysis. The end result is full utilisation of the cutting tool and the machine tool.”

Johnston agreed and said, “At the event, we were cutting titanium and saw significant improvement, but I think Force is just as suitable for machining easier materials like, aluminium and for other general purpose work. I look forward to using it for future projects.”

Courtesy: CGTech
Using renewable energy to drive supply chain innovation

With renewable energy being more accessible and affordable than ever, the manufacturing industry should try to evaluate their supply chains for ways to switch to renewables, such as solar, wind, biomass, geothermal and hydro power, to start realising the benefits as soon as possible. The article explores various Industry 4.0 technologies and their potential impact for enabling digital supply networks in manufacturing.

Renewable energy resources, or ‘renewables’ are naturally replenishing energy sources that can replace coal, oil, natural gas and nuclear power across the supply chain with clean, safe and reliable power at low or zero carbon emissions. It has the potential to avoid risks and cost implications of fossil fuel price fluctuations and regulatory changes; it attracts customers, partners and employees interested in corporate responsibility and drives corporate growth by maintaining pace with the competitors. This could improve supply chain by decreasing long-term costs, providing price stability, mitigating future regulatory risk, enhancing brand value, driving new revenue and improving employee engagement. Renewable energy requires careful upfront feasibility assessment, based on the availability of resources, infrastructure, investment strategy, financial returns and secondary considerations, such as, reputation enhancement.

Recent developments and outlook

Overcoming traditional barriers has accelerated the pace of adoption and progress of renewables, making it more accessible and affordable than ever. The United Nations Conference on Climate Change (COP21) which resulted in 195 countries
approving the first universal, legally binding global climate deal on greenhouse gas emissions & underscores the growing influence policy has in shaping renewable energy growth. In response to shifting public sentiment, many organisations are reviewing and modifying energy management initiatives, of which renewables are typically a core component. Corporations, such as, Apple Inc, and Kohl’s are ‘going all-in’ on renewables. 154 companies have signed the American Business Act on Climate Pledge and 81 companies have committed to pursuing 100 per cent renewable energy through the RE100 initiative.

Benefits of renewable energy in supply chain

Increasing the use of renewable energy in supply chains has the potential to increase revenue. Consumers increasingly choose to purchase from and invest in more environmentally and socially responsible companies. Generally speaking, many of today’s supply chains are still people intensive. Positive impact on corporate talent strengthens the case for adopting renewable energy. Company performance on sustainability issues can help attract and retain talent. Switching to renewable energy in ways that are visible to employees can help decrease attrition rates, thus reducing training costs, increasing in-house experience and serving as a talent differentiator.

These talent-related, intangible benefits may be more difficult to quantify but are nonetheless an important consideration in renewable energy strategy decisions. Installing highly visible renewable energy technologies — solar carports in parking facilities, for example — is just one-way companies can achieve intangible benefits from renewable energy.

Criteria for evaluation and adoption

- **Operational considerations**
  
  Increase in renewable energy used across the supply chain starts by developing an energy procurement strategy based on the company’s profile and specific needs. The following five attributes can help shape one’s renewables strategy decisions and determine the potential overall return on the company’s renewable energy investments.

  1. **Company size and energy profile**
  
     Renewable energy procurement options and constraints vary according to company size and energy profile, with smaller companies typically being the most challenged. It is important to assess that does one represent a small (< $100M revenue), mid-cap ($100M-$500M revenue) or an enterprise company ($500M+ revenue); the energy used each year and if the company’s energy profile is either purchased energy or an onsite generation.

  2. **Facility profile**
  
     Energy procurement decisions should be based on facility type and whether it’s owned or leased. Leased properties are typically more challenging; installing onsite renewable energy is more viable when a company owns the building and has decision-making power as well as access to the roof, parking lot and other real estate required for system installation. It is necessary to understand the types of facilities (laboratory, data centre, manufacturing facility, distribution centre, etc) that would be used with renewables.

  3. **Locations and markets**
  
     Energy incentives and regulations vary among and within countries. What is viable in one country may not be in another. In the United States, for example, PPAs are only possible in states with deregulated electricity markets. Facility locations and local markets will offer different options for available types of generation and ownership models. Basic evaluations need to be made on the basis of, the countries one operates in, if the facilities are concentrated in one state or country or are they distributed worldwide, availability of renewables in the specific location(s) and the impact of regulations and business model options in each location on one’s renewables strategy.

  4. **Investment**
  
     Renewable energy procurement can be heavily tailored to limit risk and overall investment. Even for companies in highly competitive, energy-intensive industries, renewable energy can be a good option that conforms to specific financial obligations and risk tolerance. One must take into account the investment that would go in and the financial feasibility of new energy generation at the specific location.

  5. **Proximity and visibility**
  
     Renewable energy has the potential to be a highly visible corporate responsibility statement. This is becoming increasingly important as stakeholders, such as, downstream customers, have become more vocal in their expectations, and even more so as employees and customers align with more responsible corporate environmental action. Many companies adopt renewable energy to be more socially responsible. Selecting a highly visible location for the system may be more important in this case than the actual renewable energy type, as long as the financials and technical viability are sound. One must assess if & why the visibility of a renewable energy system’s important and are there any other alternative measures that could provide value.
Framework for decision making

- **Renewable energy success factors**
  Leveraging industry leading practices can help define and facilitate implementation of an optimal renewable energy strategy. Goals for driving renewable energy in the supply chain should match the company’s overall vision, goals, strategy and ability to implement and continuously improve.

- **Investment impact matrix**
  Renewable energy investments should be prioritised to achieve energy procurement and sustainability goals. While renewable energy can pay dividends in many ways, it is important to work towards the optimal portfolio for the company’s profile and specific operational considerations in order to achieve the desired benefits. The dividends realised for talent, growth, risk mitigation and cost & efficiency will differ based on the magnitude and type of renewable energy investments made. Returns, or derived benefits, such as, an energy portfolio that creates positive cash flows and reduces long-term energy costs, should be strategically managed to create the desired position.

- **Renewable energy procurement options**
  Once one has established the desired outcomes for increased adoption of renewable energy in the supply chain, he can begin to evaluate procurement options and determine which best suit his organisation’s goals. The key takeaway is that today’s renewable energy leaders can and should tailor investment decisions to their company’s individual energy profile and corporate goals.

**Key levers for renewable energy in supply chains**

- **Supply chain applications**
  Significant renewable energy opportunities exist at each stage of the supply chain. Examples:
  1. **Develop:** Energy consumption is often high during designing and prototyping activities due to the energy requirements of early stage designing of equipment. Renewables can help reduce energy spent and the impact, improving overall Life Cycle Assessment (LCA) of products during this stage of the product lifecycle.
  2. **Plan:** Improve forecasts and reduce exposure to commodity price fluctuation associated with traditional fossil fuels
  3. **Source:** Effectively shift energy from an overhead to direct material by sourcing a 15-year PPA for energy generated from an offshore wind farm
  4. **Make:** Decrease manufacturing-related operational costs and sensitivity to commodity prices by locking in cheaper, longer-term contracts for renewables
  5. **Deliver:** Reduce warehouse energy spending through onsite rooftop solar photovoltaics and reduce transportation fuel costs through truck electrification technologies powered by the same system

6. **Return:** Use material waste or unsellable organic products (food waste) to make energy using waste-to-energy technologies, such as, anaerobic digesters

  These examples are just a few of the many opportunities to advance supply chain with renewable energy. Opportunities exist in end-to-end supply chain for cost reduction and value creation.

**Motivation for action**

The time for companies to assess their supply chains for renewable energy adoption is now. Access to renewable energy is better than it has ever been. Overall technology costs have decreased and new financing structures are providing flexibility for dynamic implementation. Through improving shifts in capital costs, technology efficiency, regulations and public or other stakeholder opinions, the motivation and momentum for renewable energy is strong. Renewable energy can be a significant source of value for many organisations. While each company that builds the capabilities to capture value from renewable energy must design a portfolio of investments tailored to its own organisational profile, making investments in renewable energy can have a profound, positive impact on their businesses.

*Courtesy: Deloitte*
Engineering the manufacturing revolution

India is estimated to be the fifth largest manufacturing country by 2020. To garner a better understanding of the latest trends of Industry 4.0, roles of different stakeholders in the functioning of a plant and sustainable manufacturing being the future of the industry, The Economic Times hosted the second edition of the Plant Leadership Summit, 2019, in Mumbai, India, under the theme ‘Plant automation through new revolution’, where EM was the media partner. A post event report...

The advent of industrial revolution – Industry 4.0/Digital 4.0 – has already started transforming the way the manufacturing industry functions. It’s deemed to be a merger of traditional manufacturing practices and sophisticated technologies, thus enabling better decisions and reorientations, bringing about greater efficiency and productivity throughout the plant. To deliver a ROI-based evaluations of learnings, The Economic Times hosted the Plant Leadership Summit for manufacturing plant leaders across sectors with discussions around the challenges they faced from planning to final execution on ground, issues faced with regards to plant, people, processes and technology, to achieve operational excellence and to build the plant of the future.

Devising the future

The skull session on the theme ‘Plant automation through new revolution’ began with a panel discussion on the topic ‘How India can build for the future’. The erudite list of panellists comprised – Sourav Sen, MD & CEO, Elrich India; Krishnan Sadagopan, Sr Vice President, Ashok Leyland; Manoranjan Sahu, Deputy General Manager, Toshiba JSW Power Systems and was moderated by Khushroo B Panthaky, Director, Grant Thornton. Responding to a question posed by Panthaky on how India is shaping for it future, Sen replied, “It is very important to look beyond the short-term challenges and develop the country’s
future. Education and skill development are of absolute necessity for a sustainable growth.” Elaborating on the challenges in the automobile sector, the current and the future scenario, Sadagopan mentioned, “Customer requirements & demands are changing. We need to carefully monitor the change and deliver to it faster, better and greater.” Discussing how one can follow the Make in India agenda and work towards making India a $5 trillion economy, Sahu retorted, “It is essential to decentralise and digitise to ensure success. It is equally important to include the remotest part of the country in the development.”

Following this, V Bino George, Head of Business Consulting, Infor South Asia, hosted a session on ‘Factory of the future – bringing together the operational & informational sides of manufacturing’. During the session, George detailed on everything right from the asset management trends to connected workers to connected future. He mentioned, “Asset management is a culture. With the development of new technologies, it is helping companies create competitive advantages.”

Industry 4.0 has been a driving force in the manufacturing industry. Data, connectivity and customers are the driving force behind making companies smarter and competent. To offer an improved understanding of how Big Data is making the food & beverage industry smarter, Sirish Yadav, Vice-President – Manufacturing & Technology, ITC Foods, presented a case study on ‘Assembly plants with Industry 4.0 at the forefront’. Speaking of smart factories and digital solution for production, Yadav accentuated, “The Indian food industry is on a growth trajectory, and it is helping us embark on the journey of Industry 4.0.”

With an increased throughput in processes that are bottlenecks in manufacturing, the industry has become ever-so competitive. To get a better understanding on how and why one needs to move on and adopt the evolving technologies, Vijay Kalra, CEO, Mahindra Vehicle Manufacturers, Chief Manufacturing Operations, Mahindra & Mahindra, hosted a session on ‘Manufacturing competitiveness in the ever-changing world’.

Following this, the symposium witnessed an interactive panel discussion on ‘Planning towards smart manufacturing with solutions to overcome current challenges’. Moderated by Shripad Ranade, Management Consultant, Ikigai Consulting, the esoteric line of panellists comprised, Amar Dhanwade, Head - Operations Strategy, Welspun Group; Tarun Mishra, Founder & CEO, Covacsis India; Senthil Kumar, CTO, Kiran Global Chem and Manish Manek, Chief Plant Officer, MG Motor India. Discussing what Industry 4.0 means for the industries and how has it worked/not worked, Mishra reveals, “The trick lies in not resisting but in quick adoption of the new technologies.” Adding on to the topic, Dhanwade complemented, “You need to take baby steps in adoption and continue the process of learning.” Detailing on how to maximise output throughout the process, Manek accentuated, “Unless the entire value chain is engaged, one cannot draw out the effectiveness or the results desired.” Speaking about the change in traditional manufacturing and the changes encountered, Kumar emphasised, “One should have a clear-cut roadmap of what they are doing. Think big but start small.”

**Digitising and connecting**

Following this, to give a detailed explanation on how one can digitise their plant, Nikhil Bhat, Head of Business Development, Akrivia, hosted a technology session on ‘Plant digitisation using Akrivia’. During this, Bhat stressed, “You need to connect digitally to perfect reality.”

To give a detailed explanation on the pros & cons of AI on the shop floor and its ability to increase efficiency, Harish Lade, Vice-President Supply Chain, Asian Paints, hosted a session on ‘Pros & cons of Artificial Intelligence on floor shop efficiency’.

Next, Mishra, took the stage to delve on the topic of ‘Real life applications of Industrial IoT and Artificial Intelligence’. During the session, he explained on how the new age technologies are changing the face and the future of factories. Mishra commented, “New generation of manufacturing comes when we welcome an intelligent world of manufacturing.”

Proceeding further, S Vaidhyanathan, Business, Transformation & Operational Excellence Professional, Hindalco Industries, took the stage to speak on ‘How lean and six sigma can accelerate Internet of Things’. During the session, he elaborated on the areas where lean and six sigma can accelerate implementation of new technologies.

Concluding day one on a prominent note, the symposium witnessed the final panel discussion - ‘Asset management to improve plant reliability’. Moderated by Dibeyendu De, Director, Reliability Management Consultant, the panellist comprised, Prashant Shinde, Group Head – Analytics IoT, Reliability Centre Maintenance CoE, Tata Power; Sundar N P, Independent Consultant and S Vaidhyanathan, discussing the cause why plant reliability hasn’t been achieved and how one can improve & achieve plant reliability.
Evolving and upgrading

The second day began off with an opening address delivered by Subhash P, Head of Manufacturing - Digital, Bosch Engineering Automotive, on how 'Industry 4.0 can be the key player in changing the shape of manufacturing'. This was followed by a deep assessment on how one can be prepared for the fourth industrial revolution during the session, 'Getting Industry 4.0 ready', by Nikhil Joshi, Founder & CEO, SNIc Solutions.

To understand the myriad benefits of preserving quality in the manufacturing sector, the next panel discussion deliberated on 'The importance of quality in manufacturing'. The faction of panellist included, Nitin D Chaudhari, Vice President, Sandvik Asia; Viren Dhulla, Vice President & Head, Corporate Health Safety & Wellbeing, Vodafone India; Sunil Nighot, Quality Team Lead, Johnson & Johnson and Rajesh Maheshwari, CEO, Quality Council of India and moderator Ankur Basu, Partner, PwC. The session witnessed an elaborate discussion on how manufacturers can ensure quality is maintained and how one can manufacture the quality expected first-hand.

Collaboration boosting productivity

This was followed by another interactive session on 'Industry 4.0 - Total productive maintenance in digital age', hosted by Pallavi Wad, Head, Product Supply Organisation for India and SAARC, Godrej Consumer Products and Mahendran PA, Director, Global IT Operations, Philips. During the session Wad and Mahendran elaborated on how old technologies can be evolved and used and the use of TPM 2.0 in the context of new age revolution. “In Industry 4.0 the first step that we need to achieve is, visibility to the shop floor officer,” emphasised Wad.

Following this, to give a detailed explanation on how humans and robots would be co-existing in the future factories, Pradeep David, General Manager South Asia, Universal Robots, hosted a session on 'Factories of the future: Collaborative robots & Industry 4.0'. Subsequently, Harsimrat Bhasin, Co-founder & CEO, Neewee, took the stage to speak on 'Implementation examples of enlightened manufacturing'. During the session, Bhasin threw light on the changing phase of manufacturing and the necessity of integrated analytics and shop floor.

Giving a new touch to the event, the symposium next witnessed an un-conferencing session on the topic 'The future of productivity and growth in manufacturing industries'. During this, elected leaders from the audience explained the 'Impact of technologies', 'Impact on human resources' and 'Impact of policies on the future & growth for industries', post critical group discussions.

Moving further, a workshop on 'Plant leadership and sustainability development goals' hosted by Dibyendu De. During this, he elaborated on the modern manufacturing and the development thrust plant manufacturing and leadership is undergoing for sustainable development. He mentioned, “Modern manufacturing is in the frontier of growing India.” Bringing the two-day event on a prominent note, R C Bhargava, Chairman, Maruti Suzuki, summarised the event by delivering the closing speech.

Enabling the revolution

With sustainability and plant performance being a key concern for plant leaders, the platform developed at the Plant Leadership Summit proved to be fruitful to the plant leaders to foster discussions around the challenges they faced and helping create a roadmap to bring about operational excellence and build plants of the future.
Driving sustainability with the virtual world

Sustainable manufacturing was the main highlight at the Dassault Systèmes’ show - Manufacturing in the Age of Experience - held recently in Shanghai, China, that also discussed how global manufacturers are using the virtual world to reinvent their business. EM got an opportunity to witness the expertise and stories along with interactive learning expedition on what is possible and what is necessary to achieve sustainable manufacturing with digital transformation. The post-event report...

Dassault Systèmes’ annual event – Manufacturing in the Age of Experience – held recently in Shanghai, China, featured global manufacturing thought-leaders and decision-makers who discussed digital trends, insights and best practices for sustainable manufacturing in the industry renaissance. The 5th edition of this annual event allowed the attendees to explore how the 3DEXPERIENCE platform creates opportunities and how to grow in a business environment where sustainability is not an option, but obligation.

Thought leaders from Accenture, China Center for Information Industry Development, FAW Group Corporation, Huawei, IDC and SATS joined the CEOs of Dassault Systèmes’ brands DELMIA and NETVIBES EXALEAD on stage to delve into digital trends, value creation strategies and best practices for achieving sustainable growth, innovating and inspiring the future workforce. Their expertise and stories about how to tackle sustainable manufacturing & insights into Chinese manufacturing trends provided the attendees a lot of food for thought.

Through interactive experiences with Dassault Systèmes’ 3DEXPERIENCE platform, technological workshops, consulting sessions, networking opportunities and a ‘hackathon’ challenge, the attendees from the manufacturing sector could explore how to transform the way they invent, learn, produce and trade by using digital platforms, Artificial Intelligence, Digital Twins, robotics...
and more to optimise global operations, orchestrate value networks and leverage existing skills.

Sustainable manufacturing

At the opening of Manufacturing in the Age of Experience event, Guillaume Vendroux, CEO, Delmia, declared, “Sustainability is a ‘must be’ and ‘must behave’ activity; but it is also a tremendous opportunity - the green marketplace is worth trillions, and it’s clearly a business and innovation driver.” He furthered, “Sustainability can and must extend to many parts of a company’s business, and manufacturing is no exception. Sustainable manufacturing is not only about energy efficiency or zero-waste strategy. It is about innovation for social and societal responsibility. And smart manufacturing with digital transformation is a prerequisite to sustainability.” He focused his discussion on the three pillars to achieve sustainable manufacturing and create value for all - workforce of the future, global operations optimisation and value network orchestration. Fostering collaboration, transparency, visibility & harmony across the value network is a way to create sustainable value for all stakeholders while delivering unique experiences to market, he concluded.

Getting smart about sustainable manufacturing

Ke Wang, Managing Director, Digital Production & Operations, Accenture China, delivered the keynote address on getting smart about sustainable manufacturing. He explained how digital value chains are central to delivering the next generation of consumer services. “For today’s customers, value isn’t only found in ‘the product’ a manufacturer produces and sells, but also in the services and experiences built around it. To deliver this kind of value, manufacturers must work ever more closely with their partner ecosystems to ideate, innovate, produce, sell and service products & experiences that are centred around the needs of individual consumers,” he opined.

According to Wang, there are three components every business needs to get right to ensure a smooth transition to sustainable digital manufacturing – align the strategy, prioritise the use-cases and ensure the technology foundation. Wang also presented the statistics on Smart Manufacturing in China. In 2018, the economic value of industrial digitalisation reached 24.9 trillion yuan, an increase of 23.1 per cent over 2017, he informed.

Automotive manufacturing in the age of experience

ABB and Dassault Systèmes have a wide spanning global partnership to offer customers in digital industries, a unique software solutions portfolio ranging from product life cycle management to asset health solutions. Michael Larsson, Group Vice President and Head of Robot Systems at ABB, delivered the keynote speech on automotive manufacturing in the age of experience. Driven by changing customer behaviours, labour shortages and the regionalisation of markets, the world of manufacturing is being disrupted, and ABB’s answer to these external drivers is more digital, flexible, with collaborative solutions, he said.

Shaping new power of industrial intelligence

Mark Chen, Vice President of Global Partner Business Dept, CLOUD BU Marketing & Sales, Huawei, gave insights on Huawei as an industrial internet platform, through its cooperation with Dassault Systèmes and presented a testimonial on how this collaboration jointly builds industry solutions to help industrial enterprises upgrade manufacturing.

Enabling enterprise digital transformation with Digital Twin

Albert Pozo, Chief Digital Officer, SATS, shared his experience with digital transformation and how the implementation of new modeling capabilities has become an essential capability that enables business transformation. SATS is Asia’s leading food
solutions and gateway services provider that uses Dassault Systèmes’ 3D EXPERIENCE platform on the cloud to create a 3D Digital Twin experience of a virtual kitchen that pairs virtual and physical operations to provide data-driven analytics for better resource planning.

**Sustainable manufacturing in action**

Marie-Catherine Lizotte, Director of the DELMIA CoE Innovation Center, Dassault Systèmes, presented a programme on sustainable manufacturing in action to experience live the solutions in a holistic approach on the main stage.

**Sustainable Hackathon challenge**

In the Sustainable Hackathon challenge, 4 teams with 20 students from 5 countries, answered the challenge to develop in just 48 hours, their solutions for a sustainable manufacturing factory of the future. The Hackathon participants presented how sustainable manufacturing can be applied to the environment, the factory and the workers, in order to create the sustainable factory of the future. After hearing the pitches, the audience voted for the winning project. The award went to the Team Red that had developed a solution which uses sharing economy principles to be applied to a large-scale manufacturing.

**Interactive learning expedition**

The world is experiencing a global transformation in how we invent, learn, produce and trade. In this context, the event presented eight workshops with a dedicated scenario underlining the challenges and business value of a digital continuity showcase told through a relatable manufacturing story. The eight topics were: supply chain planning & optimisation, Digital Twin visualisation, optimised process planning, robot programming & virtual commissioning, operations & monitoring, collaborations & lean practices, maintenance management and interactive automation experience.

**Chinese manufacturing perspectives**

Day two of the event put the focus on manufacturing in China, where innovations come at impressive speed & scale. Ying Zhang, China Managing Director, Dassault Systèmes, presented on what is the manufacturing strategy in China and what is the perspective in the context of a global transformation toward sustainability. According to the Global Innovation Index, which reviews the innovation performance of nearly 130 economies around the world every year, China is number 14, leading the world with over US $2.01 trillion of manufacturing output, he informed.

**Industrial software to intelligent manufacturing**

In order to grasp the overall development situation of China’s industrial software market, CCID Consulting evaluated the mainstream enterprises of China’s industrial software market based on the scale of their revenues in the field of industrial software in 2018, and formed "2018 China’s Industrial Software Enterprise Ranking List". Yunhou Wang, Vice General Manager, Software & Information Service Research Center, CCID, presented the situation and trends of China’s industrial software market.

**Lean oriented MOM solution**

Yang Dongxu, Director of Final Assembly Technology, FAW Group Corporation, gave a case study presentation on how Dassault Systèmes helped FAW Car to enhance their data collection processes.

**Beyond Manufacturing 4.0**

Robert Parker, Senior Vice President, IDC, shared data on the maturity of digital transformation in the manufacturing industry, both globally and in China, and provided a roadmap to a Future Operations model that enables manufacturing firms to take advantage of the economies of intelligence to innovate faster and more effectively.

Overall, the Manufacturing in Age of Experience event demonstrated how the 3DEXPERIENCE platform can help manufacturers to start and then accelerate their journey to sustainability, providing all the environment, ecosystems and tools to turn ideas into on-the-ground valuable actions, collaborate and scale solutions to create sustainable growth.
Variable speed drive liquid ring vacuum pump

Atlas Copco recently launched LRP 700 -1000 VSD+ range of intelligent liquid ring vacuum pumps. Ideally suited to wet, humid and dirty applications, it is a state-of-the-art vacuum solution with unrivalled innovation and integration capabilities. It is a compact, high-performance, energy efficient system enclosed in a strong, noise-containing canopy. Also, it is an uncomplicated plug-and-play product. This pump contains many performance-optimised components that would normally be supplied as accessories, often taking up additional space for piping and installation; it resulted into maximised efficiency, performance and space saving. Indeed, with operating noise in the range of 65dB(a) the LRP VSD+ is an extremely quiet liquid ring pump. Along with noise reduction, the sturdy canopy and cubicle ensures that the pump and internal electronics are effectively protected against dust and water, thus qualifying for the harshest industrial applications – extending the lifetime of the electronic components as well as the service intervals. The twin VSD system operates in absolute harmony within the pump, ensuring optimal vacuum performance always.

Distributed servo drive system

Beckhoff recently added AMP8000 and AMP8620 to its list of distributed servo drive systems. The AMP8000 is ideally suited for adjusting the nacelle of wind turbines as it integrates the servo drive directly into the servomotor in a very compact design. This reduces the space requirements in control cabinets and cabling. The result is, significant savings in terms of weight, construction volume, material and installation effort. The space requirements for the drive in the control cabinet, in the nacelle in particular, can be eliminated entirely through the use of the new AMP8620 IP65 supply module, because the AMP8620 module is directly connected to the mains supply and contains all circuitry components required for this purpose. Depending on the power requirements, the supply module can control up to five distributed AMP8000 Servo Drives via EtherCAT P, i.e., via a single cable for EtherCAT and power. Preassembled connecting cables simplify logistics considerably and minimise wiring errors. The motor cabling and installation requirements are also reduced effectively.

High-temperature industrial thermal camera

Flir Systems recently introduced one-of-a-kind industrial diagnostic tool that combines accurate temperature measurement with the ability to image up to 1,030°C, the Flir TG297. It provides a non-contact high-temperature measurement and thermal imaging for professionals in one tool making it ideal for industries, such as, measuring the heat of glass furnaces, kilns, and forges as well as manufacturing applications, allowing one to accurately target potential faults, troubleshoot repairs, and monitor processes. The patented Flir MSX® (Multi-Spectral Dynamic Imaging) Enhancement improves image clarity by embossing visual scene details on full thermal images. The images can be recorded to ensure that machinery and systems are functioning safely and at peak efficiency. Also, it is a 160×120 IR pixel imager with the thermal sensitivity less than 70 mk. It works from a safe distance to measure the high-temperature objects (like, a glass furnace) with a portable tool protected by an IP54 enclosure. Also, this can withstand a 2-metre drop test. The company gives 2-10 years warranty. It can peer into the darkness and hard-to-reach areas with the bright LED flashlight.
Robot programming software

Hypertherm recently announced the release of Robotmaster Version 7.1, which is a major update to the completely redesigned and advanced architecture of its Version 7 software that was released previously. In total, this new robotic programming software contains more than 40 new features, 500 improvements and dozens of bug fixes. Many of the changes, driven by customer feedback, are designed to continuously improve the software’s CAD/CAM technology and automate programming, allowing customers to enjoy the best error-free robotic path in just one click.

Added features and improvements include:
- Ability to automatically recognise weld joints embedded in CAD models which simplifies and speeds up programming
- Ability to transform operations to reduce multiple manual selections
- Ability to modify operation geometry (a section of the path or the entire path) so the user can match CAD model to the actual part when a mismatch exists

Today, the software is used on robots that drill airplane fuselages, polish automotive dies, cut material, support Additive Manufacturing and add value to a multitude of processes at family-owned job shops around the world.

Robotmaster Version 7.1

Online e-chain expert tool

igus recently launched an e-chain expert, which is an online tool that users can use to design their energy chain system on a smart phone, tablet or a desktop computer. Irrespective of an unsupported, gliding or hanging application, the configurator determines the energy chain that is optimally suited. To do this, the user must open the e-chain expert, select the unharnessed or harnessed cables, enter the application and environmental parameters, decide on the appropriate energy chain from a pre-selection and configure it. In the energy chain configurator, the user can choose from over 1300 highly flexible chainflex cables tested by the company as well as over 4200 harnessed ready cable drive cables. Based on the specified cables and the application data, such as, installation space, movement and environment of the energy chain, the customer can choose from a selection of 150,000 e-chain parts for the most cost-effective solution. An interior separation configurator is used in the online expert. The ready-to-connect energy chain system can be ordered online or the customer can also request an individual offer for their configuration.

e-chain configurator

Sensory toolholder

Schunk recently presented the smart future of gripping systems and clamping devices in modern production under the motto ‘Empowering Machines & Operators’, the sensory toolholder iTENDO, the precision toolholder for real-time process monitoring and control for machine tools. It can be used to detect vibrations, chatter marks, and tool failure, and adapt processes immediately and fully automatically. The sensory toolholder allows documentation of process stability, real-time compatible control of RPM and feed rate and unmanned limit value monitoring & tool breakage detection. Its applications range from classical milling applications and micro-cutting to deburring with brushes. Further highlights were the smart quick-change pallet module VERO-S NSE-S3, the smart long-stroke gripper EGL, presented with a plug-&-work-compatible interface for lightweight robots by Universal Robots and automatable run-out and conical run-out compensation for high-precision workpiece clamping with tolerances of a few micrometres. In addition, the company presented a wide range of solutions for flexible, automated machine loading: Lean automation solutions, palletising systems for the smallest batch sizes, but also high-performance co-act solutions for human-robot collaboration.

iTendo

Shark line taps

Dormer Pramet recently expanded its range of shark line taps with a new assortment for high strength steels and titanium alloys. The new range is available in spiral point (E334) and spiral flute (E335) geometries for through and blind hole threading respectively. Also, the new taps provide high-performance process security in hardened and tempered materials below 45 HRC. These taps are immediately identifiable due to the black ring on their shank, and it incorporates a robust geometry which significantly increases the cutting edge strength and supports problem-free, high-quality thread production. In addition, both feature a TiAlN-Top coating and E334 & E335 are manufactured from a unique powder metallurgy tool steel for toughness, longer tool life and increased performance at higher operating temperatures. The E334 spiral point tap provides through-hole threading up to 2.5xD with a low rake angle for good chip control and edge strength. With a balanced higher relief on the chamfer and lower relief on the guidance, the E335 spiral flute tap supports blind hole threading up to 1.5xD.

Range of shark line taps
Encoders for different applications

Heidenhain offers a wide range of encoders for accurate applications as the simple connection options should always be available for every application in the respective industry. Included in this connectivity are mechanical & electronic connections, as well as connections between individual components and within complex networks. This diversity of interfaces in various combinations allows machine manufacturers to select the encoder best suited to their drive solutions.

Electronic connectivity

In electronic connectivity, trouble-free communication with the machine or equipment controller is a crucial criterion in the selection of an encoder. But this goes beyond the reliable and correct transmission of position data. By contributing to the avoidance of machine downtime and reducing the number of maintenance cycles, this data can increase equipment availability and simplify process planning. Position encoders from the company are available for this purpose, with a wide variety of interfaces – Heidenhain EnDat, Fanuc Serial Interface, Mitsubishi High Speed Interface, TTL, HTL, etc.

A digital interface for position data also enables the transmission of the 'electronic ID label', which contains data for the commissioning of the encoder and the drive. The digital interfaces also transmit additional information, such as, the temperature of the motor winding or diagnostics data—information that is dependent on the interface. For example, the EnDat 2.2 interface makes it possible to quickly and reliably provide information about the functional condition of the position encoder during operation, as part of regular maintenance or in the event of a malfunction. Maintenance measures can then be derived from this information.

Mounting compatibility

A machine and equipment manufacturer can always select the optimal solution for the specific control requirements from the Heidenhain product programme. As many encoders from the company are mechanically and electrically compatible. He can thus, keep the number of motor variants to a minimum without limiting the breadth of potential applications. Also, the solutions include different shaft diameters and mounting flange variants for rotary and angle encoders, scale tape solutions for extremely large radii or long measuring distances, and encoders with mechanically safe connections.

Most encoder versions from the company with incremental and absolute measured-value acquisition are available with mounting compatibility. These absolute rotary encoders are further subdivided into singleturn and multiturn variants with gears or battery buffer for the counting of complete revolutions.

The ECI/EQI 1100 and ECI/EQI 1300 inductive rotary encoders feature mounting compatibility with the EQN/EOQ 1100 and ECN/EQN 1300 rotary encoders with optical scanning and integral bearing. While the linear encoders from the LIDA series are available with various graduation carriers (steel, glass, or glass ceramic) and a corresponding variety of measuring accuracies.

Safety, system monitoring and function reserve

For encoders, functional safety means that position data must always be correctly and precisely ascertained and transmitted to the machine control. Other aspects include encoder diagnostics and mechanical fault exclusion. These encoders feature user-friendly solutions for a wide range of safety-related applications.

- In conjunction with a safe control, these encoders satisfy all of the requirements for safety-related applications in conformity with SIL 2 (as per EN 61508) or Performance Level ‘d’ (as per EN ISO 13849).
- When properly implemented in the subsequent electronics, some encoders are also suitable for systems in conformity with SIL 3 (as per EN 61508) or Performance Level ‘e’ (as per EN ISO 13849).

Examples of encoders for a safe connection to the drive are the functional safety versions of the ECN/EQN 400 series. These encoders feature a hollow shaft connection featuring mechanical fault exclusion for the blind hollow shaft in diameters of 10 mm or 12 mm. As a result, faults that are undetectable by the control, such as, the slippage of a friction connection, can be avoided.

Thanks to serial interfaces, the encoders also provide complete information for commissioning, monitoring, and diagnostics. This information supports the analysis of complex machines. The encoder makes diagnostics much easier using valuation numbers, which enables the assessment of an encoder’s function reserve. The high level of expertise formerly required for the evaluation of encoder signals is no longer necessary. This design feature is also available with other interfaces besides EnDat.

The company offers a diagnostic tool for all its encoders with absolute and incremental interfaces: the adjusting and testing package consisting of the PWM 21 and the ATS software. With this package, the condition of the encoder can be tested during machine operation and as part of mounting or repair work.

For the evaluation of the function reserve in closed-loop operation, encoders generate valuation numbers. These easy-to-understand numbers provide detailed information about the state of the following factors:

- The internal scanning signal
- Position-value formation
- The encoder itself

Based on these data, controls or inverters can provide statements about the function reserve. The scale and meaning of these numbers are identical for all encoders, allowing for evaluation across board. Transmission is performed in a closed control loop, and the resource usage in the subsequent electronics is relatively low, since only numerical values are evaluated and displayed.
» Medical Machining
Medical device manufacturing involves different procedures to produce the devices. Medical device manufacturing is highly intricate and entails precision CNC medical machining companies. The next issue discusses the capabilities and technical abilities required for medical machining, the challenges involved and the latest trends in medical machining.

» Logistics & Supply Chain
Logistics and supply chain impact manufacturing companies in umpteen ways, including the availability of inputs needed for production developments and profitability of manufactured items. As it has helped manufacture goods more resourcefully and cost-effectively, it has also become complex with time. The following issue explores the top supply chain and logistics dilemmas faced by the manufacturing industry and how it is experiencing a disruptive change in the sector.

» Gear Cutting/Hobbing
The demand for precision gears is on the rise across sundry industries, with new developments coming in them. The next issue finds out the latest trends in gear cutting and hobbing and the challenges while producing high quality gears.

» Manufacturing & Data Analytics
Manufacturing dashboards and data analytics can streamline operations by giving more dedicated and actionable insights that help to continuously modify the production line. We find more manufacturers applying data analytics across their processes to improve their supply chains and monitor machine usage and dependability. The consequence issue throws light on how data analytics can result in clear enhancements across manufacturing operations, how it is being used to direct the industry towards fresh spaces and what are some data analytics mistakes that manufacturers should avoid.

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Application Examples
- Hirth Coupling
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