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Being world class!!!

During my recent visit to China, the most noteworthy quality I observed among people was the willingness to reach the end-goal at any cost, followed by punctuality, smart work and perfection. No wonder, a goal-oriented spirit inherent to every Chinese person along with sheer determination and diligence has helped the country to be an economic superpower. Their rapid development over the last decade is not because of their technological advancement, but it’s attributed more towards world class work performance and the Chinese culture work ethic of the locality.

When it comes to manufacturing, the world class work performance becomes even more important. To qualify as world class, a manufacturing organisation has to demonstrate outstanding performance on both productivity and quality measures, which will come from pursuance of best practices in manufacturing. China is the best example to look up for, in this case.

The Cover Story in this issue brings you an eye-opening discussion on what separates world class performers from others and what are the preparations and practices required to become a world-class player. An interesting read, check it out…

I would also like to specially recommend two big interviews in this issue – Vikram Kirloskar, President, CII & Vice Chairman, Toyota Kirloskar Motor and Deepak Jain, President, ACMA & CMD, Lumax Industries, who share their views on the economic revival in the current situation, developments in the EV area and how to drive change to stay relevant to customers. Have a look!

No matter what sort of year you have had, you still have the opportunity to end this year with an upbeat attitude and start the New Year on a positive note! Best wishes!!!

Shekhar Jitkar
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In business, productivity is frequently referred to as the amount of output per unit of input. When one does something as efficiently and effectively as possible, he is being productive. It can also help firms to follow their mission, vision, policies, objectives and targets. Likewise, it enables them to identify their weakness and strengths along with the opportunities and threats evolving from the market, which is another reason as to why productivity is pivotal.

Companies assess their weak spot and try to compensate and produce what things they expect, which helps them to control the output driving various departments. Even though, over productivity sometimes leads to fail in company growth, some researchers believe that the profit report of the company is not enough, and it is only the last result, while productivity that determines the efficiency/effectiveness of processes and policies. It can be influenced by many factors, including the skill of the workers, condition of equipment, environment and even the culture of the organisation. Measure of efficiency appraises the organisation’s ability to achieve output(s) considering the minimum inputs level. Efficiency, effectiveness and productivity need not be work-related. You can be very efficient at picking wild berries; but if they’re poisonous you’re not being very effective. On the other hand, picking nutritious berries might be effective, but doing so by choosing only the large ones and removing them from the bush one at a time might not be the most efficient way of doing it.

The position of an organisation’s productivity can be classified into four quadrants: Dark (A), Grey (B), Grey (D) and Golden (C). Quadrant (A) is where the organisation involved has low effectiveness and low efficiency, it means, neither the services/products that organisation presents to its customers is correct nor the goals of the organisation can be achieved. Therefore, this is the end of activity for the organisation.

But, in Losses Quadrant (B) & (D) because of defects in one of the necessity elements of productivity and effectiveness, customers are not satisfied with the organisation’s performance. This problem has appeared in a short time and because of good efficiency and bad effectiveness, this view brings-in short-lived profitability. Also, on the contrary, emphasising on effectiveness and disregarding efficiency may lead to ‘unprofitable growth’ that happens in Losses Quadrant (B) & (D). In addition, in the second Losses Quadrant (B) & (D), the goals of organisations are obtained but not with the same resources; organisation in order to achieve their goals, should allocate more resources and budgets, which otherwise leads to ‘slowly dying’. Although, how long the organisation can survive depends on if they are governmental, private, small, or large sized organisation. Thus, if organisations do not attempt to run away quickly from their current position, they will fall in the Dark Quadrant. On the other hand, Golden Quadrant is the ideal position that each organisation would desire to be located in.

Thus, it is necessary that organisations pay attention equally to the effectiveness and efficiency and only then growth of profit can be maintainable. With right productivity, organisations will be able to provide better services/product and also win customer hearts with their effectiveness.
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Siemens acquires Atlas 3D

Siemens recently announced that it has signed an agreement to acquire Atlas 3D. Atlas 3D will join Siemens Digital Industries Software, where its solutions will expand Additive Manufacturing capabilities in the Xcelerator portfolio of software. Sunata™ software uses thermal distortion analysis to provide a simple, automated way to optimise part build orientation and generate support structures. This approach allows the designer to perform these simulations, thereby reducing the downstream analysis that needs to be conducted via Simcenter™ software to achieve a part that meets design requirements. Siemens plans to make the Atlas 3D solution available through its online Additive Manufacturing network. Welcoming Atlas 3D to the Additive Manufacturing team, Zvi Feuer, Senior Vice President, Manufacturing Engineering Software, Siemens Digital Industries Software, asserted, “The cloud-based Sunata software makes it easy for designers to determine the optimal way to 3D print parts for high quality and repeatability. The combination of Sunata with the robust CAE Additive Manufacturing tools in Simcenter enables a ‘right first time’ approach for industrial 3D Printing.”

PwC introduces Demand Driven Materials Requirement Planning

PwC India recently launched Demand Driven Materials Requirement Planning (DDMRP) offering as a part of its Supply Chain Transformation suite of solutions, which is aimed at manufacturing and distribution companies and will help significantly reduce inventories, while improving service levels. Discussing the attempts of the company, Sastry Subrahmanya, Partner and Leader, Supply Chain Transformation, PwC India, adhered, “We have constantly endeavoured to bring cutting edge global innovations to India to make Indian businesses fit for future. I believe DDMRP as a planning concept is at an inflection point, having been enabled by a mature set of digital solutions. We look forward to working with companies that will adopt them to strengthen their Industry 4.0 journey.”

IMTMA organised symposium ‘Smart Automation 2019’ in Bengaluru

Indian Machine Tool Manufacturers’ Association (IMTMA) recently organised symposium themed ‘Smart Automation 2019’ at Bangalore International Exhibition Centre (BIEC), Bengaluru, India, which featured presentations and discussions on various facets of automation with case studies and panel discussions, with over 300 delegates from around 125 companies. The sessions were divided into parallel tracks: Robotics & Automation and Digitalisation, which ran concurrently, followed by a panel discussion on ‘Overcoming obstacles in the journey to smart automation’. Highlighting the importance of automation, Indradev Babu, President, IMTMA, said, “The path for realising the vision of ‘Make in India’, calls for a paradigm shift in our manufacturing process. This necessitates the adoption of automation and smart technologies, not only in our respective manufacturing facility but also across the entire manufacturing value chain.”

SIAM signs pact with KAMA from Korea

Society of Indian Automobile Manufacturers (SIAM) recently signed a pact with Korea Automobile Manufacturers Association (KAMA), which aims for cooperation and support in promoting a sustainable, safe, clean, affordable and efficient automobile industry. SIAM stated that an MoU to this effect was signed between SIAM and KAMA during an event in Mumbai, India. It further added that the two organisations will set up regular information exchange mechanism to maintain their cooperative dialogues and deliberate on issues on the subjects of their common interests. Commenting on the partnership, Rajan Wadhera, President, SIAM, said, “In context of the auto sector, ties between India and South Korea can be traced back to 1996, when Hyundai Motors entered the Indian market. Indian manufacturers, like Tata Group and Mahindra & Mahindra, have made significant investment in Korea’s auto industry till date. We hope that the MoU will benefit both the organisations in facilitating further collaboration in areas of technology advancements and R&D in the automotive sector.”
CERATIZIT Group inaugurates manufacturing facility expansion

CERATIZIT Group recently inaugurated the expansion of production at the CERATIZIT Bengaluru site, which was conducted by HE Jean Claude Kugener, Ambassador of Grand Duchy of Luxembourg in India, in presence of Members of the Board - Thierry Wolter, Andreas Lackner, Andreas Schwenninger and Gerhard Bailom, AK Sareen, Director, CERATIZIT India and Anil Kumar, MD, CERATIZIT India. With the expansion, the company has gained the flexibility to accommodate the machines necessary for further growth and to optimise its production processes. The original building, opened in 2009, currently has an area of 36,500 square feet. The new extension has more than doubled it to 85,000 square feet and now offers the urgently needed space. Explaining his views on the expansion of the facility, Kumar said, “Due to the growth in recent years, we have been lacking the space to install additional machines. The extension removes this crucial bottleneck and allows us to continue growing here at the site.”

Elgi Equipments conferred the 2019 Deming Prize in Tokyo, Japan

Elgi Equipments recently got conferred with the Deming Prize for excellence in Total Quality Management (TQM), in over 60 years. Dr Jairam Varadaraj, Managing Director, ELGi Equipments, received the coveted medal from Hiroaki Nakanishi, Chairman, Deming Prize Committee, at the award ceremony in Tokyo, Japan. In his acceptance speech, Varadaraj, dedicating this award to all the employees at ELGi, stated, “On paper, the path to success is pretty straight forward. But realising it requires a secret sauce and TQM has been our secret sauce. We have a long way to go but TQM has helped us become a better company for all our stakeholders. I would like to dedicate this award to our employees, who are the key stakeholders in our company.” Also present at the award function were R Jayakanthan, Director – People, Systems and Strategy; Sundarrajan Pattabiraman, Vice President, ELGi Business System; Ramesh Ponnuwami, Executive Director; Sriram Srinivas, Director – Operations; Anvar Jay Varadaraj, Global Brand Head and Dr K Venu Madhav, Director – Technology.

Tata Motors inaugurates ‘Advance Power Systems Engg Tech Center’

Tata Motors recently inaugurated its state-of-the-art ‘Advance Power Systems Engineering Tech Center’ at the Engineering Research Center in Pune, India. The company says that the centre will cater for engineering, developing and testing new-age powertrain solutions.

The powertrain solutions will be featured in the company’s products across the passenger vehicle, commercial vehicle and electric vehicle verticals. The new facility will focus on the development of BS-VI Phase 1 & Phase 2 engines, real driving emissions, CAFE II, hybrids, electrification and BS-VII compliance. Witnessing the new technology centre going live, Guenter Butschek, CEO & MD, Tata Motors, said, “The centre was established in a record time of 15 months. This facility will act as a hub to develop class-leading powertrain solutions for our vast product portfolio across ICE and Electric. It reiterates our commitment to offer our customers a wide range of clean, sustainable technologies, thus meeting their aspirations.”

Discussing the benefits of the centre, Rajendra Petkar, President & CTO, Tata Motors, stated, “This would help offer powertrain solutions across multiple segments under one roof.” Loaded with future-ready design elements, this facility will allow for Tata Motors to offer tech-heavy products to the customers. The company’s all new facility is spread over 12,000 sqm and is equipped to develop, calibrate and type-approve requirements for light and heavy-duty powertrains. It will also be used to test range, power and durability of the company’s electric vehicles. With the addition of this new Advance Power Systems Engineering Tech Center, the company now has state-of-the-art R&D facilities and design centres in India, South Korea, Italy and the UK.
VDMA organises symposium on electric mobility in Pune

VDMA India recently organised a symposium ‘Electric mobility – Disrupting technology in the transportation industry’ in Pune, India. The event kicked off with a welcome note by Rajesh Nath, MD, VDMA India, where he cited, “The Government of India plans to make a major shift to electric vehicles (EVs) by 2030 with the help of FAME scheme. The scheme creates demand incentives for EVs and deployment for charging technologies and stations in urban centres which will result in an estimate selling of up to 474 million tons of oil equivalent and 846 million tons of net CO₂ emissions.” This was followed by the lamp lighting and release of the VDMA annual publication by the dignities on the dais. The event went on with an addressing note by the chief guest, Anand Deshpande, Sr Deputy Director & Head Automotive Electronic Department, ARAI. Explaining the global scenario and outlook on EVs, Deshpande opined, “In the western world, a lot of focus is on autonomous development, while in India, it’s on shared mobility basis.” He further added, “Various vehicle manufacturers have announced their plans for electrification. Also, the Government of India has undertaken many initiatives.” He also pointed some of challenges that are being faced in the development of EVs, like, powertrain development, chassis development, EV safety (in a tropical country like ours), EV component development, EV charging interoperability and so on.

Moving further, Christian Kunze, Deputy MD – E-Mobility Forum, VDMA Frankfurt, delivered a presentation on ‘FVA from gear research to holistic drivetrain technology – Precompetitive Research for Electromobility’, where he discussed the challenges and opportunities in drivetrain industry. Summarising the session, Kunze concluded, “Innovation will speed up further in the next years and we have to cope with that. Production technology will be one major enabler for future mobility. Plus, strong networks are more important than ever to innovate and keep up pace with the change.”

The symposium also had a few technical presentations, like, Vineet Martin, Managing Consultant, EAC India, presented on ‘Impending e-mobility penetration in India’; Anirban Mukherji, Head-Automotive, Schaeffler India, on ‘Innovation solutions meeting stringent CO₂ regulation accelerating the market’; Girish Kamala, Director, Infineon Technologies India, on ‘EV trends and semiconductor applications’; Debasis Nandi, President – South & South East Asia, Lenze, on ‘Innovation for e-bus’; Prasad Patil, Manager – Automotive & Robotics, Fronius India, on ‘Joining solutions for EV vehicles’; Markus Roever, E-Mobility Global Sales Head, Schuler Pressen GmbH, on ‘The future of prismatic battery case production’; Arvind Tekur, Director – Marketing & Product Management, Harting India, on ‘Electric mobility solutions’; Sachin Gambhire, Associate Director – Business Development & Marketing, Trumpf India, on ‘Laser application in e-mobility’.
EMAG (P)ECM TECHNOLOGY

AVIATION

BLISK
- Process/Machine Development
  » Material: Nickel-based alloys / Titanium

SINGLE FOIL
- Process/Machine Development
  » Material: Nickel-based alloys / Titanium / Titanium Aluminide

AUTOMOTIVE

TURBO CHARGER
- Fuel injector
- Turbine wheel
- Turbine casing
- Thrust bearing
- Valve disk, etc.

INJECTION SYSTEM
- Valve plate
- Pump casing & Injector
- Rail, etc.

DISC
- Process/Machine Development
  » Material: Nickel-based alloys

DIFFUSOR
- Process/Machine Development
  » Material: Nickel-based alloys

VALVE TRAIN
- Connecting rod
- Camshaft & Cam piece
- Cam
- Piston, etc.

TRANSMISSION
- Synchronizer body
- Synchronizer ring
- Drive shaft
- Parking lock, etc.
“Sustainability is no longer a mere choice”

...says Shankar Karnik, General Manager – Industrial Lubricants, ExxonMobil Lubricants. He throws light on the emerging growth trends that are expected to propel the demand for lubricants, the company’s commitment to minimising environmental impact and the significance of using the right type of lubricant. Excerpts...

As ExxonMobil recently launched Mobil DTE™ 20 Ultra series, can you please elaborate on the benefits of the product? Which key industries does it cater to?
The new Mobil DTE 20 Ultra Series is designed for all industries with hydraulic oil applications. The oil is designed to deliver up to two times longer oil life and an exceptional performance in the harshest of conditions, helping industries achieve unprecedented performance goals easily. The new series lowers maintenance frequency, minimising man-machine interaction. The oil also provides improved deposit control of 89.2% for longer oil life and precision operations.

What specific challenges faced by machine shops/manufacturing sector does Mobil DTE 20 Ultra address?
Hydraulic systems across industries need maintenance due to both, oil and machine factors. As the oil oxidises with time, deposits are formed, causing replacement of both, oil and filter. Moreover, often, even valves, pumps and other parts of a machinery wear with age, wherein the damaged components require replacement. This maintenance can be reduced and made effortless by using Mobil DTE 20 Ultra as it plays a major role in slowing down equipment ageing and decreasing maintenance efforts.

Which new trends and innovations will shape the future of the lubrication industry and propel its growth?
The emerging growth trends that are expected to propel the demand for lubricants, both globally and in India, are high demand from the automotive sector, where the increasing demand for lightweight passenger cars and heavy-duty commercial vehicles has fostered global automotive production, which in turn is conducive for the development of lubricants for multiple applications in this field. Also, the rapid industrialisation in countries like India, China, Brazil and Mexico has encouraged applications in industrial machinery maintenance, thus driving the lubrication sector.

Could you comment on the requirements and challenges related to the Indian manufacturing sector. How does your company’s lubricants meet these requirements?
Tool life and uptime are critical to the success of the Indian manufacturing industry. We invest heavily in research and development to help the sector overcome these challenges; Mobil lubricants are formulated with product compatibility in mind, since machine and machine tool lubricants often commingle. Besides, we also provide a range of technical services to help keep machine shops running at peak efficiency while also extending machine and oil life.

How important is the selection of the right lubricant for right applications? How does your company assist customers in choosing the right lubricant?
With usage of the lubricant closely linked to varying factors like environmental conditions, load & temperature, getting the usage right is imperative for manufacturers. Whenever a new machine or component is installed, one of the first things to be addressed is the type of lubricant to use. Base oil viscosity is one of the most important properties manufacturers consider when making a lubricant recommendation. It should take into account the speed, load and ambient temperatures. However, it’s important to keep in mind that the working environment of a component could be outside the manufacturer’s tested parameters.

Could you elaborate on the company’s efforts in the direction of developing sustainable and eco-friendly metalworking fluids?
Today, sustainability is no longer a mere choice, but is now embedded into the very core of every activity. Our innovative products and services help deliver tangible performance benefits in the areas of safety, environmental care and productivity. In terms of safety, innovations in product formulations and services deliver long lubricant life. Purely in environmental terms, our commitment to minimising an environmental impact has created technologically advanced products and services, which is achieved through optimised oil drain intervals. Many of our advanced-technology lubricants lower overall traction versus mineral oils, helping to reduce the amount of fuel or energy consumed. ☐
How do you enable a customer’s true digital transformation, through multi-cloud managed services, professional services and managed services?
The biggest challenge is that while people have accepted that digital is the way forward, there is still a significant lack of research and knowledge. We help organisations to bridge the gap between their IT operations and the business requirements. The first step is enabling a technical transformation, i.e., balancing computing infrastructure via the right mix of on-premises and cloud platforms. The second leg of the journey is to use these technologies such as cloud, IoT, managed services, mobile, social, data and analytics to drive speed to market. For this, we understand the customer requirements, technology vision and current IT infrastructure by using best industry practices. We become their trusted partner in the emerging technology space to gain real value from their digital initiatives. Whether it’s choosing between the public, private or hybrid cloud or outsourcing application development, we help them choose the right path for their future success.

With cloud comes the concept of managed services and remote infra managed services and other professional services. A lot of companies struggle to take that first step towards their cloud journey. So, we help them understand the need and benefits and the operational efficiencies that can be driven through it and aid them in creating a business case for their management. We help IT departments move from being a cost centre to a profit centre.

How does your start-up enable companies to face the challenges associated with digital transformation?
We go beyond simple IT assistance and infrastructure management with multi-cloud managed services, NOC services, professional services, cybersecurity and managed services to enable true digital transformation. Many new start-ups are mushrooming up and at the same time, many such are closing down because of the lack of funds of clear-cut, long-term strategy, systems and processes. We are very clear on our technology roadmap. We are also investing in creating the ‘centre of excellence’ around emerging technologies like security, cloud, analytics, NOC/SOC/NAC, AI/ML and blockchain. Besides, we have a 10-seater NOC based out of GGN and plan on setting up SOC and NAC in two quarters from now.

Your customers range from SMEs to large companies. Does each of them pose a special challenge?
The challenges are not primarily about the segments alone, but are also industry specific. Lots of mid and large segment customers come with legacy baggage and are averse to adopt changes because of obvious reasons and comfort within the current scenario. Whereas, we have seen small & medium-sized businesses and start-ups adapt to changes more willingly and much faster. They are probably also more willing to be flexible with IT resource needs and going OPEX, rather than blocking funds to set up on Prime Infrastructure.

What new technologies or trends do you expect for digitisation in your industry in 2020?
It’s important to understand the value of digital from the very beginning. We see multi-cloud, analytics, AI/ML, blockchain and cybersecurity solutions leading and taking the front seat. The future belongs to digital technologies, with cities going smart and IoT taking up – smart homes/classes/cities are all catching up rapidly. And all of this has allowed new entrants and like-minded people to come from an unexpected place.

Where do you see your company in the next five years?
We see ourselves as a true ‘brand agnostic’ trusted technology solution provider and advisor for the new-age world. We plan on continuing to build around competencies to scale up and be future-ready. ☐
Michael Dell, Founder, Dell Technologies, has been acclaimed as a visionary and an innovator, but he has also acquired praise for being a stable, rational leader. While everyone knows of his vast empire of business and computers, not many know that he founded the company with only $1000 of investment.

Born in Houston, Texas, Dell was enamoured of both, business and electronics; at age 15, he bought one of the first Apple computers and immediately disassembled it, to see if he could put it back together. As a student at the University of Texas at Austin, Dell started his computer business (originally called PCs Limited) in 1984 with $1,000 in start-up capital. Dell realised that no company had tried selling directly to customers. Going past the middleman, Dell started building and selling computers for people he knew at college. By the second half of his freshman year, he had sold $80,000 worth of computers. So, he dropped out of college to run his company full-time. PCs Limited became the Dell Computer Corporation and eventually Dell Inc.

From the steps the entreprenuer billionaire has taken, it is quite clear that he doesn’t mind making mistakes, which he advises other entreprenuers to follow. "Don’t be afraid to make a mistake,” he says, “If you want to really make it big, you better come up with something unique.”

Additionally, Dell is of the firm opinion that when someone is the leader of a company, one can’t do everything by himself. That is why, he always makes it a point to surround himself with the best talent that he can find – the more talented people one has to help him/her, the better off that person and the company will be, he believes.

In 2004, Dell stepped aside as CEO of the company, but remained chairman of the board. He also sat on the governing board of the Indian School of Business in Hyderabad. Plus, in 1999, Dell and his wife, Susan, formed the Michael & Susan Dell Foundation. Dell recently defined the vision for Dell Technologies for 2030; according to him, there is focus on enhancing sustainability, gender equality and one-for-one recycling.

Michael Dell has grown to be one of the most appealing leaders we know today. In an industry that changes swiftly, he has efficiently remained in charge as a prominent player, in the exhaustive sphere of IT.

Surrounding oneself with the best talent

Michael Dell
FOUNDER
DELL TECHNOLOGIES

"DON'T BE AFRAID TO MAKE A MISTAKE"

Michael & Susan Dell Foundation
"DON'T BE AFRAID TO MAKE A MISTAKE"

Don't be afraid to make a mistake, advises Michael Dell, the founder of Dell Technologies.

The company's leadership values and growth strategies are highlighted, showcasing Dell's resilience and strategic vision.

Featuring Juli Eklaahare, the writer, who adds context to the narrative.
THE WINDOW TO YOUR FUTURE

Jindal Aluminium Limited is India’s largest aluminium extrusion company with a legacy spanning 50 years. Known for our quality and ability to produce the widest profiles in the country, we are undoubtedly the first choice of Architects, Builders and Fabricators.

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With standards rapidly rising in virtually every industry, it is important to understand where great performance comes from. In order to get ahead of competition, it is essential to know how to refine skills in the best possible way. Also, our education system has taught us to give credence to intelligence, while the term can differ from person to person. At the same time, while many are certain that a high IQ score means guaranteed success, does it really account for great performance?

The Cover Story examines these angles, leading to discover what really separates world-class performers from everybody else. It also takes a deeper look at the significance of deliberate practice, its impact on lean implementation, why it’s important to begin the journey towards a goal early on, along with some noteworthy examples of peerless performers and what directed them to reach their matchless positions. A read-on…
What really distinguishes world-class performers from the rest? Stories like those of Toyota and Mysore Kirloskar tell us what really world-class excellence even during market recession is. Many believe that people’s talents are what turn them into world-class performers. In fact, talent has nothing to do with performance. The backbone to Toyota’s excellence is built not on individual talent or excellence, but on deliberate practice of everyone’s daily routines, learning and training. In fact, Toyota recruits ordinary people and turns them into world-class performers through training and challenging employees to grow.

What determines extraordinary achievement?

Most people spend the bulk of their waking time at work, performing without being world-class at it. So, if we devote most of our time to our jobs, why are most of us not amazing at what we do?

The reason is that extraordinary achievement is not determined by experience alone. Many people do not improve at their work even after many years of experience; in fact, some actually get worse with time. The graveyard of lean failures is littered with companies who have refused to engage in the right practice due to being stuck in old ways of thinking and habits. Great sportspersons to dancers do not start with any prequalification for success. The secret to their success lies in the discipline of their daily routine – their dedicated, deliberate, passionate, committed and persistent daily practice. And in their ability to change and move away from what does not lead to world-class performance.

Intelligence and performance

Who is an ‘intelligent’ person? There are different ways of being intelligent and the popular technique used for measuring general intelligence is the Intelligence Quotient (IQ) test. People generally believe that a high IQ score correlates with greater success in life. But the average performance of employees increases with the complexity of their jobs—when assigned more complex jobs, people upscale themselves to do better and become good at it through adaptation and practice. This has nothing to do with IQ scores or anybody’s judgement of an employee’s intelligence. For instance, sales heads believe that a more intelligent salesman will procure more orders. But when intelligence was measured against actual sales results, it was found that there was no correlation, thus making intelligence useless as a predictor of sales performance. Thus, world-class performance is independent of or has different components other than just intelligence.

Rigorous preparations

Dr Schuller writes, ‘great ideas come when God gives them to you’. Yet, researchers say that creative breakthroughs almost never appear out of nowhere; rather, they come most readily to those who already practise and exhibit mastery in their field.

Documented studies show that it takes about ten years of rigorous, dedicated, persistent and consistent practice to be able to produce anything noteworthy. Researchers find that this ten-year rule holds good for outstanding performance in many domains. Tiger Woods, recently during his preparation for the European Masters in Ireland, would wake up and go to practice in Florida at 0300 hours in the morning to set his body clock in tune with Ireland time. Strong intent is necessary to inculcate the habit of making what may seem dislikable change into core strength for excellence.

Most people spend the bulk of their waking time at work, performing without being world-class at it
Deliberate practice

We all know the saying 'practice makes perfect'. There is a powerful correlation between the time spent practicing and increased performance. Practice is the only differentiating factor between world-class and pathetic performance. When I tell people that in my early years of lean implementation, I spent 12-16 hours every day working on the Gemba (workplace) to embed lean thinking and practices, many look at me in disbelief. I had to practise lean implementation and ensure others practised it, too. I had virtually taken a sabbatical from my family for a cause that was important at that time. So, great success comes with great sacrifice as well.

'Deliberate practice' means identifying the essential ingredients for improvement in one's daily routine and then sharply focusing one's efforts on those areas, practicing those activities extensively and getting continuous feedback in order to improve.

This is best demonstrated by Toyota, where all the employees relentlessly follow the philosophy, principles, training, routines and behaviour as required by the Toyota Production System, resulting in Toyota becoming a world-class company. The company's talent is developed through deliberate practice in relentless pursuit of perfection.

Perceive, know and remember

Watching an extraordinary performer like an acrobat, magician or ballerina may lead to one getting the feeling that they are superhuman in order to be able to perform those feats. They are not, but the feeling is true. Or even chess masters beating computers may make one think that they are incredible geniuses. However, it’s all because of many years of deliberate practice and remembering moves. It is deliberate practice that exemplifies great performers and makes them different from others in many ways.

Deliberate practice helps to perceive more relevant information in any field of expertise and absorb & remember vast amount of knowledge. For example, developing expertise on Just-in-Time (JIT) techniques, practising Jidoka and remembering to recall the right problem-solving tool or technique to achieve the target condition. Continuous Improvement (CI) requires the habit of deliberate practice to keep improving continuously and not making CI a one-time goal, which many companies seem to have done. Deliberate practice, certainly, can bring about positive changes in the mind and body.

Begin early

One might wonder why the theory of relativity was not conceived by a college physics student. Or why people win recognition of their work with a Nobel Prize at a later age. That’s because it takes longer to master growing knowledge and reach a point where discoveries can be made.

When we talk about 'great achievements' in the realm of physics, we usually mean new discoveries. To be able to make new discoveries, one first needs to have an understanding of all the existing laws and theories (akin to philosophy and the principles of lean thinking and lean manufacturing). In other words, one needs a lot of knowledge. Similarly, leadership can succeed with lean transformation once one has acquired sound knowledge and understanding of the concepts of lean manufacturing and developed belief; not just through power points or
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reading books, but by practising the routines. Only then will one be able to produce groundbreaking achievements. Companies that delay in making the decision to embark on their lean journey carry more fatigue in the form of archaic thinking, wastes, ancient business processes, ways of doing things and reluctance to unlearn and change.

**Look for motivation**

Developing a habit of deliberate practice to become a world-class performer might appear like a demanding task, so some motivation will help. Motivation can come from a goal, a vision, enthusiasm from seniors and peers or can be purely necessity-driven. The cause or purpose must be rewarding in its results. Receiving support and coaching from the senior management can motivate one to practise more and accelerate the process. People at Bridgeport Indonesia and at Mysore Kirloskar were motivated when they saw my work ethic in my daily deliberate practice of lean thinking and routines, and were motivated to multiply my efforts (like monkey see, monkey do), that resulted in producing a world-class excellent result, many of which stand unsurpassed.

**Motivation for kick-starting the journey of lean manufacturing**

A majority of the organisations that embark on the lean journey are usually those in existence rather than new ones. Since we cannot travel back in time to reap the benefits of an early start, we can only apply the principles of deliberate practice to help us reach our lean goals.

Since achieving exceptional performance is demanding, one must know precisely what his/her goals are and be committed to reaching them even when the circumstances are not ideal. Stories of great successes tell us that the practice was always relentless. One will need rock solid determination in order to put in the amount of practice necessary to become great. This determination can come only from knowing what one wants; simply ‘liking’ something will not drive one to put in the practice necessary to become a world-class player.

Achieving great performance requires one to identify the specific critical skills needed in order to improve and then practise them and working over and over on those specific aspects that need improvement, instead of making only a few general drills on what one wants to become better at.

With the proper motivation, anyone who uses deliberate practice to improve will succeed in any field, including lean manufacturing. If one wants to become successful with implementation of the lean manufacturing system, then one must remember to focus on ‘how’ he/she practises daily routines. In order to make the biggest improvements, one needs to design a method of deliberate practice that focuses on those areas critical to one’s field and that offers immediate feedback.
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Many people have predicted about the economic revival. How optimistic are you in terms of the economy bouncing back on track? Can you put a timeline?

The economy will need some time to consolidate and recover from its current subdued phase. Typically, it takes two to three quarters for a correction in an economic downturn, as prices moderate and inventories come down. So, I would expect the second half of FY20 to be better than the first half and the next financial year to be better than the current one. One can expect a slow but steady recovery over the next few quarters.

Do you think the series of measures announced recently by the Finance Minister will be a game changing move for the manufacturing sector? How effective would the measures be in the short-term and long-term?

Responding to headwinds, the government has recently announced a slew of measures to provide a much-needed boost to the economy. The announcements included a range of measures, such as, reduction in the corporate tax rate, provision of additional depreciation to automotive industry, upfront release of ₹700 bn for bank recapitalisation, addressing the problem of delayed payments, taking steps to help MSMEs and moving towards non-human interface between the tax authorities and tax payers among others.

The interventions have been well designed, and the announcements can be expected to be effective in addressing the key industry concerns. With the RBI also acting in concert, interest rates have been reduced substantially, which can also drive business sentiment. However, these measures will take time to have an impact and one should not expect any reversal in the business cycle in the short-term.

As the President of CII, can you suggest further steps that the government and the industry should take to attain a double-digit growth?

First of all, we should not be targeting a double-digit growth in the current global scenario where all economies are slowing down. The government has set a sensible target of achieving USD 5 trillion economy by 2025, which itself is a tough target, but achievable. This should be our goal.

An immediate step for both the government and the industry should be to step up investments which can drive growth in the medium term. Public investment can be increased by fast tracking infrastructure projects, such as, roads, railway, airports, waterways, etc. to the extent fiscal space allows. Outstanding payments to the private sector need to be cleared so that they are not cash strapped. Foreign investment should be facilitated with land allotments and fiscal incentives. This is an opportune time to attract FDI that is seeking locations outside China. The Government of India should work with state governments to handhold investors to get them suitable locations in India and help them with all clearances.

Ensuring liquidity and credit availability in the economy is another priority, as any problem in the financial sector will transmit itself into the real economy. Banks and NBFCs need to be well capitalised and have reasonably clean balance sheets. Some attention is required to ensure the stability of the financial sector.

What, according to you, is the competitive strength of the Indian manufacturing industry, today? Do you think the industry is leveraging enough on this to strengthen its global footprint?

Indian manufacturing is competitive within the factory premises. However, external factors, such as, power, logistics...
Vikram Kirloskar has a Bachelor of Science (SB) degree in Mechanical Engineering, from MIT USA. He is responsible for partnering with the Toyota group and starting a major automobile manufacturing industry in Karnataka. For this he has been recognised by the Government and presented with the ‘Suvarna Karnataka’ award. He is currently the President of CII and also Past President of ACMA and SIAM. He is also involved in many activities at MIT and serves on the Visiting Humanities Committee and Educational Council.

and taxation tend to drive up the cost of doing business. The government is working on these issues and we are confident that suitable solutions will be found. Meanwhile, the industry needs to step up its spending on R&D to move ahead and increase its global presence.

Can you share your views with us on the government’s target of 30% electric vehicles by 2030? How ready are the OEMs and auto-component players for this?

We appreciate the government’s initiative to promote clean and green environment with special benefits to encourage electric vehicles. EVs do bring the benefit towards fossil fuel conservation and lowering of carbon emissions. Efficient use of fuel is critical in reducing carbon emissions and tackling global warming.

The industry is moving towards an era with more alternate, cleaner and efficient powertrains, where all electrified vehicle technologies [xEVs] will remain relevant. We believe that a technology agnostic approach will effectively support a smooth mobility technology shift. Today, our country is still at the nascent stage of EV technology, with the key concern being the lack of necessary infrastructure, including battery makers. EVs need a nationwide network of charging stations and this can be achieved by a collaborative effort from the government as well as private players. India also needs to adopt designs and technologies to develop electric cars, whilst manufacturing newer and more efficient batteries.

We also foresee xEVs [HEVs, PHEVs, BEVs and FCEVs] will coexist, based on customer requirement and usage. Ultimately, customer/market will decide which technology is suitable rather than fixing target for electrification. Toyota has always been in the forefront, working on ever better mobility solutions. Being a pioneer in electrification technologies enables them to develop and introduce various types of electrified vehicles such as HEVs, PHEVs, BEVs and FCEVs based on each market’s local requirements, regulations, road conditions and infrastructure, thereby reducing carbon footprint and conserving the environment.

Would you like to highlight any learnings from Toyota for the Indian manufacturing industry? Tell us about Toyota Production System.

In terms of learning, we truly believe in playing a much greater role than just manufacturing world class cars. Consumers today are knowledgeable about the safer and greener technologies with ever-increasing expectations on enhanced safety features, fuel efficiency, comfort as well as luxury. Catering to these ever-changing needs, we always strive to adopt newer technologies, offer sustainable options and lower costs to drive a transformational change to meet the customer expectations as well as protect our environment.

The Toyota Production System is an important tool which has been adopted to ensure flexible production which takes into account the market requirement and consumer sentiments in terms of volume and preferences. We always work towards maintaining lean inventory throughout the manufacturing system, including dealers and suppliers. Based on a ‘pull system’, it helps us regulate how much is required by when and how, thereby regulating production basis the market demand, i.e. customer drives sales and sales in turn, drives production. Our demand and supply operations aim at delivering the right car to the right customer at the right time and right place with highest quality.

How much is the current percentage of localisation for TKM? Any plans to increase it in the future?

As a manufacturing company, we are constantly trying to increase our localisation levels which range from 60-85%, depending on the model. In our journey of two decades, we have constantly been focusing on increasing the number of supply base through localisation of parts & components, thereby providing an opportunity for local suppliers to be transformed into world class manufacturing, with a strong focus on quality and cost, at par with the global standards.
Tell us your plans for ACMA to focus exclusively on EVs & future mobility. How will you help ACMA drive change through the entire auto component manufacturing chain and help its members stay relevant to their customers?

We changed the whole structure of ACMA two years ago into four pillars, one of which is the business development pillar, within which we have got a much focused team that talks about EVs and sustainable mobility. We intend to first make the whole industry aware about what are the opportunities in the future of mobility. What’s more, we ensure that the ACMA members get an opportunity to facilitate with strategic partnerships globally through the strategic alliance pillar. Our key focus is to ensure that we can get sustainable and localised manufacturing in India – one of the most relevant needs of OEMs today.

What do you mean when you say that the Indian automotive industry needs a ‘technologically agnostic approach’?

As ACMA, we say very clearly that we will follow our customers. We are completely supporting the national agenda of the government of basically clean and sustainable mobility, so that the pollution levels in the country come down and the oil dependency is reduced. But our only request to the government and the OEMs is that we must follow a technologically agnostic approach. The component industry is willing to invest not just in one technology but in all relevant technologies, depending on what sectors it comes through. So, that’s what I meant by a technologically agnostic approach. The end consumer will decide which technology is relevant. The government’s job is to make policies and give an overall umbrella on national sustainable mobility solutions, which are in the national interest, that ACMA and any organisation fully supports.

What are your top priorities as the ACMA President right now and what is your strategy to fulfill them?

When I took over as ACMA’s President, we saw to it that we direct our efforts towards becoming more responsible and responsive, while being more inclusive, communicative and engaged with all stakeholders – our members, customers, media partners and foreign partners – as an ecosystem. My priority is very simple – in the long-term, we would like to have more weightage and recognition by all stakeholders because we are such an important link in the economy. We need to be a little more proactive and, of course, engage with...
the government from their mandate and agenda of clean and sustainable mobility.

With the industry currently seeing a drastic downturn, when do you see the revival happening? What would be your advice to the industry players to survive in the current period and be ready when the demand resumes?

“When do we see the revival happening?” is a tricky question, really. I can only say that we have now almost completed a year of slowdown. The slowdown started happening in October last year. However, I think the revival will take some time and won’t happen easily. This is not the first downturn the country is facing and will not be the last downturn either. The good part is that we have had the maturity as an industry to be a little bit resilient to these downturns. We need to focus on three very basic things in a downturn – quality, technology and people.

When BSVI comes into effect post April 2020, what is the fuel strategy that companies should adopt? Will there be a price increase then?

We will definitely see a shift in pattern from diesel and gasoline – OEMs have already declared that. The price escalation will be too much and would probably not be actually viable for the OEMs to continue with a diesel engine of low capacity. There is also the issue of alternate fuels – the Government of India is very clear about CNG. So, we need to wait & watch and see how customers are adopting this. From a component standpoint, considering the ACMA perspective, all efforts will be put into localising technologies and ensuring the ‘Make in India’ continuum continues.

What is the current global exposure of the Indian auto components industry? What are the projections for the next five years?

When we say global exposure, we actually export about $15 billion. We are actually a net importer – $17 billion is imports. We have primarily been a net importer but the deficit has increased over the last two years, mainly because of the shift of electronics. As for the next five years, there should be a positive growth, for sure.

What is your vision for the auto component industry? Do you have any targets in mind?

The vision is to remain relevant and to ensure that our customers’ needs are met by being more competitive, technology-oriented and being very globally quality conscious. Plus, also as a national agenda, we will put in all our efforts to take the ‘Make in India’ initiative forward, do localisation and hopefully, become a global net exporter in the future rather than a net importer.

Where do summits like the ACMA Technology Summit & Awards lead and how do they help?

The awards at the summit motivate people in the challenging industry. Besides, the summit imparts knowledge on technology and makes the industry aware. Largely, our members are MSMEs and may not have the bandwidth to invest in relevant technologies to be future-ready by themselves. So ACMA, as an association, pools in and offers these resources to all the members at large.

Deepak Jain is the Chairman & Managing Director at Lumax Industries. He is also currently the President of Automotive Component Manufacturers Association of India (ACMA), Vice President of Toyota Kirloskar Supplier Association (TKSA), Executive Committee Member of Maruti Suzuki Supplier Welfare Association (MSSWA) and Tata Motors Supplier Council. He has also held the positions of President, Supplier Club, Honda Cars India (2010-11) and Sr Vice Chairman, Society of Automotive Engineers (SAE) – NIS (2012-2014).
CII recently hosted the Smart Manufacturing Conclave in Pune, India, under the theme ‘Digital by default’. The event witnessed the presence of prominent industrialists from across the country who came together to delve on the topic of digitalisation and its impact. Inspired from it, EM magazine reached out to the speakers of the event to get their concise opinion on the topic of digitalisation, its impact on the industry, on customer experience and the future that one should work towards. Here is what they have to say…

“Data is everywhere and it’s converging to give us actionable insights”

Digital transformation can be defined as the accelerator of business activities, processes, competencies and models to fully leverage the changes and opportunities of digital technologies and their impact in a strategic way. Organisations now, are making enormous strides and realising the benefits of new digital business models and processes. We see examples of this everywhere — in how people shop, work, learn, communicate and even how they elect leaders. Companies that do not embrace digital transformation will find it difficult to remain competitive.

Our company is also embracing digital transformation and bringing that to our customers. Our digital solutions portfolio is growing with offerings that will change the way building owners, managers and occupants interact with their built environments. A great example is the new Bee’Ah headquarters in Sharjah, United Arab Emirates. It will be one of the first buildings in the world to have full integration with AI to support new seamless experiences for optimisation of efficiencies, performance and functionality.

Broad trends including urbanisation and increasing urgency for sustainable development will continue to shape customer demands. Energy conservation is one key driver, both from the sustainability angle as well as cost savings. Also, there has been an increased expectation for more personalised services and products. This means that there are more opportunities for companies
to appeal to their customers by understanding their unique needs. Digital transformation is revolutionising the way we use data to create, design and manage everything around us. Now, it’s time to think about places and spaces differently, because data is everywhere and it’s converging to give us actionable insights, enhanced productivity and increased efficiency. It is about changing the way a business interacts with its customers and how they provide their customers with a consistent experience whenever and wherever they need it. Digital transformation is forcing companies to change their business models and adapt to the new market.

Delivering a great customer experience has become a top strategic objective to win new businesses and perhaps, more importantly, to retain customers. Hence, design thinking, understanding the different customer personas and mapping the customer journey are all important capabilities that companies need to have. Of course, establishing channels for customer feedback and systematic review and incorporation of the feedback as well as learning from best practices will always be critical.

“Digital transformation is a journey and not just a one-time setup”

New age technologies like IIoT, robotics, etc are the game changers for manufacturing organisations and are being considered as the latest industrial revolution. For any business, there are few vital parameters viz organisation growth (both top line and bottom line), taking competitive advantage, innovation and creating value to customers and all other stakeholders. To accomplish these, it is pivotal to have a close connect and visibility of each aspect of the business. In manufacturing organisations, keeping the shop-floor agile and highly productive with quality output is essential to support accomplishments of key business parameters. These technologies enable predictive capabilities which are extremely helpful for maintenance, forecasting, pre-failure predictions, taking proactive measures, etc. This helps save a lot of manual efforts, and data collected directly from machines using sensors, PLCs, etc are more accurate and in a structured manner, which gives more meaningful actionable insights to managers in the quickest way without human intervention.

Technological advancements in new machines used in manufacturing lines, extended capabilities, cloud (private, public or hybrid), continuously enhanced partner echo system for enablement, etc have accelerated the value of IIoT, which ultimately supports smart factories. However, manufacturers are facing challenges for aligning old and new machines, old and new (millennial) workforce alignment, skill enhancement of workforce, driving change management and investments to convert traditional factories to smart factories. I think the government also faces similar challenges in their areas of operations along with voluminous and widespread coverage.

Organisations can adopt certain methodology towards digital transformation because digital transformation is a journey and not just a one-time setup. A suggestive approach can be – identifying the digital Cross Functional Team (CFT), including representation from top management, production, maintenance, manufacturing engineering and IT people; identifying the digital strategy and defining the road map to digitalisation; starting with small area/line by identifying the right combination of tools/hardware and software with scalability; doing retro fitment for data acquisition using sensors in old machines; equipping with new machines which are IIoT enabled; implementing, analysing and establishing digital setup and doing an actual cost benefit analysis and extending it further for multiple lines or manufacturing sites and adopting continuous improvement/enhancement models to take it to an advanced level or for a wide coverage.
“ML aids manufacturing by augmenting human capability and intellect”

We are amidst a massive change in the way we deal with various goods, services and applications in our lives. We unconsciously expect a level of intelligent responses, to the extent that we are impatient if we don’t receive them. For instance, we don’t like it if our shopping apps make unintuitive recommendations. This change in consciousness of customers makes it imperative for manufacturers to build a layer of intelligent interaction in their offerings. Telematics enabled service in automotive is a great example of this. This intuitive service model makes service prescient and rapid by predicting failures, identifying service locations real-time and ensuring availability of parts. Customers feel involved and cared about and therefore, bond emotionally with the company.

Robotics and Machine Learning (ML) are revolutionising manufacturing by taking efficiencies to a new level. ML works in two ways – the first one is by replicating human intelligence. Together with robotics, this has made manufacturing more repeatable and has improved quality. The second way ML aids manufacturing is by augmenting human capability & intellect. Organisations transforming in order to become data-driven in their decision making should focus on both, ‘data offence’ and ‘data defence’. Data offence activities focus on making organisations’ data complete, usable and useful in driving decisions. Enterprise data can be looked at from a handful of critical themes; for example, a product journey from the supplier to production to customers. Organisations can focus on completing data collection for a theme by connecting disparate systems like MES/ERP systems and investing in data collection mechanisms like IoT devices and sensors to bridge gaps. Data Lakes are a great way to make data usable and accessible to analysis.

However, these data collection focused tasks are easier pieces of the ‘data defence’ puzzle – the harder part is ensuring that data is driving business outcomes. Setting up an outcome focused data science and data engineering team and supporting their efforts with executive sponsorship are critical. Data offence activities focus on minimising enterprise risk arising from the widespread use of data. Data governance frameworks and their implementation through information security tools spread awareness of the responsibilities and risks of data stewardship within an organisation.

“Smart digital technologies will enable organisations to grow”

Propelled by the digital wave and IIoT, there has been a paradigm shift in the way organisations design their business models to fulfil the changing needs of customers. Digital transformation is not only about choosing a smarter solution for businesses, but also about providing value added products and services, which is determined to fulfil the ever-evolving customer requirements. Companies need to ensure that the business delivers enhanced value and helps achieve sustainable competitive advantages, with a focus on customer experience. This will enable organisations to capture customers’ virtual mind space by being prognostic, which is a key driver in re-shaping business models in order to adapt to the volatile and uncertain environment that we are in.

Customer-centric vision, with a digital focus, is the cornerstone for any organisation to establish sustainable competitive advantages. We need to create an integrated strategy with a focused digital strategy based on capturing all stakeholder needs and expectations, especially to understand how customer expectations have evolved in the environment of digital transformation. Comprehensive and digitally strategic objectives, that are communicated with effective strategy deployment plans and monitor value-added goals, spur innovations, creativity and measures digital strategies, which would transform the future of businesses. ‘Smart’ digital technologies will not only bring in product innovation and major changes in the way we design our processes, but at the same time create a new market space & enable organisations to grow in their core business.
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“Factories of the future will need to manage complexity explosion”

Are organisations preparing for the upcoming big change? My response, averaged over feedback from many CEOs, is a blunt no. Most continue to wait in the shadows, and some have their heads buried deep down. I wonder when they lift their heads, much later, will they still have the time to react and attempt an over-night change to sustain organisational growth? In contrast, there exist companies who are dabbling with new technologies to reap the benefits they offer.

Remote equipment monitoring and off-line access, along with remote repair, is a technological change, that is being honed to perfection in few plants. High-level skills can, thus, be located centrally, in lesser numbers and be able to support multiple maintenance sites. Add to this in one’s trial AI and data analytics and one can reach a state where an equipment may never reach a break-down point. Much ahead of final failure, a predictive, sensor data tracking-based system will caution the plant manager. This model would also permit lower level skills to be placed inside each plant. Next, Machine Learning (ML) or data-analysis based maintenance takes a critical part in the upcoming phase. At yet another auto car plant in Europe, trials are being taken for easing the life of assembly operators by speeding up execution. Typically, line operators receive a printed sheet, telling them which specific parts need pickup from line-side and get assembled onto the next-in-line approaching car body. Holographic objects are used in this trial and thus, an operator wearing a band on his head can see a mid-air screen projection in place of a printed sheet or a PC screen and interact with this digital data. Factories of the future will need to manage complexity explosion at reduced cost but deliver at lightning speed. These holographic projections, right at the operator’s work-station, would help towards this goal.

Sudhir Gurtoo,
MD & CEO,
Leadec India

“Digital transformation is all about doing things in a different way from the past”

Emerging technologies such as IoT, robotics, ML/AI and data analytics are currently experiencing a profound impact on the manufacturing industry. However, the impact may vary from sector to sector as well as from geography to geography.

The transformation of factories or manufacturing organisations lies in the right planning. Change in management processes for a digital organisation meaning, the top management buying into the digital transformation journey in a planned manner is essential. Unfortunately, limited top management executives, as of today, have the right knowledge & courage to learn or access to the right intellect to plan and execute transformation initiatives. It is a must for the survival of a manufacturing enterprise, when & how are the questions to be answered by the respective management. To address this, the first thing would be to create/empower the current digital transformation program, led by a capable individual. The transformation is generally a multi-year program and, therefore, organisations need to define a vision – a target state for each functional area where the organisation plans to be in a three to four year time frame.

The next phase would be to understand the current gaps in each area and look at what different technologies can bridge the gap to reach the desired stage and finally evolve the ‘target state architecture’. Once the ‘target state architecture’ is defined – it’s time to define the prioritisation matrix of what project to execute with respect to the timeline perspective. It is essential to exercise it too – low hanging fruits may result in immediate cost reduction/benefits and this capital saving, in turn, can be brought back to the digital transformation initiatives. It is also important to note that the organisation may not have all the talent to implement such initiatives – they need to either reskill their current manpower or identify a reliable partner. A good mix of the two will be more advisable though. In the end, digital transformation is all about doing things in a different way from the past i.e. a cultural change in organisations. It would be important that organisations have the right leaders in place, starting from the top management to transform themselves digitally and become future ready.

Narendra Saini,
Head – Product Management,
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The medical manufacturing industry is one of the most complex industries requiring absolute meticulousness. The following article explores how the CAD/CAM solution by Mastercam has enabled various companies to meet the difficult demands of the industry whilst simultaneously adding great value to medical machining.

Medical manufacturing is one of the more demanding disciplines, and manufacturers in the medical industry require quality and precision at the highest level. From research to development, and prototyping companies to medical suppliers and contractors, manufacturers expect accuracy and repeatability on finished parts, with unrivalled material removal processes on even the most delicate or intricate medical parts.

CAD/CAM solutions, therefore, need to meet the rigorous demands of the industry in this field, including:

- Ability to import, create or cut virtually any CAD model
- Offer a wide range of CAM tools for solving complex machining issues
- Adjust feeds, speeds, entry points and dwell for faster cutting with less tool wear
- High-precision toolpaths for cutting extremely small parts
- Streamlined 5-axis cutting, trimming and drilling with strategies to help eliminate burrs on critical medical parts
- Simulation & verification, in-spec material removal and to detect interferences
- Checking machining program against the CAD model for accuracy and quality assurance

Software or a CNC machine that is ideal for manufacturing medical components is the only one ingredient to achieve success. Collectively, software, machine, tooling and material suppliers need to work cohesively in order to help companies make quality components, efficiently as well as quickly.

The essential link in manufacturing

One such company that balances quality, costs and time effectively, is Greensboro, NC-based — Progressive Tool & Manufacturing, USA. The company has been making custom tooling & gauges for the medical industry, defence contractors & aerospace companies that conduct prototype testing, since 1984.
“All of our shop employees are skilled toolmakers,” Richard Dick Thompson, Founder, Progressive Tool said. “Even if they’re apprentices, they’re toolmaker apprentices. Everyone can do everything – from setting up the material and squaring up the parts to running the CNC machines to making the programs to doing their own set-ups and making their own fixtures.”

The company has 4-axis CNC milling machines, multi-axis CNC lathes, CNC sinker and wire EDM machines, run by Mastercam, allowing them to generate machine tool programs that can achieve extremely tight tolerances. Calling it ‘an essential link,’ Thompson noted that his company’s toolmakers don’t do any programming at the machine tool. “We do everything through the software.”

For most jobs, Progressive Tool starts with a solid model given to them by the customer or they design something in-house. “We prefer to have solid models,” Thompson says & adds, “because, then, everything is there.” They take the files into Mastercam, create toolpaths and use the original design geometry from the model to run the toolpaths. “Basically, everything we do is custom,” he says & goes on, “I’m writing 10 to 20 different programs a day in Mastercam & running them one or two times.”

The company had been using Mastercam software for nearly 20 years. When it purchased new equipment – the CNC lathe with a sub spindle, C and Y-axis and live tooling – they upgraded to Mastercam’s latest version. The new equipment and software’s one feature that wowed everyone was the dynamic milling (or Dynamic Motion technology) which uses proprietary algorithms programmed into the software to automatically detect changes in the material as the tool cuts through. The tool remains constantly engaged with the material, minimising air cuts and allowing the machines to be pushed to their full capacity.

“It’s not for every part,” asserts Ryan Thompson, Thompson’s son and the company’s design engineer. “But with the right application, it works amazingly well.” Run times, too, have been reduced dramatically. “For example, one part we made in 304 stainless that used to take about an hour to rough and finish, now takes about 18 minutes – easily three or four times faster than the way we used to do things using multiple tools,” Ryan adds.

Progressive Tool’s ability to make parts with extremely tight tolerances have kept one customer in particular – a contract manufacturer of over-the-counter nutritional and pharmaceutical soft-gel products – coming back for over a decade to help design and make parts for their metering pumps and other production equipment. "The dosage that fills each gel cap has got to be precise," mentions Ryan and continues, “Obviously, the system for metering the amount of formulation demands the same level of precision. The custom-designed machinery must always be operating accurately and reliably, pumping the medicine at very specific rates.” Today, the company maintains a reputation for having the highest quality shops in the area for custom parts.

Greater engagements in manufacturing

Similarly, NOVO Engineering in Vista, California, provides the engineering behind a variety of medical devices, life science automation, digital imaging equipment and commercial products from clients such as Medtronic, Synthetic Genomics, Hewlett-Packard and TaylorMade. Its start-to-finish contract design service offerings include concept development, engineering, prototyping, fabrication, testing and transition to manufacturing.

NOVO has 26,000 square feet of space in San Diego and 12,000 square feet in Minnesota devoted to design offices, testing labs and a well-equipped prototype shop offering CNC turning and milling, FDM and PolyJet 3D printing technologies and various other processes, including surface grinding and welding. Machinist, Leo Castellon explains that each machinist in the shop notes the required tolerances and geometries, designs any workpiece fixtures, sets up the CNC machines, machines the part, inspects it and then releases it for assembly and testing. Each industry sector that NOVO is engaged in generates different challenges. Drug delivery systems, such as wearable injectors, routinely use tiny components; scientific instruments require
high precision or unusual materials, and optical devices rely on tight assembly tolerances. Parts are designed in CAD and then seamlessly transferred to Mastercam. Design changes are simple to make and don’t trigger extensive reprogramming. “We do a lot of iterations of our parts, so if we make a change in CAD, we can quickly pick it up in Mastercam and regenerate the model to create the new geometry. Mastercam will pick up the right code,” says Castellon. An example of this streamlined approach was a prototype part for a beam splitter. The material was a soft plastic that would be exposed to direct light, and a smooth surface was required to avoid image distortion. Through systematic trial and error, the engineers and machinists came up with a prototype that had a surface smooth enough to meet the optical requirement, yet strong enough to withstand the impact of a drop onto concrete.

The team went through six iterations of that design, and while it sounds time-consuming, Dr Rajan Ramaswamy, President and Chief Technology Officer, NOVO, was quick to point out how Mastercam supports rapid iteration. “Regardless of the improvements made in computer simulation tools, prototype and test iterations remain an essential part of the development process for the types of products that NOVO develops,” he said. This is especially important when developing medical products that require extensive FDA testing, often necessitating the fabrication of dozens of prototypes to support all the required verification and validation tests.

Many of the parts NOVO works on require tight tolerances, usually within 0.002”, on small features. For example, drilling 0.008” diameter holes through stainless steel or plastics. “With medical devices, one is working with parts where the hole diameter is frequently well below 0.040”. Orders for some of the parts have us going through 0.120” of material with an 0.008” diameter hole,” said Ramaswamy.

Mastercam Dynamic toolpaths efficiently remove a large volume of material in a timely fashion. This is the result of proprietary algorithms programmed into the software that intelligently detect changes in the geometry, allowing the tool to have greater engagement with the material, resulting in higher material removal rates.

The machinists also find Mastercam’s twelve plus surfacing toolpaths particularly useful because on complex parts, any one toolpath often can’t perform all the functions needed. For parts below 0.020” thickness, the team does not use Dynamic toolpaths. “This is because the controller can’t keep up with the processing speeds and that’s a limitation with our CNC machine – it can’t process enough blocks per second to do it efficiently,” explains Castellon and goes on, “The machine has to catch up. So, when I use the Dynamic toolpath at the smallest, I am using maybe a 0.0625” diameter end mill. Anything less and there are problems with not being able to process the code fast enough to keep up.” Instead, Castellon uses 3D legacy toolpaths for the smaller parts. When machining plastic, the Dynamic toolpaths often take the machining time down from 10 minutes to 30 seconds.

The machinists use the tool library to create their own tools. For one project, they needed a 4-inch diameter end mill and created it easily in the tool library, imported the tool to ensure that all clearances were right and found that it worked well in that application. Although the company rarely does repeat jobs, if an application is akin to something they have done before, they locate a similar tool in the library, regenerate the geometry and Mastercam will pick it up.

Castellon has found the Mastercam Forum to be invaluable when seeking advice on how to work with unconventional specifications. Even when the most unusual of parts come through, he can find advice from the Mastercam user community.

Adding value to manufacturing

It is without a doubt, that advanced CAD/CAM systems continue to add great value to medical machining, and collaboration between machine tool, software and tooling suppliers provide the added knowledge base for medical manufacturers to go the distance. ☐
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Grinding special gearings: Shifting the boundaries of what’s possible

The steadily increasing requirement for transmissions and other drive components are not just simply posing tremendous challenges for the design engineers who develop them, but are also confronting manufacturing departments with a continuous stream of new tasks. The case study elaborates on how Zörkler procured a new multi-functioning machine, and how it has helped in achieving convenient, precise machining of complex special gearings.

Zörkler’s product range offers several complex special applications for the aviation, railway, automotive and industrial sectors – a spectrum requiring a production line that delivers flexibility and high precision in equal measures. To meet these requirements, Zörkler acquired a new multi-functional machine for small and medium-sized workpieces. What makes this machine so special is its control software that can be adapted specifically for each machining task. It is suitable not just for standard tasks, but also for a variety of special tasks, making it extremely economical. Moritz Wurm, Head of Gear Grinding at Zörkler, mentions, “We rely on the Höfler brand’s many years of experience and development. Its list of options covers just about everything that can be manufactured using the profile grinding method — starting with countless variants of involute and non-involute cylindrical gearings to cylindrical worms, clutch gearings and splines to side faces and circular faces.” Support from the control software makes the difference.

In most production plants, grinding of commonplace Hirth
gearings is done on a CNC machine suitable for this purpose, but generally without specific software support. The time required for manual DIN programming and the ‘finesse’ needed for the setup are always an obstacle to achieve shorter machining times and higher quality. Also, when users create machining programs entirely on their own, they are unable to benefit from the advances made by the machine tool manufacturers. Besides, dependency on specialist knowledge, typically of a single employee, is a significant risk in terms of staffing.

What a modern machine tool has to offer for convenient, precise machining of complex special gearings, in contrast, is demonstrated by a uniform, intuitive operating concept harmoniously combined with application-specific adaptations for data input, operator guidance and machining sequences. This feature played a key role in Zorkler’s purchasing decision of the new RAPID 800 K. For years in fact, all (further) developments of Klingelnberg’s GearPro software has centred on this user-friendly interface and an intuitive operating concept. GearPro is also used in the RAPID 800 K cylindrical gear grinding machine, which combines the familiar user interface for standard gearings with a range of functionalities that have grown over the years — from visualised, three-dimensional gearing and machine models, to calculating and generating appropriate tool profiles, to determining the precise position of surfaces to the ground as well as sophisticated grinding and dressing strategies. For Hirth gearings, due to their sometimes-large number of teeth & optimised indexing methods, such as the sector indexing method established in gear cutting, are indispensable to achieve high-quality indexing.

Special gearings with free profile option

An additional application field is opened by the ‘free profile’ option, which enables the transverse profile of cylindrical gearings to be defined by any number of straight line and circular arc sections. Here, the usually data-intensive representation of the profile can be generated externally and then imported, or can be calculated from just a few input values if a parameterised description is provided.

Cycloid speed reducers

The cycloid speed reducers, frequently used in robotics, are one of the most important applications of such special gearings. This is a special type of cycloidal drive, in which one or more cam disks with a cycloidal outer contour roll over cylindrical pins. The cams are supported with appropriately shaped concave slots of a surrounding ring housing. On the housing side, the profiles to be ground consist of simple circular arc sections and can therefore, be described in the definition table with just a few parameters specifying their position and radius. The cycloidal profiles of the cam disks, by contrast, follow a more complex mathematical relationship; however, they can also be described within a few parameters. With the help of wizard functions programmed for this purpose, this makes it possible, to present the inherent complexity and associated design know-how only to the extent necessary to machine the workpiece.

When programming machining cycles, a range of variants are available for centring, grinding, measuring and correcting. Among these is a data interface for the Klingelnberg P-series measuring machines, which spares users the need to generate appropriate measured data – a process that is time consuming and prone to errors.

The free programming variant

Free programming is the ultimate, in terms of integrating application-specific machining sequences into the user-friendliness of the GearPro interface. With these, customers can themselves program and manage any machining sequences and combine them with functions provided by the machine manufacturer.

Even reusable subfunctions and diameter-dependent tool paths can be simulated using this flexible concept. In this way, the design know-how remains entirely in the customer’s hands, whereas the control software continues to handle the management, operator guidance and provision of basic machine functions, as well as control of individual sequences such as dressing.
Latest applications

The most recent applications of the GearPro operating variants include grinding of clutch gearings with typical, extremely pronounced crown teeth, as well as grinding of freely defined profiles on circular faces.

Asymmetric profiles a challenge

Particular challenges always arise in addition when the profiles to be generated are asymmetric. For involute gearings too, this property is increasingly used wherever significant outputs are transmitted via a transmission operated preferably or exclusively in one direction only. The advantage of the quite often significantly different pressure angles of the left and right tooth flank in these gearings is that a greater load-bearing capacity is achieved on the load-bearing flank, and the tooth root strength is improved considerably due to the larger possible radii of the root rounding.

Because of two tooth flanks with differing slopes, the removal conditions can differ widely, making the standard machining process uneconomical or even impossible. This is reflected not least in the limited values of the performance-related chip parameters, such as the specific stock removal rate $Q'W$. If the unequal conditions are not considered, this will inevitably result either in a great deal of wasted time or an excessive thermal load on a tooth flank. The difference becomes clear by comparing the geometric conditions when grinding an even surface and a sloped surface. Although, the same radial infeed produces the same cross section (AQ) and thus, the same machined volume (VW) per unit of time $\Delta t$, the swept areas (AK) differ significantly.

Grinding cylindrical worms

When grinding cylindrical worms, in contrast, fundamentally different geometric conditions arise due to the extreme helix angle alone. Not infrequently, the transverse profile of one thread encompasses more than 180° and the axes of the tool and workpiece are nearly parallel to one another. GearPro consequently touchgrinds the two tooth flanks in the axial direction – contrary to the usual practice – and in this way, generates significantly clearer signal edges in the solid-borne noise sensor that is ‘listening in’. The respective grinding wheel profile, which can only be dressed in some instances with special dressing rolls, gives rise to additional special requirements for the five supported flank profiles: ZA, ZN, ZI, ZK and ZC. Due to the axially defined measurands, both the testing and correction of worm-type gearings, also differ.

Short and to the point

Grinding and measuring special gearings with GearPro combines a high degree of variability with proven user-friendliness. Users can expect customised, high-end solutions for future tasks as well.
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Supply Chain 4.0 – The next-generation digital supply chain

The application of IoT in supply chain has automated the supply chain, created a network and has significantly improved the performance and brought in customer satisfaction. The article explores the enormous changes supply chain & logistics have undergone, trends, obstructions and the transformation it can bring into one’s management system.

Over the last thirty years, logistics has undergone a tremendous change – from a purely operational function that reported to sales or manufacturing and focused on ensuring the supply of production lines and the delivery to customers, to an independent supply chain management function that in some companies is already being led by a Chief Supply Chain Officer (CSO). The focus of the supply chain management function has shifted to advanced planning processes, such as analytical demand planning or integrated S&OP, which have become established business processes in many companies, while operational logistics has often been outsourced to third-party LSPs. The supply chain function ensures integrated operations from customers to suppliers.
Trends in supply chain management

Several mega trends have a heavy influence on the supply chain management; there is a continuing growth of the rural areas worldwide, with wealth shifting into regions that have not been served before. Pressure to reduce carbon emissions as well as regulations of traffic for socioeconomic reasons add to the challenges that logistics are facing. But changing demographics also lead to reduced labour availability as well as increasing ergonomic requirements that arise as the workforce age increases. At the same time customer expectations are growing; the online trend of the last years has led to increasing service expectations combined with a much stronger granularisation of orders. There is also a very definite trend towards further individualisation and customisation that drives the strong growth of and constant changes in the SKU portfolio. The online-enabled transparency and easy access to a multitude of options regarding where to shop and what to buy drives the competition of supply chains. To build on these trends and cope with the changed requirements, supply chains need to become much faster, more granular and much more precise.

Vision of the future state

The digitisation of supply chains enables companies to address the new requirements of customers, the challenges on the supply side as well as the remaining expectations in efficiency improvement. Digitisation brings about a Supply Chain 4.0, which will be:

- **Faster:** New approaches for product distribution reduce the delivery time of high runners to a few hours. The basis for these services is built by advanced forecasting approaches, e.g. predictive analytics of internal (e.g. demand) and external (e.g. market trends, weather, school vacation, construction indices, etc.) data as well as machine status data for spare-parts demand, and provides a much more precise forecast of customer demand. In the future we will see 'predictive shipping,' for which Amazon holds a patent – products are shipped before the customer places an order. The customer order is later matched with a shipment that is already in the logistics network (being transported towards the customer region) and the shipment is rerouted to the exact customer destination.

- **More flexible:** Ad hoc and real-time planning allows a flexible reaction to changing demand or supply situations. New business models, such as supply chain as a service for supply chain planning functions or transport management, increase the flexibility in the supply chain organisation. The specialisation and focus of service providers allow them to create economies of scale as well as economies of scope and attractive outsourcing opportunities. For example, we will see an ‘Uberisation’ of transport – crowd-sourced, flexible transport capacity, which will lead to a significant increase in agility in distribution networks.

- **More granular:** The demand from customers for more and more individualised products is continuously increasing. That gives a strong push towards micro segmentation, and mass customisation ideas will finally be implemented. Customers are managed in much more granular clusters and a broad spectrum of suited products will be offered. This enables customers to select one of multiple ‘logistics menus’ that exactly fits their need. New transport concepts, such as drone delivery, allow companies to manage the last mile efficiently for single and high-value dense packages.

- **More accurate:** The next generation of performance management systems provides real-time, end-to-end transparency throughout the supply chain. We will see performance management systems that ‘learns’ to automatically identify risks or exceptions and will change supply chain parameters in a closed-loop learning approach to mitigate them. That enables the automatic performance management control tower to handle a broad spectrum of exceptions without human involvement and to only leverage the human planner for the disruptive events/new events. With this, a supply chain is continuously developing towards its efficient frontier.

- **More efficient:** Efficiency in the supply chain is boosted by the automation of both, physical tasks and planning. Robots handle the material (pallets/boxes as well as single pieces) completely automatically along the warehouse process – from receiving/unloading to putting away to pick, pack and ship. The network setup itself is continuously optimised to ensure an optimal fit to business requirements. To create an ideal workload in the supply chain, various transparency and dynamic planning approaches are leveraged to drive advanced
Digitisation of supply chains enables companies to improve efficiency & address customer requirements better.

Demand shaping activities (e.g. special offers for delivery time slots with low truck utilisation).

**Digital waste hindering Supply Chain 4.0**

In today’s supply chains, many sources of digital waste can be found (in addition to the existing waste) that prevent the potential of Supply Chain 4.0. It is crucial to understand the sources of waste and develop solutions to reduce/avoid it in the future state. The sources of digital waste can be classified in three types:

1. **Data capturing and management**: Often, available data is handled manually (data collection in a system, paper-based data handling, etc) and not updated regularly, e.g. master data on supplier lead time that is entered once (sometimes even only dummy numbers) and then remains unchanged for years. Another example in warehousing is advanced shipping notifications, which are received but not used to optimise the inbound process. On top of these examples, it is typically not clear which additional data could be leveraged to improve processes, e.g. sensing of supply disruptions – if the lead time of a supplier is continuously increasing, a warning should be sent out to make planners aware of the situation and enable them to mitigate supply disruptions at an early stage. In current systems, this signal will not be recognised and will lead to a lower supplier service level reported at the end of the month. If the worst comes to the worst, the issue will cause trouble in the assembly line replenishment and operational problems.

2. **Integrated process optimisation**: Many companies have started to implement an integrated planning process, but very often this is still done in silos and not all information is leveraged to achieve the best planning result possible. Beside the intracompany optimisation, the process optimisation between companies has not been fully leveraged yet and improvement potentials created by increased transparency are not realised. To get to the advanced level of integrated process optimisation, the organisational setup, governance, processes and incentives need to be aligned within and between partners in the supply chain.

3. **Physical process execution of humans and machines**: Nowadays, warehousing, assembly line replenishment, transport management, etc are often done based on gut feeling, but not leveraging available data, e.g. to improve pick paths in the warehouse. Warehouse operations are still managed in batches of one to two hours, not allowing the real-time allocation of new orders and dynamic routing. Also, opportunities arising from new devices, such as wearables (e.g. Google Glass) or exoskeletons, are not leveraged.

**Transformation into a digital supply chain**

The transformation into a digital supply chain requires two key enablers – capabilities and environment. Capabilities regarding digitisation need to be built in the organisation but typically also require targeted recruiting of specialist profiles. The second key prerequisite is the implementation of a two-speed architecture/organisation. This means that while the organisation and IT landscape are established, an innovation environment with a start-up culture has to be created. This ‘incubator’ needs to provide a high degree of organisational freedom and flexibility as well as state-of-the-art IT systems (two-speed architecture independent of existing legacy systems) to enable rapid cycles of development, testing and implementation of solutions. Fast realisation of pilots is essential to get immediate business feedback on suitability and impact of the solutions, to create excitement and trust in innovations (e.g. new planning algorithms) and to steer next development cycles. The ‘incubator’ is the seed of Supply Chain 4.0 in the organisation – fast, flexible and efficient.

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A good CAM software is as significant for manufacturers as the effective machines and tools they use to cut the chosen parts. Machine shops of all sizes are making the most of good CAM software beyond proficiently programming their machining jobs. This case study discusses how C&S Machine and Manufacturing Corporation was experiencing restrictions with the CAM programming software it was using and turned to ESPRIT, so as to bring about efficiency and get over any kind of limitations.

C&S Machine and Manufacturing Corporation was founded in 1969 by Robert Steele and Ronnie Cook in a 180 square foot shed on Cook’s property in Louisville, Kentucky. The company started out primarily as a job shop building repair parts for local manufacturing and processing companies. In 1980, C&S purchased its first CNC machine, an Enshu vertical machining center. The move to CNC helped the company produce more complex parts at higher levels of quality and overtime, C&S expanded its business model to incorporate higher levels of production machining. Steele bought out Cook in the early 1980s. Today, C&S Machine has three buildings with more than 60,000 square feet, housing 30 CNC machines, including vertical machining centres, horizontal machining centres, vertical lathes and horizontal lathes with live tooling. The company also offers laser cutting, bending and welding services. The company, today, is led by Ryan Steele, grandson of Bob Steele, whose goal is to continue the company’s focus on innovation, quality, safety and workforce development.
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Switching to new CAM software

As the company invested in the latest CNC machine tools, it began to experience limitations with the CAM programming software it used in the past. “The CAM software that we used previously could handle nearly all of our programs, but it was somewhat awkward to use,” says Kyle Dunn, Machinist, C&S Machine and adds, “In the past, we would write a toolpath, post it out and paste the resulting G-code into our hand-written program. This process was time-consuming and prone to mistakes that might wreck a tool or workpiece.”

The company made the decision to purchase ESPRIT because it was recommended by several machine tool companies as providing a pathway to leverage their latest features. Another factor was the ability of ESPRIT CAM to easily import solid models from SolidWorks computer aided design software and other design tools used by the company’s customers, which saves time by largely eliminating the need to recreate customers’ geometry and ensures that the program matches the customer’s design intent.

A typical example of type of programming done with ESPRIT is a lower jaw for a custom-built machine. This part is produced from a solid piece of \(10 \times 9 \times 8\)-inch alloy steel. The customer provided a SolidWorks solid model of the part geometry and the programmer loaded the model into ESPRIT. He created a block around the part to define the workpiece from which the part is machined. He began the programming process by choosing from a tooling library that he had created in the past that includes ball nose end mills, square end mills, drills, taps, etc. The library ensures that the programming and simulation match the dimensions of the actual tooling, including stick-outs, tool numbers, number of flutes, etc. to ensure accurate collision detection. He then used ESPRIT’s automatic feature recognition capability to restore the intelligence of the part geometry by organising it into features such as holes, bosses and pockets. He selected many of these features for use in creating toolpaths.

**Toolpaths for basic outline**

The programmer created toolpaths for the basic outline of the part by chaining edges and line segments to create a few larger surfaces covering the exterior of the part. He then selected these surfaces one at a time and defined contouring operations to produce them. He selected a contour milling strategy for each contouring operation and ESPRIT automatically generated an efficient sequence of roughing, semi finishing and finishing operations to produce the surface. The ESPRIT Stock Automation engine calculated the contouring times in seconds. These operations begin with efficient roughing at high metal removal rates with an indexable end mill that removes all areas of the part which can be removed with this tool, without gouging the workpiece. Then the program loads the next smaller size tool and again calculates which areas of the part it can remove. This process continues down to the smallest tool, usually a ball nose end mill, which generates fine details on the part. Each toolpath avoids re-cutting previously machined regions so as to reduce cycle time.

The programmer defined discrete features such as holes and bosses that were automatically recognised by ESPRIT as discrete toolpaths. In some cases, he pulled toolpath settings from a library of saved processes, which allowed him to use programming strategies that have been proven on previous parts. When all the toolpaths were created, the programmer simulated the operation of the program in ESPRIT which showed the workpiece, cutting tools and machine tool as realistic solid models. This approach makes it relatively easy to identify any problems with the program and when identified, they can be corrected by modifying the tools, geometry or
toolpaths that make up the program. The simulation generates a model of the part produced by the program which can easily be compared to the design intent as provided by the customer. The simulation also estimates the cycle times which help improve the accuracy of the company’s quoting. “We use this feature on long-term, higher-volume projects to estimate how much machine time will be required to produce each part,” says Mike Curry, Manufacturing Engineer, C&S Machine.

Benefits for C&S Machine and its customers

The increase in CAM programming capability provides several key benefits, both, to C&S Machine and to its customers. The more efficient CAM programming workflow, the more it helps reduce programming time. The program for the part described took considerably less time to create and validate than it would have taken with the software used in the past. The automated strategies provided in ESPRIT reduce cycle time, which in turn helps reduce the cost of machining. The ability to visually simulate machining operations and accurate post-processors provided with ESPRIT has eliminated problems like crashes, when running programs for the first time. Tom Grace, Operations Manager, C&S Machine, concluded that the use of ESPRIT has also contributed to the company’s four and one-half times increase in revenues at the company since it started using the software.

“There are many factors involved in our growth, including investments we have made in new technology, workforce development and the dedication and support of our entire team,” Grace says and adds, “But there’s no question that the improvement in our CAM programming capabilities that we have achieved with ESPRIT has played a major role in our success.” □

*Courtesy: DP Technology Corp*
The four most common causes hindering the bearings from reaching its maximum life are - inadequate lubrication, contamination, overload and improper handling & installation. These conditions affect a wide variety of bearing types, including cylindrical, spherical, needle, tapered and ball designs. For bearing systems to reach maximum life – and to avoid serious consequences from malfunctioning bearings – it’s important that plant managers and technicians understand how to monitor and prevent conditions that damage bearings.

Overload

When bearings are forced to operate beyond rated design limits in terms of load, speed or temperature, it is called overload.
The greater the overload, the greater the decrease in bearing life. Surrounding components may also be affected. In extreme cases, fracturing of the bearing components can also occur. While overload can result from improper operation, it can also result from a mismatch between the bearing design and the application.

When selecting the proper bearing design for the application, OEMs and bearing manufacturers should consider operating temperature, rate of temperature change, type and degree of potential contamination, operating speeds and acceleration, vibration and more. Warning signs of overload include noise or vibration, system temperature rising, metallic chips in the lubricant and filters and diminished system performance. One indication of overload is fatigue spalling – pitting or flaking away of bearing materials. Spalling primarily occurs on the races and the rolling elements of the bearing.

Other indications of overload are:
- Roller fracture
- Peeling
- Outer ring subcase fracture
- Hard lines or evidence of plastic deformation at the edges of the roller and non-ribbed raceway contacts. These hard lines appear black and can be felt with sharp tipped tools.
- Metal deformation into the undercuts of ribbed raceways.

If one observes any of these signs of damage due to overload, the bearings must be repaired or replaced, or one runs the risk of further damage and more serious consequences.

Improper handling and installation

Technicians should be sure to employ the proper methods and tools when handling and installing bearings. Bearings are highly engineered components and even the smallest denting or nicking can undermine the performance and reliability. Until bearings are ready for installation, one must keep them stored in the anticorrosive protective wrapping. Many cases of premature bearing damage can be traced due to improper storage practices. Always use clean tools in a clean environment. And do not wipe away the preservative on the bearing. One common error is wiping away the preservative applied by the bearing manufacturer and removing protective packaging. If, for any reason, the bearing must be removed from the original packaging, one must take care to apply preservatives and ensure that the parts are well wrapped. Bearing manufacturer service representatives can assist with best practices.
Record keeping is also essential to retain a record of all maintenance activity, noting the date, equipment model and serial number, bearing assembly and serial number (if applicable), and manufacturer. One must include comments regarding housing or shaft reconditioning and other components that were replaced. These records can be essential when establishing trends in bearing performance, defining service intervals and planning future maintenance. Records are also the baseline for troubleshooting equipment performance issues & related bearing damage analysis. One should take care to avoid damage to bearing components – especially cages – by using appropriate devices and methods during handling and through the installation process. Note that cages are usually made of mild steel, bronze or brass and can be easily damaged by improper handling or installation, resulting in premature bearing performance problems.

When driving outer-races out of housings or wheel hubs, careless handling can result in burrs or high spots in the outer-race seats. If a tool gouges the housing seat surface, it will leave raised areas around the gouge. If these high spots are not reworked (scraped or ground down) before the outer-race is reinstalled, the high spot will transfer through the outer-race and cause a corresponding high spot in the outer-race inside diameter. This increases local rolling-contact stress and can result in decreased fatigue life, localised spalling or, in extreme conditions, component fracture. The immediate effect of the gouges and deep nicks can include roughness, vibration and noise in the bearing.

Below are specific types of damage that may result from improper handling, installation or removal. Each may be very serious. If one discovers damage of this kind, one should replace or repair the component and identify the root cause.

- Outer-ring denting
- Fractured inner-ring rib
- Broken rib on outer-race
- Roller spaced nicking
- Dent or depression on raceways (brinelling)

Bearing installation starts with paying careful attention to fits, alignment and bearing setting. For this, the manufacturer’s advice should be followed to ensure proper bearing performance.

Proper alignment during installation is important, because a statically misaligned bearing will shorten life if the bearing capability is exceeded. Service life reduction will depend on the degree of misalignment. If misalignment is excessive, load distribution within the bearing will not be distributed along the rolling elements and races as intended, and it will be concentrated on only a portion of the rollers or balls and races, potentially resulting in early fatigue of the metal.

Abutting surfaces, the seats and shoulders & corresponding fillets and undercuts are sized for appropriate support and transmission of forces. These must be within specified limits set by the bearing manufacturer. Bearing setting includes proper assignments of free and mounted Radial Internal Clearance (RIC), axial endplay or, in some equipment, axial preload. Incorrect clearance can result in a variety of conditions that include increased torque, stress, cage damage or overheating.

Protecting equipment & operations

Bearing damage on a large scale is less common today, thanks to improvements in machine design, education and training of original equipment manufacturers and users. Also, operators are increasingly diligent in bearing handling, monitoring and maintenance of equipment, lubrication and seals. Establishing a reliable and ethical supply chain for bearings and power transmission components can substantially protect a customers’ equipment and operations.

Yet the need to understand key causes of bearing damage – and how to prevent them – is no less urgent. One must take care to adequately lubricate, guard against contamination, avoid overload and properly handle and install bearings. In doing so, one can protect these essential industrial components from damage, increase uptime, prolong service life and increase the financial health of one’s operations. ☐
IoT & data analytics – Catalyst of the smart factory

Today’s manufacturers must operate at breakneck speed to keep pace with the ever-changing customer demands, market trends and global competitors in a rapidly evolving marketplace. Yet many traditional challenges, such as increasing costs, unplanned downtime, Quality Control (QC), evolving business requirements and aging infrastructure, continue to hamper progress. The article throws light on the equation of how IoT plus data analytics equals smart manufacturing.

The manufacturing sector is no stranger to change. Over the course of three industrial revolutions, companies have relied on everything from water and steam to electricity and information technology to power their operations, provide services and make products. But the evolution taking place with Industry 4.0, which McKinsey & Company defines as ‘the new wave of technological changes that will trigger a paradigm shift in manufacturing,’ may be the most significant change of all.

The catalyst for this shift, in which ‘smart factories’ can respond in real time to quality issues, equipment outages and other production challenges, is a combination of several interrelated technologies that are maturing at the same time, it being, the Internet of Things (IoT), advanced data analytics, Artificial Intelligence (AI), Machine-to-Machine learning (M2M) and cloud computing.

Improving production

Unplanned downtime from equipment breakdowns, unforeseen bottlenecks, supply chain disruptions, labour shortages or changing customer orders can idle assets, resulting in loss of production time and revenue.

Taming complexity

As the manufacturing sector moves from mass production to mass customisation, QC is becoming increasingly complex. Even the most minor variations in production can negatively affect the quality, leading to widespread recalls, costly lawsuits, consumer mistrust or exorbitant warranty expenses. Also, production line irregularities can produce enormous waste.

Finding flexibility

Legacy systems based on proprietary or outdated technologies can’t be integrated with new applications without costly customisations, thereby limiting their extended functionalities. In addition, legacy systems can be expensive to maintain and can
divert resources from more-innovative initiatives. In response, manufacturers are turning to IoT technologies that combine manufacturing assets with embedded sensors, advanced analytics, AI and cognitive computing. The goal is to generate digital intelligence across the entire value stream.

**Advanced analytics at the core**

At the core of IoT and its potential to create value is advanced analytics. According to research firm Gartner, advanced analytic techniques include machine learning pattern matching, cluster analysis, multivariate statistics and a variety of other methods. Using capabilities of advanced analytics, manufacturers can aggregate, sort and analyse the vast volumes of information generated by the four Ms of manufacturing, blend structured and unstructured data and convert this data into actionable insights. These are some of the benefits:

- **Improving quality**
  Inconsistent product or component quality can reduce yields, create costly waste and cripple production capacity. Consider, for example, a manufacturer whose polymer mixing process continues to produce output of inconsistent quality. The need to scrap poor batches results in huge costs and compromised production capacity. Worse yet, if left undetected, this material issue creates inferior product quality down the line and can lead to losses of millions of dollars in revenue.

  An advanced analytics platform that integrates a wide range of production and sensor data could visualise, analyse and diagnose the mixing process. As a result, the production engineering team can understand the correlations and can cause/effect, leading to inconsistent or poor-quality output from a wide range of variables.

  This type of advanced analytics eliminates poor-quality output. It helps manufacturers boost average yields and reduce operating costs as the focus shifts from scrapping poor batches to optimising manufacturing processes. By adding Machine Learning capabilities, the system can also adapt to changing conditions, such as new product designs, increased product variations and new or changing ingredients.

- **Maximise performance of critical assets**
  Equipment failures can cost manufacturers millions of dollars in downtime and productivity loss. One survey of the auto industry manufacturing executives by Thomasnet.com showed that every minute of stopped production costs an average of $22,000. Advanced analytics and Machine Learning can help avoid production shutdowns by monitoring sensor, event and historical data to detect trouble spots. Using these types of prescriptive analytics, manufacturers can proactively identify machineries requiring attention and conduct necessary repairs under controlled conditions before it stops working.

  Consider air compressors, an essential part of most manufacturing and production processes – they are used to power equipment in 90% of all industrial companies. By deploying a condition-monitoring system that uses advanced analytics, manufacturers can track the machine’s performance in real time. The system will send alerts about conditions, such as excessive pressure or rising temperatures, that could lead to breakdowns and unscheduled production halts. Rather than simply reacting to production halts, maintenance becomes a proactive, integrated part of production.

  Detecting inaccuracies in the early stages of a production cycle can also offer a critical advantage. By pre-emptively detecting production line problems, such as nonconforming parts or improper calibration, manufacturers can decrease the likelihood of producing defective products, thereby improving throughput yield without having to commit time, money and resources into rectifying defects.

  Improving asset uptime can also significantly boost plant productivity. An IoT approach can result in a 20% to 25% increase in production volume and a 45% reduction in downtime. By eliminating unknown problems, such as equipment failure, manufacturers can optimise production schedules and shorten lead times, for improved quantity and quality of finished goods.

  A detailed understanding of equipment performance through
analytics offers several benefits. Using analytics to monitor production line quality can help identify quality problems quickly and improve yield. Additionally, analysing historical equipment performance data and real-time data can reduce maintenance costs and increase equipment availability. Manufacturers can also more easily adhere to factory safety and regulatory compliance standards by taking the time to convert IoT-generated data into actionable insights, such as how to prevent system vulnerabilities.

The wisdom of a co-creation approach

In today’s highly competitive digital business world, manufacturers must act fast and pivot quickly to meet fluctuating market trends and consumer demands. IoT, combined with advanced analytics as part of a broader digital transformation strategy, can help manufacturers create new business models, improve operational efficiencies and drive innovation in products & services. Yet, nearly 70% of all digital transformation initiatives are considered unsuccessful, according to data from McKinsey.

Many manufacturers lack the multidomain experience and expertise required to create innovative solutions that will lead to successful digital transformation. Although they have in-depth manufacturing industry knowledge, it’s rarely accompanied by a deep understanding of IoT, computing and communication technologies, predictive analytics or AI. However, by partnering with a vendor that has both Information Technology (IT) and Operational Technology (OT) expertise in data analytics, a manufacturer can co-create solutions that cater to unique needs and business requirements. This innovative co-creation approach to IoT and advanced analytics includes four critical steps:

**Step 1: Engage**

The vendor and manufacturer work together to create a shared vision, understand pain points and goals, conduct discovery in reviews and workshops and analyse data. They discuss options and distil abstract concepts into a prioritised list of use cases to address.

**Step 2: Build a model**

A team of data scientists sifts through various data sets. Then they cleanse the data, standardise and enrich it and choose the right analytics techniques and algorithms to build an analytical model to fit a manufacturer’s use case.

**Step 3: Create the solution**

Solution developers deploy an analytics platform and tools. Then, they build the solution model code and algorithms, user-experience wire frames, user-interface design models and templates. Lastly, they integrate these with IT tools for analysis. The concepts of the solution are exposed to pipelines of real data and proven to deliver the expected results. Co-creative spaces help ensure effective workshop processes and simulation tools produce positive results.

**Step 4: Test and validate**

Delivery engineers integrate the solution with a customer’s Operational Technology (OT) and IT systems in an operating environment. Next, they integrate live data, deploy analytical pipelines, test robustness and scalability and validate business outcomes and Key Performance Indicator (KPI) results to ensure optimum value.

By drawing stakeholders directly into the innovation process and supporting them with an ecosystem of partners and expertise, a co-creation approach fosters a deep understanding of a manufacturer’s pain points. And it solves issues with a customised solution rather than an off-the-shelf tool. As a result, co-creation delivers the following benefits:

- Offers a low-cost methodology for developing new products and services
- Sparks innovation and advances complex projects
- Reduces risks associated with implementing new digital initiatives
- Helps speed up desired outcomes

Together, these benefits provide a solid foundation for business transformation.

Analytics for long-term productivity

Today’s manufacturers are under unprecedented pressure to produce high-quality products at record speed and with unmatched precision. To keep pace with fluctuating market trends and satisfy rising customer expectations, manufacturers must embrace IoT technologies and leverage advanced analytics to bring insights into asset health, output quality and operational processes.

However, just as no two companies are the same, no two IoT solutions are the same. For this reason, it’s critical for manufacturing firms to work with a partner that has both OT and IT expertise in data analytics to co-create solutions that address those unique requirements and specific needs. This type of partnership can help realise the promise of IoT and enable companies to enhance product quality, cut operational costs and optimise manufacturing operations for long-term rewards.

*Courtesy: CIO & Hitachi Vantara*
**Industrial PC**

B&R recently added a powerful PC with 7th generation Intel Core i processor to its portfolio of mobile machinery. The full-fledged PC with IP69K protection is specially designed for use in harsh environments. Its high performance makes it suitable for smart machines that communicate with each other and with the cloud. Its performance can be scaled from a 2.2 GHz Celeron processor to a 2.8 GHz Core i7. It offers up to 16 GB RAM and 480 GB of flash memory and is equipped with a TPM module. Also, it supports standard operating systems like Windows 10 IoT Enterprise and Linux. The PC's computing performance enables implementation of semi or fully autonomous machine functions. They can also be used as an edge controller, collecting large volumes of data from one or more mobile machines, pre-processing it and then sending it to higher-level systems or the cloud. Their rugged design is resistant to shock, vibration, salt, UV light and oil. The zero-maintenance PC has a specially developed temperature management system that allows it to be operated from -40 °C to +85 °C surface temperature.

**EtherCAT technology with gigabit**

Beckhoff recently presented the gigabit technology addition to the EtherCAT, which is an extension of EtherCAT standard. The 100 Mb/s EtherCAT technology remains the proven solution for many applications. However, EtherCAT G offers additional user advantages, especially in applications where particularly large amounts of process data must be transported per device. This can include, for example, machine vision, high-end measurement technology or complex motion applications that go beyond the scope of classic drive control. As an extension of standard EtherCAT technology, EtherCAT G is fully compatible; existing devices designed for 100 Mb/s can be seamlessly integrated into an EtherCAT G system and EtherCAT G devices in a 100 Mb/s EtherCAT system behave like classic EtherCAT devices. It's central element uses the EtherCAT branch controllers, which fulfil two main functions: On one hand, they act as a kind of node for the integration of segments from 100 Mb/s devices. On the other hand, they enable parallel processing of the connected EtherCAT segments. This reduces the propagation delay in the system, which increases system performance many times over previous levels.

**Progressive flow controller**

Hyprostatik Schönfeld GmbH recently introduced the progressive flow controller — PM controller for short. This controller raises the stiffness of hydrostatic elements by a factor of four to five, compared with solutions with capillaries, which is a prerequisite for high concentricity precision which is many times smaller than 0.1 µm and can be copied to the part in an acceptable manufacturing time. Also, with the help of self-developed computing programmes, the hydrostatic components are designed ideally for static and dynamic loads, so that the stiffness and high damping values are achieved. In addition to freedom from wear, this is a significant prerequisite for peak part precision, performance, tool life and high machinery availability and working life. Plus, many manufacturers try to avoid fluids in production. Dry machining and machine tools with greased rolling elements are preferred. These systems are simpler and merely demand low maintenance efforts, which are restricted broadly to an occasional filter change or topping up with oil. Only very rarely is an oil change required. Instead, the company recommends a central coolant supply with external heat transfer.

**Slowing ring bearings**

Igus recently offered slide-supported slowing ring bearings in its product range, which is the new PRT-04 range where users can use slowing ring bearings even in compact installation spaces with medium loads. Up to 50% space can be reduced by using this, compared to the PRT-01 series with a 100 mm inner diameter. In addition, the user saves 20% of his costs because of the new slim type. The new PRT-04 range is available directly from stock with inner diameters of 50 to 300 mm along with a wide range of accessories for the slowing ring bearings. The new slowing ring bearings have also demonstrated their long service life in the company's own 3800 square metre test laboratory. The data collected in the tests are incorporated in the iglidur PRT slowing ring configurator, which allows the customer to quickly select the correct slowing ring bearing as well as calculate the service life in the individual application.
**Slide rings / wear rings**

Rollon Bearings recently introduced the Rollon slide rings / wear rings, also known as ‘bearing tape’ for reciprocating applications such as for piston rods and pistons in hydraulic cylinders, pads in booms of cranes, in mechanisms of steel mills and textile machinery. When the rings are properly installed, they prevent metal to metal contact between piston rod and gland or between piston and cylinder bore and have a slight interference fit. This causes a slight deformation of the material which in turn increases the bearing area. These rings are manufactured from bronze-filled PTFE along with special wear resistant additives, which makes them wear-resistant and stable. The rings are available in following standard thicknesses, viz 0.8, 1.2, 1.6, 2, 2.5, 3.2 & 4 mm and in varying widths. Few of the advantages of the slide rings are that they have simple groove design, which is easy to install, has no hydro–dynamic problems, prevents migrating of dirt, increases the service life of the sealing surface, metal/plastic pairing eliminates fretting/seizure, absorbs external particles from the system, eminent wear and slide qualities and no tendency to ‘stick–slip’.

**Integrated gripping system**

Schunk Intec recently developed an integrated gripping system that actively uses its strategically exposed position ‘closet to the part’ in order to autonomously complete all procedure steps required for handling and quality inspection, the battery cell gripper, which offers an efficiency advantage to produce lithium-ion batteries. The smart gripper combines flexible handling, identification and the 100% quality inspection of li-ion cells in one compact module. All recorded process data and characteristic curves on geometry, temperature and charge levels are processed via an integrated PC system on the level of the gripping module and transferred as purified information via Ethernet TCP/IP both to the plant controller and the superordinate database systems. In so doing, the battery cell grippers is making an important contribution towards shaping autonomous processes within the intelligent production environments of Industry 4.0. These grippers can be related to a wide range of robot or gantry systems and also provide the opportunity for autonomous processes and contribute to the production of tomorrow in many regards.

**Mini end mill series**

Seco Tools recently expanded the Jabro® range of solid-carbide end mills by introducing the new Seco Tools JM100 Mini end mill series. In micromachining operations with zero visibility of workpiece and cutting tool, the JM100 Mini delivers longer tool life, stability and guaranteed surface quality, thanks to its extremely precise geometries, virtually zero runout, advanced coatings and tight radius tolerances. Targeted to achieve precise surface finishes on mould and die components, the JM100 Mini helps shops minimise secondary benchwork that can increase part processing time. The end mill’s special coating reduces tool wear to help lower overall tool costs and eliminate the need for frequent tool changes. It also ensures smooth and consistent surface finishes that yield exceptional part performance. Tight radius tolerances of ±0.005μ on the tool reduce runout virtually to zero, increasing output and contributing to lower cost per part with high process precision, stability and reliability. It is available in tool diameters from 0.2 mm to 3.0 mm, corner radii ranging from 0.05 mm to 0.3 mm RE = ±0.005 and overhang lengths from 1.5* DC to 20* DC, with two and three-flute versions.

**3D Printer for medical devices**

Trumpf recently unveiled a new 3D Printer at Frankfurt’s Formnext, which is called TruPrint 2000, that lends itself to medical engineering and other applications with lofty standards and quality. The system has been revamped, so inert gas now flows through it back to front, which enhances printed parts’ quality. In another new development, the operator can now remove excess powder from the component right there in the system rather than having to take it out and unpack it at a separate station, as in the past. This is easier and saves time when dealing with the smaller built chambers of 3D Printers such as the TruPrint 2000. The newly designed machine now processes the printing powder in an inert gas environment, which prevents contaminants from infiltrating the powder circuit. The 3D Printer features the multi-laser design. Two 300-watt lasers working in tandem illuminate its entire build chamber to boost the system’s productivity. Its laser’s focal diameter is 55 micrometres so that it can print components with smoother surfaces, enhanced quality and intricate grid structures.
Highlights - January 2020

» Metal-forming Technology
With evolution in metal-forming, new technologies are getting integrated as are the manufacturing processes. The upcoming issue will throw light on the latest technologies and recent developments in the metal-forming industry.

» Welding Technology
Being a non-separable part of manufacturing, welding technologies are also gearing to embrace the fourth industrial revolution. The upcoming edition will explore the scenarios where Industry 4.0 technologies have been widely adopted in the welding industry and global practices and sentiments towards intelligent manufacturing.

» Grinding Machines
Grinding is a very simple and old manufacturing technology responsible for machine accuracy and dynamics. The next edition explores the latest grinding technologies and discovers solutions towards manufacturing success.

» Warehousing & Inventory Management
Due to new technologies, the warehousing industry is set for some major transformations. The following issue explores the future of warehouse efficiency, how one can maximise warehouse management systems to increase profits and the best practises to follow in warehouse operations.

» IMTEX FORMING 2020
A significant exhibition for South East Asia, featuring all aspects of sheet metal forming technologies, with concurrent shows - Tooltech 2020, AME and Factory of the Future

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The number of passenger aircraft is set to double to more than 40,000 by 2030. Twenty-first-century long-haul aircraft have a take-off weight of up to 500 tonnes. The task of lifting these goliaths into the air economically is about more than keeping the weight of materials and components down – our future needs require stepping up process reliability and quality when machining them too. This is presenting suppliers to the aviation and aerospace industries with a huge challenge. Having a tool partner that keeps costs firmly on the ground is therefore crucial.

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