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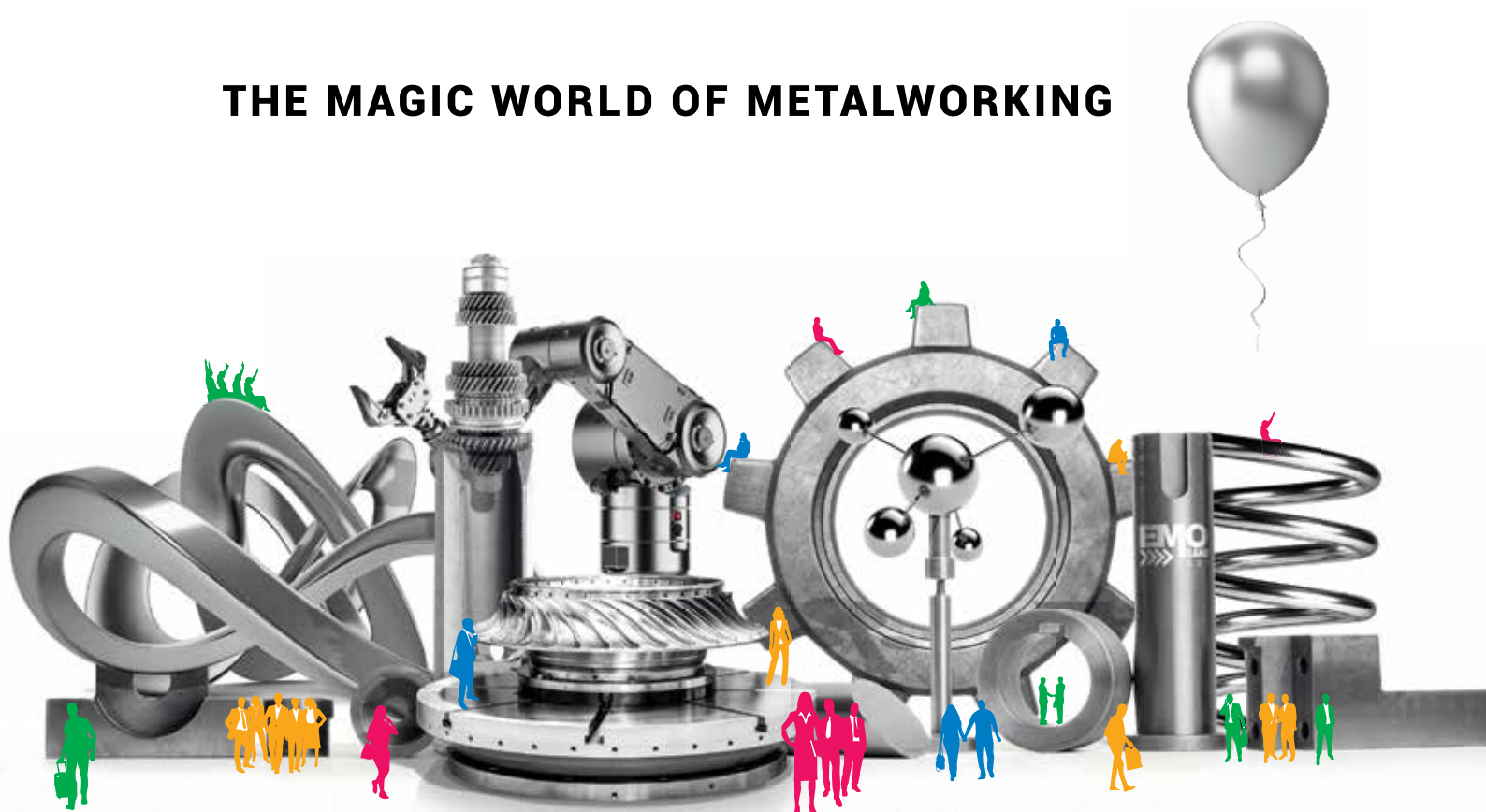
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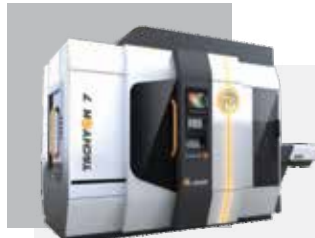
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The race for mass-markets EVs

The history of the electric car is much longer than you might think. One of the first practical electrical cars was created around 1884, but the actual mass production was seen only in 90s. Today, almost every automaker has already started their foray into electric vehicles or announced their new launches of electric vehicle models for the coming years, further accelerating automotive and mobility trends. What will help EVs gain market share is that OEMs have reached ranges with their EVs that allow them to focus on reducing price points, for example, by increasing design efficiency or reducing manufacturing cost in order to become affordable to more customer segments. As battery technology evolves quickly, allowing the newest EVs to have ranges which are not a bottleneck anymore, we see early indications that EVs are moving toward practices common in mass production. In fact, a tipping point is approaching where mass adoption will become unavoidable because of falling battery costs, pressure from regulators and generous government subsidies.

Established carmakers around the world are ripping up their business models in the hope of adapting to a new world of EV manufacturing. In short, the race for mass-markets EVs has begun as factories are being overhauled to produce electric cars. There is a slowdown in the pace due to the pandemic, which presents new and unprecedented challenges to automotive OEMs and start-ups. But the EV market is still poised for growth in the near future.

Here is the Cover Story in this edition that talks on EV manufacturing by leveraging comprehensive digital twins of the product and production lines to deliver higher quality products to market in less time, and respond to changes with greater agility and intelligence.

Shekhar Jitkar

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Cover image courtesy: Siemens

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SUPPLY CHAIN MANAGEMENT

Distribution centres – The epicentre of supply chain transformation



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Chiranjeev Saluja,
MANAGING DIRECTOR,
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2020 has been a watershed year that saw the economy facing perils never seen before. All sectors – be it banking, education, manufacturing or retail – saw a shift in their production techniques and quantity output. The Government of India’s aggressive push for ‘Make in India’ to bolster domestic manufacturing and make its economy ‘self-reliant’ in the post-pandemic era is a welcome opportunity for India’s solar energy sector. It has not only encouraged local companies to increase captive capacity but also boosted manufacturing capabilities. Plus, it has compelled businessmen to look inwards because of which corporates are now looking for more indigenous products. The whole year has shed light on the importance of being financially independent through the manufacturing of products made in India to boost the economy & simultaneously transforming local businesses.

The pandemic proved to be an eye-opener for a lot of business owners. It exposed the weaknesses in supply chains, and many companies started reconfiguring their sourcing & manufacturing footprints. With the use of localised materials and reinventing technologies to suit manufacturing, companies have come a long way.

“INDIA IS SET TO BE A FUTURE POWERHOUSE”

Despite making significant progress in solar power generation and emerging as the world’s third largest solar market, India’s domestic solar equipment manufacturing industry has not been able to capitalise on the opportunity thus far. The country imports 80% of the components required for its solar energy production from China. This raises an important question – does India have the core competency, capital and capacity required to offer domestic manufacturing of solar power equipment at a scale that could substitute for its massive imports?

There is an urgent need to devise a policy framework that aims at creating a diversified domestic manufacturing industry for solar modules as well as ancillary products that could significantly reduce its import dependence, ensure a self-sufficient, sustainable & affordable machinery access and generate greater employment opportunities. According to a McKinsey report, many of India’s manufacturing value chains enjoy advantages that could help power them to rapid growth. India’s natural resources

– for example, iron ore, bauxite, high solar insolation and cotton – and low-cost labour are a boon to makers of basic metals, textiles & apparel, renewable energy and chemical products. Further, the country’s large numbers of well-trained workers lend strength to skill-intensive value chains, such as pharmaceutical formulations, capital goods and automotive components. The makers of fast-selling technology products, for example, enjoy ready access to millions of Indian consumers.

In the 2020-21 budget, our Finance Minister emphasised the need to push our flagship programme, ‘Make in India’, by incentivising manufacturing and providing a fillip to exports. Even with the emergence of digital factories and e-commerce platforms, buying trends are shifting online, which makes the markets bigger in terms of consumers. Additionally, to tackle this factor, more and more workforce will be trained to build a digital workforce.

COVID-19 has certainly pushed us to the fore. Amidst this, one of the sectors that have been impacted is local manufacturing. Going forward, India is set to be a future powerhouse in terms of manufacturing and exports. Consequently, the economy is set to grow in the coming years. □



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Hero MotoCorp announces tie-up with Gogoro

Hero MotoCorp recently announced its strategic partnership with Taiwanese electric scooter manufacturer, Gogoro, to tap into India's nascent EV two-wheeler space. The company said it would, in partnership with Gogoro, build a battery swapping network across India, and the strategic tie-up will also result in the birth of Hero-branded, Gogoro Network-powered, electric two-wheelers. Gogoro believed it could make a swappable battery system work for two-wheelers, taking the hassle of long charging times out of the equation. Speaking about the tie-up, Dr Pawan Munjal, Chairman & CEO, Hero MotoCorp, stated, "This partnership will further extend the work, which we are doing in our R&D hubs at the Centre of Innovation and Technology (CIT) in Jaipur & our Tech Centre in Germany. With this new partnership, we commit to introducing a sustainable mobility paradigm, first in India and then in other markets around the world."

Quaker Houghton enters joint venture with Grindaix

Quaker Houghton recently entered into a joint venture with Grindaix GmbH. The solutions provided by Grindaix apply to a wide range of machining processes, including grinding applications in the metalworking sector. The technology the company provides helps customers precisely measure and optimise parameters, such as coolant flow, velocity, temperature, nozzle angles and pressures. Expressing his views on this partnership, Joe Berquist, SVP & Chief Strategy Officer, Quaker Houghton, expounded, "This partnership is an excellent strategic fit with broad application. We see several advantages for our customers investing in system automation and optimisation trends evolving from Industry 4.0." He further added, "Advanced capabilities by Grindaix enable us to deliver on our promise to make our customers more competitive, as we combine advanced product chemistry with equipment solutions to deliver an optimal package for performance, cost and quality. We call this powerful combination 'Fluid Intelligence'. Their data-based approach to coolant system operation has been growing steadily in the German market, and we see an opportunity to leverage their technology across our broader solutions portfolio."



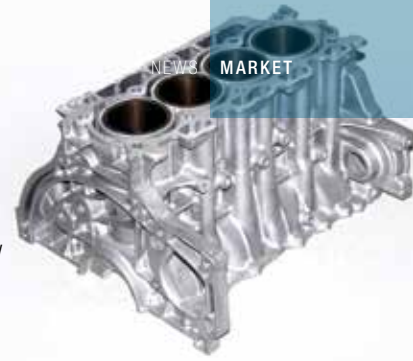
Posco to invest \$12 billion to set-up integrated steel plant in Odisha

Posco recently announced that it would set up an integrated steel plant in Odisha, India, with an investment of \$12 billion. The Indian Chamber of Commerce in association with IPICOL, Government of Odisha, organised the roundtable on 'South Korea & Odisha: Promoting Bilateral Business Opportunities' on April 19, 2021, in Bhubaneswar. Capt Divya Shankar Mishra, Minister – Industries, Energy, MSME & Home, Government of Odisha, briefed that Odisha & Korea have many possibilities to collaborate across the identified focus sectors of the state. He also said that Odisha is in the process of implementing a strategy document, Vision 2030, which aims to ensure that 50% of the primary metal produced in the state value-added with Odisha. Dr Nitin B Jawal, IAS, Special Secretary, Department of Industries & MD, IPICOL, Government of Odisha, showcased the strength & diversity of Odisha through an AV. He also elaborated on the Vision 2030 of Odisha and informed that Odisha is expecting an investment of 200,000 crores.

National Engineering Industries and Amsted Seals announce joint venture to manufacture railway bearing seals in India

National Engineering Industries (NEI) and Amsted Seals recently announced a joint venture (JV) to manufacture railway bearing seals in India. With an installed capacity of two million seals per year, Amsted Seals will be supplying products in India as well as in international markets. The JV will be a big step towards supporting the vision of self-reliant India to set up best-in-class manufacturing infrastructure in the country. Speaking on this development, Rohit Saboo, Director, NBC-Brenco and President & CEO, NEI, stated, "This collaboration is a significant step towards diversifying our product range and offering complementary products to our customers in railways around the world." Further, Michael Carter, Director, NBC-Brenco and President, Amsted Rail Company, asserted, "We are looking forward to developing localised India seal manufacturing capabilities with our long-time partner NEI. Our newly constructed seal facility in Jaipur, India, will be state-of-the-art with the ability to serve both the domestic India market, as well as the world rail seal market."





Jaya Hind Industries expands technical cooperation with KS Huayu Alutech GmbH

Jaya Hind Industries, which has had a 12 year-long successful technical tie-up with KS Huayu Alutech GmbH (KSATAG), recently announced that the agreement to manufacture automotive cylinder blocks and cylinder heads is extended till 2027. The scope of the agreement has also been expanded to cover new parts from Sunrise Industries, such as Electric Vehicles (EV), structural parts for chassis, etc. KSATAG belongs to the renowned automotive supplier KSPG, with operations in Germany and China. It has also been active in the Indian market for many years. Since 2007, KSPG's subsidiary Pierburg India in Takwe near Pune, produces bearings, pumps and components for emission control for the Indian automotive industry. The objective of expanding and extending the cooperation is to offer its customers the combined strength of partners who now have a global footprint and have synergised to offer critical products that are made by following standardised global processes that ensure standard global quality. Both companies, as partners, are now able to offer a unique combination of world-class technology from KSATAG at an affordable Indian cost structure.



Siemens and Google Cloud to cooperate on AI-based solutions in manufacturing

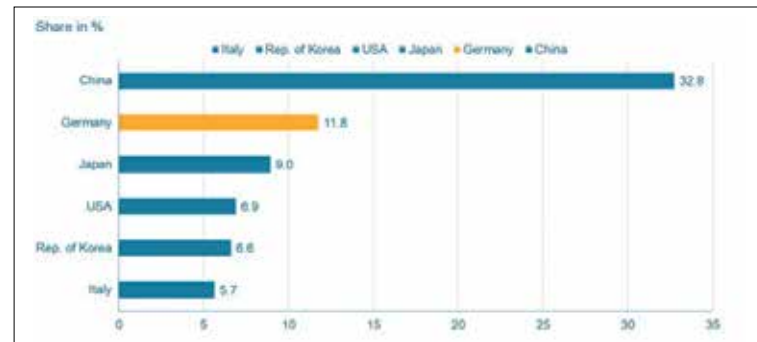
Google Cloud and Siemens recently announced new cooperation to optimise factory processes and improve productivity on the shop floor. Siemens intends to integrate Google Cloud's leading data cloud and Artificial Intelligence/ Machine Learning (AI/ML) technologies with its factory automation solutions to help manufacturers innovate for the future. Discussing the potential of AI, Axel Lorenz, VP – Control at Factory Automation, Siemens Digital Industries, cited, "The potential for AI to radically transform the plant floor is far from being exhausted. Many manufacturers are still stuck in AI 'pilot projects' today – we want to change that. Combining AI/ML technology will be a game-changer for the manufacturing industry." Adding to it, Dominik Wee, MD – Manufacturing & Industrial, Google Cloud, briefed, "This cooperation will combine the best of both worlds and bring AI/ML to the manufacturing industry at scale. By simplifying the deployment of AI in industrial use cases, we are helping employees augment their critical work on the shop floor."

Indo-German trade in the engineering sector in 2020

India was one of the first countries to grant diplomatic recognition to the Federal Republic of Germany; this March, the two countries celebrated 70 years of diplomatic relations. In September 2020, the German government laid out its Indo-Pacific guidelines illustrating its interest and commitment to a region where India is a key protagonist. Germany is the seventh largest foreign direct investor in India. Germany's total FDI in India from April 2000 until June 2020 amounted to approximately \$12 billion. Bilateral trade between the two countries in 2019 was valued at more than €21.3 billion. In 2020, Indian imports from Germany amounted to €10.7 billion, out of which machinery imports comprised 21.5% and stood at €2.3 billion.

India ranks 19th globally in the list of top 50 destinations for the German mechanical engineering exports. In 2020, the total import of machinery from Germany reached a volume of €2.3 billion. This was a drop by 23.6% compared with the same period of time in the previous year owing to the pandemic. India exported machineries to Germany to the tune of €688.2 million in 2020, which was a drop of 9.2% as compared to the previous year. Among the machinery sectors, a major demand for German equipment was for power transmission (12.7%), valves & fittings (5.8%), machine tools (5.7%), air handling technology (4.9%) and construction equipment & building material machinery (4.8%). There are other sectors, like plastics and rubber machinery, fluid power equipment, textile machinery and food processing & packaging, which are growing steadily in India.

Out of the total export of German mechanical engineering to Asia of €37.7 billion, India is the fourth largest sales market in Asia for the German engineering industry, with a share of 6.2%, after China (48.1%), Korea (7.6%) and Japan (6.8%). In 2020, India imported machinery of the value €19.6 bn globally. Germany is the second most important supplier to India globally, with a share of around 11.8%. With around 44% share of German investments, Maharashtra remains to be the most attractive destination for German investments in India. In the last four to five years, Pune has become the hotbed for new German investments.





“The goal is to help vaccinate and save lives through innovative technology”

...mentions **Jesal Doshi**, Deputy CEO, B Medical Systems – a global manufacturer and distributor of medical-grade devices – in his conversation with Anvita Pillai. He discusses the effects of the pandemic, the innovation enabled, new manufacturing facilities and more. Excerpts...

Each company had its share of deceleration and accelerations during the initial pandemic period. Being a medical systems provider, can you elaborate on the deceleration/acceleration encountered?

In 2020 & 21, you had many significant partnerships, like Spicejet, Toyota, Seiki, etc. Could you explain the strategic importance of these partnerships to strengthen your global position?

With the recent MoU signed with the Adani Group, how far along are you from inaugurating the state-of-the-art solar-powered vaccine logistics solutions in India? Can you glimpse us at the manufacturing facility & the technology it will host?

How has technology innovation, especially during the pandemic, ensured B Medical stays relevant to the demand and need?

Can you elaborate on your organisation's long- and short-term goals and roadmap to achieve those?

COVID-19 brought a lot of focus to our, i.e., medical refrigeration industry. Our biggest driver was the vaccine roll-out. Despite being a global leader of the vaccine cold chain for the last 40+ years, we witness an unprecedented demand wave across our products. The biggest challenge has been to keep our production running, but thanks to our employees, we have not lost a single day of production.

Our partnerships have helped us with the proximity to the end-customers and to serve them faster. Our partnerships with Adani Group, Spicejet and Omega Seiki in India helps us cater to the needs of the Indian market more efficiently. The partnership with Toyota (at the global level) has helped us develop the world's first and only WHO pre-qualified refrigerated vehicle. Recently, we also started a partnership with Kuehne and Nagel in Luxembourg. These partnerships are a testimony to the trust these organisations have in us and our products.

There are two aspects here: Firstly, the commencement of our local manufacturing in India. Our Indian facility, within just five months, is already manufacturing vaccine boxes and carriers for the Indian market. Secondly – our broader partnership with the Adani group. We are working feverishly on this second manufacturing facility in Mundra Port; it will produce our entire range of vaccine cold chain products and be operational over the next three months. The idea is to bring several innovative technologies across different areas, such as cooling technologies, monitoring/IoT solutions, as a made in India product.

Our core strength and innovation have helped us in developing ultra-low freezers. It offers storage between -20°C to -86°C and can work in extremely high ambient temperatures in hot zones, remote temperature monitoring devices, health centre kit, etc. These products had a huge impact during COVID-19; for example, the same ultra-low freezer could store both Pfizer & Moderna, offered much-needed versatility to several countries across the world in extremely harsh and demanding conditions.

Our goal is to help vaccinate the entire world and save lives through reliable, innovative technology. We will continue developing new, innovative products and expanding to new regions to achieve these goals. We have a global presence across the USA, manufacturing facilities in Luxembourg and India and a state-of-the-art R&D centre.



“Bringing about change in an established industry requires grit”

...says **Sonam Motwani**, Co-founder & CEO, Karkhana.io – a manufacturing & hardware start-up that provides a prototyping platform for the manufacturing sector – in this interview with Julli Eklahare. She explains her company’s mission of working with various types of manufacturers, how start-ups should pitch for funds & how the company has used the COVID-19 pandemic to its advantage. Excerpts...

Can you elaborate on when you say that the manufacturing industry is highly unorganised? How is Karkhana.io trying to change it?

Finding the right manufacturing vendor is a tedious and time-consuming process. The industry is still highly fragmented. There is no easy way to figure out which manufacturing process to go for, where to manufacture, what is a fair price to pay, etc. We want to change this so that new products can go from prototyping to production seamlessly at a much quicker pace. Our mission involves working with various types and sizes of manufacturers throughout the country and alleviating pain points prevalent across the supply chain. By working closely with a large network of manufacturers, our start-up can integrate operations for clients as well as gain control over the quality of work delivered.

Your start-up recently raised seed funding of \$1.5 mn. How, would you advise, should start-ups pitch for funds in the industry?

Firstly, the start-up needs to figure out if they need funding at all at the stage that they are at. Secondly, they need to look at how much funding they need, what could potential sources of funding be that would work for them and then make their pitch ready for the identified source. Also, it requires some endurance to keep at it, pitching to different sources, refining the pitch till one gathers interest and repeating the process till the deal is sealed.

How do you think the manufacturing industry can make the job of onboarding digital tools much easier, given that it’s necessary for digital penetration into the sector?

Making manufacturing more approachable for businesses, small and large, by turning the supply chain process into an accessible piece of online technology will be a tremendous growth lever for this industry. The penetration will increase if the digital tools are simple to onboard without the need for additional infrastructure and enable manufacturing suppliers to manage projects more effectively while ensuring a continuous increase in business for them.

How have you used the COVID-19 pandemic to your company’s advantage?

Amidst the difficult economic landscape, bringing about change in an established industry requires grit, innovative thinking, as well as action, which we have cultivated in our start-up since day one. We started working with our supplier network in injection moulding, machining and fabrication to mass-produce PPEs. We also tied up with other healthcare companies and helped with the procurement of tools to manufacture masks, swabs for COVID testing, ventilator parts and other products which were in shortage.

What do you have in mind for your company one year down the line?

We are aiming for rapid growth in the number of projects and new customers this year. And to fuel this growth, we are working on digitising the manufacturing experience for customers through our Quote-to-Delivery platform as well as strengthening our supply base further. Increasing the adoption of technology in our supply chain is helping us get ready for the next stage of growth.

India on its way to become the next electronics manufacturing hub?



Juili Eklahare, Features Writer

The electronics manufacturing industry is one of the fastest growing globally. With 3% share of global electronic production, India may seem to be ahead to become the global electronics manufacturing hub, and it is gradually getting there. Plus, we have the NPE 2019, which aims at endorsing ease-of-doing-business for the Electronic System Design and Manufacturing (ESDM) sector and the Electronics Manufacturing Clusters (EMC) scheme, which plans to encourage the establishment of greenfield and brownfield electronic manufacturing clusters to navigate growth in ESDM.

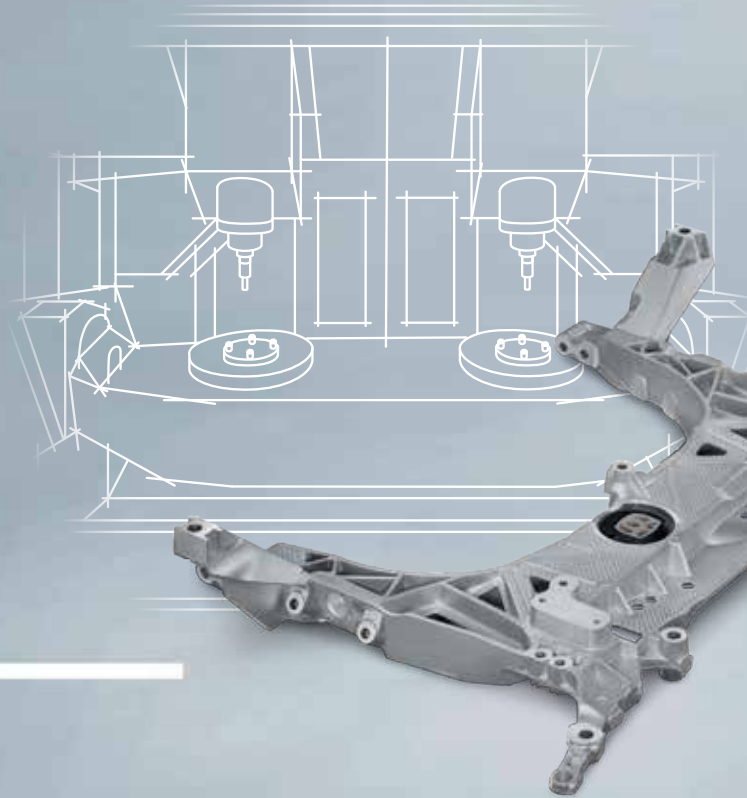
With the likely growth rates of the Indian economy, our role in global consumption of electronics in value terms is expected to double to 7% by 2026. In fact, the Andhra Pradesh cabinet recently approved the state's new electronic policy which helps the creation of top-notch electronics manufacturing infrastructure. The new electronics policy 2021-24 also intends to get a gigantic market size of \$400 billion from the present \$104 billion. What's more, the government plans the advancement of a world-class greenfield electronics manufacturing cluster being developed at Kopparthi in Kadapa district & generating over 39,000 direct jobs in the electronics manufacturing segment, employing women majorly. The India Cellular and Electronics Association (ICEA) recently said that as the Indian government renews its thrust on domestic electronics manufacturing with various incentive-linked schemes, the country has a great opportunity as well as required capabilities to establish a full-fledged semiconductor fabrication (FAB) electronics manufacturing ecosystem in the country.

However, there is lots to achieve. The Indian manufacturing sector is on the road to recovery from an immense contraction in the first quarter of FY 2020-21 due to the COVID predicament and the electronics manufacturing segment is destined for pretty much the same. Furthermore, the Indian policy is also under great constraint because of geostrategic and global affairs. And let's not forget the other challenges, for instance, the fact that the electronics industry is frequently altering due to disruptive innovation, thereby growing the pressure on the value chain to improve unceasingly, or the exponential rise in e-waste.

However, the domestic electronics manufacturing sector in India has seen noteworthy progress in the last six years. Production of electronic goods in the country went up by 187% from ₹1,90,366 crores in 2014-15 to an estimated ₹5,46,550 crores in 2019-20. Moreover, with shifting world dynamics and the colossal impetus from the Indian government for Aatmanirbhar Bharat, India has ahead of itself a vast prospect of being a global electronics manufacturing centre.

The stimulus by the government will provide more inspiration for domestic manufacturing as India gets ready to be the ensuing global hub for electronics production and exports. With future investments in electronic components & semiconductors, the country looks ready to embrace another surge of progression in the electronics segment. Furthermore, this changeover will be driven by beneficial investment policies, rising research initiatives and a huge young population.

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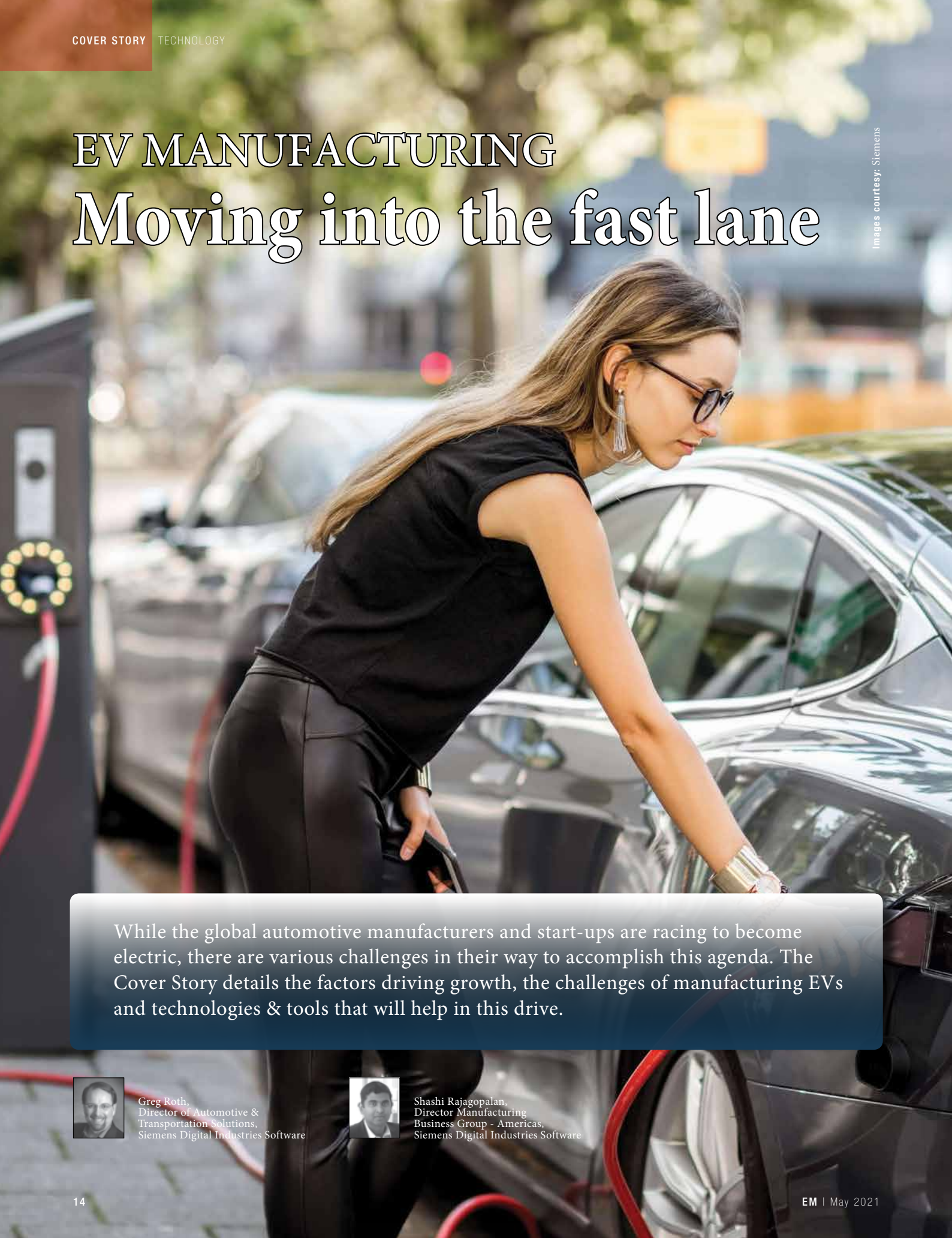
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EV MANUFACTURING

Moving into the fast lane

Images courtesy: Siemens



While the global automotive manufacturers and start-ups are racing to become electric, there are various challenges in their way to accomplish this agenda. The Cover Story details the factors driving growth, the challenges of manufacturing EVs and technologies & tools that will help in this drive.



Greg Roth,
Director of Automotive &
Transportation Solutions,
Siemens Digital Industries Software



Shashi Rajagopalan,
Director Manufacturing
Business Group - Americas,
Siemens Digital Industries Software

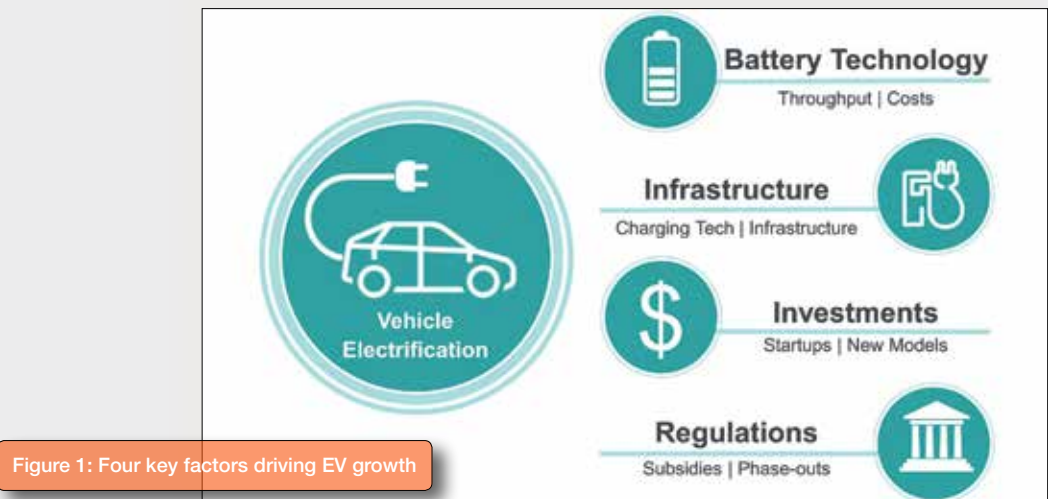


Figure 1: Four key factors driving EV growth

Major automotive OEMs and new start-ups are well entrenched in the pursuit of Autonomous, Connected, Electrified and Shared mobility (ACES). Dozens of companies have established programs for designing and testing autonomous and connected vehicles, either for personal use or as part of a shared mobility system. Progress is being made, but large-scale, real-world applications of these technologies are still years in the making. Electrified mobility, on the other hand, has the potential to create significant short-term disruption in the automotive industry and is already on the way to mainstream adoption.

The recent and rapid growth of Electric Vehicles (EVs) is driven by several factors (figure 1):

- Key EV technologies, such as batteries, are improving faster than expected
- Greater regulatory pressure at national, regional and city levels is driving early adoption of what is perceived to be a new norm
- Intense investment into EV programmes and start-up companies from a variety of sources, both traditional automotive companies and new entrants to the market
- A growing network of EV charging stations is making it easier and more convenient to use an EV every day

The effect of these driving forces is evident in the growing adoption of EVs by mainstream consumers. EV sales have seen steady growth over the last five years. EVs are projected to match the sales of Internal Combustion Engine (ICE) vehicles by 2030 and to surpass them by 2040. To meet this increased demand and remain competitive in a changing market, automotive manufacturers will need to ramp up their ability to manufacture EVs at volume.

Challenges of EV manufacturing

EVs present new challenges that major automotive brands and start-up companies are yet to face. These challenges fall into four areas: lightweighting, the transition to EV platforms, battery production and supplier evolution.

Drive range and vehicle cost continue to be central concerns of consumers. Automotive manufacturers must maximise the driving range of their vehicles while continuing to reduce costs through more efficient production. Vehicle weight is a major determiner of drive range; a 10% weight reduction can improve fuel economy up to 8% (Shea, 2012). Unfortunately, electric drivetrains and batteries are significantly heavier than ICE powertrains.

To counteract the increased weight of electric powertrains, vehicle manufacturers are incorporating advanced lightweight materials into the vehicle body. Replacing conventional materials with lightweight magnesium and aluminium alloys or carbon fibre can reduce the weight of a vehicle body and chassis by up to 50%. Vehicle manufacturers must incorporate these materials intelligently and ensure that weight reductions do not compromise vehicle safety.

Drive range is also impacted by the size and chemistry of the vehicle batteries. Many EVs currently in the market are adapted from pre-existing ICE vehicles. Due to differences in the packaging of ICE and electric powertrains, these non-native EVs compromise battery size to fit into the existing architecture (figure 2). Manufacturers are shifting to modular native EV platforms, both to better accommodate electric powertrains and to support high-volume production. Native EV platforms can accommodate battery packs that are up to



Figure 2: Native EV platforms provide more configuration flexibility and greater drive range by accommodating larger battery packs

25% larger, providing greater drive range and support flexible powertrain configurations (Chatelain, Erriquez, Moulière, & Schäfer, 2018). Advances in battery chemistry will continue to improve the energy density of these batteries, further improving the range.

The cost to manufacture and purchase EVs will decline as production increases but reaching price parity with ICE vehicles will require additional advancements in battery production methods. Batteries are the main contributor to the cost of EVs. The production of battery cells is the primary challenge, accounting for 70% of the total cost of the battery pack. Improving cell chemistry that increases energy density will help, but battery manufacturers will need additional means of reducing cell production and battery pack assembly costs to deliver cost-effective vehicle batteries.

Finally, the automotive OEM and supplier relationships will become more important and more complex. For automotive OEMs, this transition will present new challenges in managing their supply chains, including lead-time, quality assurance, and traceability of the product lifecycle across organisations. Suppliers will see a great opportunity for growth and evolution into providers of more complete vehicle sub-systems. With growth, however, comes additional risk. OEMs will set aggressive time-to-market goals for increasingly complex systems. In addition, suppliers will need to ensure robust collaboration and traceability procedures are in place as they work with OEMs and other suppliers.

Major automotive manufacturers have already embarked on the transition to EV manufacturing, triggering the largest automotive transformation in decades. Automakers will need to adapt or replace the processes, technologies and tools used throughout the enterprise to overcome the challenges of EV manufacturing.

The digital twin moves EV manufacturing into the fast lane

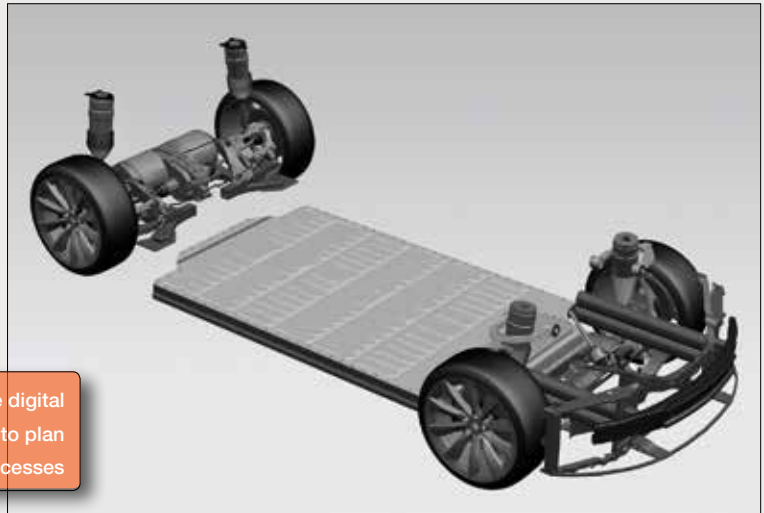
Creating a digital twin of the product and the production can solve the challenges of EV manufacturing by blurring the boundaries between design and manufacturing, merging the physical and digital worlds. Digital twins of the production process and production system are key to driving operational efficiency improvements through the factory of the future concepts. These digital twins capture physical asset performance data from products and factories in operation. The data from smart connected products in the field and factory equipment is aggregated, analysed and integrated into the product design as actionable information, creating a completely closed-loop decision environment for continuous optimisation.

This comprehensive digital twin comprises many digital threads that weave together cross-domain engineering between mechanical, electrical and software domains along the product and production lifecycle. Data analytics, cloud and IoT enable closed-loop performance engineering that spurs continuous improvement of design, manufacturing and performance. Such a comprehensive digital twin enables manufacturers to plan and implement manufacturing processes for new lightweight designs and modular vehicle platforms while reducing the costs of battery production and coordinating across deep supplier ecosystems. This approach will not be optional but will be required for automotive companies as they transition into the dynamic and fast-paced future of their industry. Let's examine how the digital twin helps solve each challenge:

Lightweight designs

The integration of new materials into vehicle architectures

Figure 3: Engineers can use the digital twins of these sub-assemblies to plan and evaluate manufacturing processes



is key to many manufacturers' strategies for reducing the weight of vehicles while maintaining vehicle safety. These new materials, however, introduce new manufacturing constraints. For example, the increasing use of aluminium and carbon fibre to create vehicle bodies has caused the adoption of new joining technologies.

A digital twin of the production process enables engineers to evaluate multiple methods of joining vehicle components, including joining technology and tool orientation, to identify the most accurate and efficient process. For instance, laser welding requires high accuracy, especially when dealing with complex component geometry. Using a digital simulation of the product components and robotic welding, a programmer can quickly define a welding seam on the product geometry that accounts for robot collision constraints and configuration to produce a single welding seam.

New materials are not the only change agent related to lightweight vehicle design and manufacturing. Advanced technologies, like Additive Manufacturing (AM), can also contribute to the reduction of vehicle weight by enabling the production of more sophisticated component geometries. AM allows engineers to reimagine the product design to expand their capabilities, improve performance and reduce material usage and weight. The intelligent use of AM can produce astounding results. AM has become a major piece of Ford's manufacturing ecosystem. One of their AM applications, according to Ford, has the potential to save the company more than \$2 million (Goehrke, 2018).

EV platforms

As manufacturers shift towards native EV platforms, their assembly processes will need to shift towards a more modular

build environment. In addition, strategic alliances between global automakers will be important methods of gaining access to foreign markets, diluting the cost of platform development and accelerating supply chain optimisation through scale.

Assembly methodologies, processes and tooling will evolve to support these modular build scenarios that can quickly adapt to market conditions. As a result, manufacturing planning must be digitalised to become more agile and integrated. Leveraging a digital twin of the product, engineers can evaluate manufacturing methods virtually, analysing multiple tools, assembly sequences and production line configurations while identifying and resolving issues (figure 3).

For example, vehicles contain hundreds of parts that need to be assembled. The planning team can define assembly processes that identify the tools and equipment needed to assemble each product and the sequence in which this assembly should occur digitally. Advanced process planning solutions help planners allocate vehicle parts to new assembly processes and can identify parts that have yet to be processed. Each of these processes can then be allocated within the manufacturing facility to define and validate the assembly sequence.

Battery production

Reducing the cost of battery production is a critical step to the success of EVs. Integrated digital solutions can help battery producers achieve cost-effective batteries by connecting battery design with manufacturing and establishing a digital thread throughout the flow.

Advanced battery design and simulation solutions enable engineers to optimise cell design and performance at the early stages of development. Cell geometry can be defined and optimised in the context of the battery modules and final

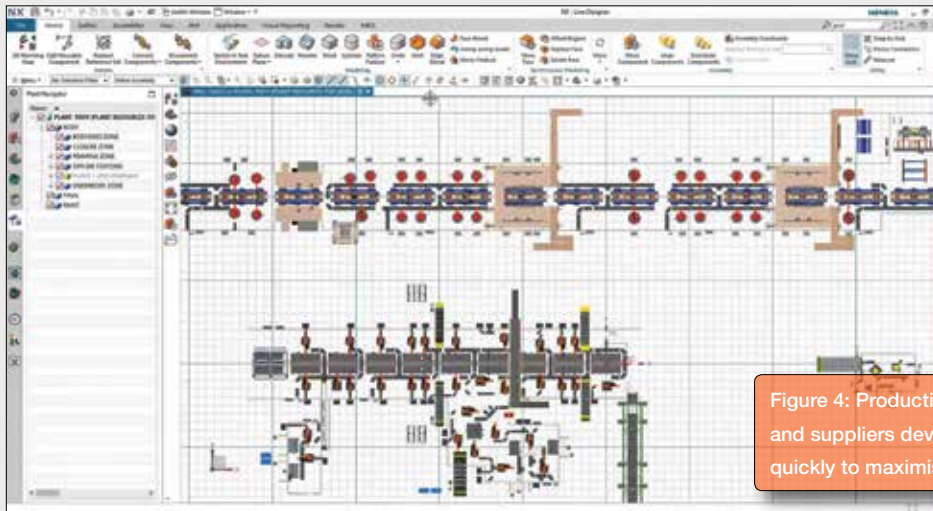


Figure 4: Production digital twins help manufacturers and suppliers develop new production capabilities quickly to maximise each facility and line

package. Then, battery cells, modules and packs can be evaluated in a virtual production process, enabling engineers to design flexible, efficient processes across all fields of cell, module and pack assembly. This caters to the market demands for improvements in efficiency and cost along the entire value chain in battery manufacturing.

Supplier evolution

Leveraging a comprehensive digital twin will enable OEMs and suppliers to collaborate effectively and efficiently under tight delivery timelines. Such a digital twin facilitates model-based definition and engineering that can help improve designs for manufacturing processes. Assembly variation analysis and automated feature-based CMM programming ensure first-pass manufacturing quality and can identify root causes of product defects. The digital twin can also be used to plan quality inspections and tie these to change management processes. With these capabilities, OEMs and suppliers can achieve faster quality ramp-up with root-cause analysis that feedback into product design change processes.

Suppliers will also need to remain flexible to short lead times and accelerated evolution of assembly methods to meet variable demands. Digital twins of the production facilities will allow these companies to make the best use of existing

capabilities while quickly identifying and designing new production lines or assembly processes (figure 4). If additional production lines or new assembly processes are necessary, manufacturing engineers can design these additions in the context of the current factory, verifying floor space and layout.

Digitalisation leading to acceleration towards EV

EV manufacturing presents new and novel challenges to automotive OEMs and start-ups seeking to become major electric mobility players. These companies will need to adopt advanced manufacturing technologies, such as AM, and develop modular production facilities to produce the lightweight and flexible platforms needed for next-generation EVs. Cost reduction and coordination across the manufacturer and supplier ecosystem will also be critical to fostering the growth of EVs in the market.

Integrated and digitalised manufacturing planning and simulation solutions can help these companies adapt and overcome these challenges by uniting manufacturing with design and the real-world with its digital counterpart. Such solutions will enable vehicle manufacturers to accelerate their production planning and ramp-up by virtually designing and validating production processes for cycle time, product quality and operator ergonomics. □



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“Flexibility still plays a major role in running the business”

...says **Suresh KV**, President & Head of Region, ZF India (a part of ZF Friedrichshafen AG – a global leader in driveline and chassis technology). In this tête-à-tête with Juili Eklahare, he talks about how the company has learnt from its experience last year, how leaderships have to be vigilant and how ZF India is working for sustainability. Excerpts...

How and what does ZF India continue to learn today from its global experience and other regions in order to grow through the pandemic?

We have been carrying out our learning experience right from February 2020, between the different ZF entities. We found out the precautions that were taken to ensure that the pandemic is not spreading in the ZF locations in China and,

the same was implemented in India as well. We started to make the same connection with our other organisations in Europe & the US. There is a single point of contact in every region who is in touch with all the coordinators of all the

regions and makes sure that the data in terms of the new developments related to the spread of COVID-19 is being shared. Plus, in India, we started learning not just from the ZF locations but also our JV locations.

How have you guided/helped your customers in understanding the changing demand through the pandemic? Once we enter the post-COVID world, how do you plan on making them most aware?

Last year has taught us a lot. For instance, when the shutdown was announced in Maharashtra, we talked to customers to understand how they are doing, looking at how their factories are operating, making sure that we exchange views in terms of how each area is going to react, etc. We also started looking at how each region is operating and began to be transparent with the customer – we have been keeping them informed about how we are operating, how our operation pattern is, about the areas where we are critical & comfortable and so on. So, it's a strong communication channel we have kept open with our customers & all business partners.

You say that supply chain risk should be reduced for a healthier future. What is your advice on achieving that and not being dependent on one region alone? What are the weak links in global supply chains that COVID-19 has exposed?

If we are dependent on a particular region and if that region goes through a difficult time, then there would be immediate disruptions in the supply chain, leading to disruptions in manufacturing & the business. So, it's important to minimise the risk. With the Aatmanirbhar Bharat & 'Make in India' initiatives, it is important that





An industry leader and veteran, Suresh KV brings with him a rich experience spanning over two and half decades in the automotive industry. He is responsible for the governance and overall growth of businesses of ZF India. He holds a PGDM in Manufacturing Management from S P Jain Institute of Management & Research, Mumbai.

we have the majority of the supply chain locally. However, this can't be done overnight. Therefore, we need to start working on this in such a way that we have a healthy combination of partnerships with business partners who are the best in the world but also with a medium-term view that we should be more dependent on the local supply chain. Coming to the weak links, supply chain disruptions topped the list as far as difficulties were concerned. It comes down to 'should we keep higher inventories' or 'should we ensure that it's just-in-time supplies'. Here, too, we need a healthy combination of both. Flexibility still plays a major role in ensuring that the business is capable of running at all times.

With intense talks about climate change around the globe, is ZF India taking any prominent steps to profoundly address climate risks in its operations?

ZF has taken this as a major step, both at the local & corporate level. All our entities are working to ensure that we are utilising more of solar power for usage within the factories. For instance, in Pune, we have a majority of our requirements coming from solar panels that are above the factory and also in the plant. Additionally, we have been working on creating greenery in & around the plants and supporting various initiatives through CSR to ensure greenery is being protected.

What do you think should be the top priority for the auto-component industry right now in India?

An important upcoming aspect is digitalisation, and we need to ensure that we are as digital as possible today. Plus, we need to make sure that we are supporting the industry in the

transformation from the traditional internal-combustion engines to electrified vehicles. It is a defining moment, but it is important to see how flexible we are. When the announcement of BS-IV to BS-VI happened, there was a lot of speculation about whether we will be able to meet the change. But despite COVID, we came out successful in this transformation. Thus, the important thing is that the leaderships of organisations have to be vigilant to be capable of transforming the organisation, without creating disruptions for themselves.

“

*WE NEED TO ENSURE THAT
WE ARE AS DIGITAL AS
POSSIBLE TODAY*

How is ZF India strategizing its operations towards the changes in mobility?

We need to have a balance of how we support the industry with well-known technologies along with ensuring that

the industry gets the partnership from our company for new technologies as well. Our strategy is two-fold – firstly, it is to use India as a market for ZF products and secondly, to use India as a hub for supporting other entities. Basically, ZF looks at India as a revenue market and also a hub.

How do you view ZF India's performance in the ongoing pandemic till now? How do you see your company changing its strategies in the post-COVID era?

Like for the other industries, the last one year has been a V-shaped curve for us as well. In spite of all the pressures & difficulties, the last one year has been a satisfying one. It gives us confidence that we can tide through any such situations as long as we are extremely strong in communication & flexible in our approach towards the business. As for our strategies, we are refining them and seeing as to what the need of the hour is & how we can incorporate it into the strategy. While the broad things will remain, the minor things will change. □

Circular economy – A revolution in the orbit of sustainability

What is the common thread tying companies like Hitachi, Jaguar Land Rover, Dassault Systèmes, Tata, etc? The execution of a circular economy. Now, what exactly is Circular Economy? How does it affect the world? How will it affect India specifically? How can India work towards creating a circular ecosystem? The Viewpoint offers answers to these questions and touches upon the nitty-gritty of a circular economy, the benefits of manufacturing adopting it and how companies that haven't adapted to it can work towards establishing the circular business model.



Anvita Pillai
Sub-Editor & Correspondent
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“Circularity promotes resource frugality while driving business innovation”

In contrast to linear economy, Circular Economy (CE) redefines growth by avoiding waste and reusing, remanufacturing and recycling. Therefore, products are made to last long by using quality materials and optimising for disassembly & reuse cycles, making it easier to manage and transform/renew these goods. The goal of CE lies in preserving and enhancing natural capital via the controlled use of finite stocks and by balancing the flow of renewable resources. Circularity promotes resource frugality to protect the planet while driving business model innovation. Manufacturing industries can advance their goals and action plans with regards to CE and have minimal environmental harm while becoming more cost-competitive, through reduced use of raw materials, reusing recycled material, repairing by maintenance and modernisation services and recycling via end-of-life product services.

Companies can begin by shifting to more recycled or reusable inputs that entail a greater share in labour costs, benefitting workers and ascertaining companies are less dependent on raw materials with more price volatility. They can also invest in the skilling of qualified ICT professionals, since such personnel may be unavailable in adequate numbers. Also, entrepreneurs and institutins should shift from short-term to long-term value creation goals since that's what CE is all about.



Venkat Garimella,
Vice President – Strategy
& Alliances, CSR & EE,
Schneider Electric India



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Akanksha Sharma,
Global Head,
Social Impact & Sustainability,
Sterlite Technologies Ltd (STL)



“Transitioning to circular economy requires a holistic approach in operations”

Unlike the more widely used ‘linear’ or ‘source-produce-waste’ models, a circular economy looks to decouple economic activities from utilisation of limited resources. It involves ingeniously removing waste out of the entire system through recycling, reuse or other methods.

In a manufacturing set-up particularly, circularity is beneficial not just in terms of efficient use of materials but also in terms of fiscal and environmental benefits that span across the value chain – Zero Waste to Landfill for instance. At STL, this endeavour has helped us recycle, reuse and repurpose 93% of the waste we generated in FY20-21 ensuring it is diverted from landfills and can be used by other industries as a resource. In a country like India, which is the highest waste generator in the world, the opportunities are infinite. However, transitioning to a circular economy requires a holistic approach in overall operations to integrate business sustainability for waste optimisation, green supply chain development, keeping the environment and community at the very centre.

Diego Groiso,
MD, Let's Improve Ltd,
Principal Consultant -
Associate, Radtac



“Companies must define value for the organisation & the ecosystem impacted”

The Ellen MacArthur Foundation defines the circular economy as ‘a framework for an economy that is restorative and regenerative by design, decoupling economic activity from the consumption of finite resources and designing waste out of the system’. Implementing a circular economy can reduce costs, create brand value and increase employee engagement, giving purpose to their work. Manufacturing companies can apply the same lean manufacturing principles they are familiar with to circular economy initiatives, just at a larger scale. Companies embarking need to define value, not just for the organisation but for the ecosystem impacted during the whole lifecycle of the materials. Move away from a linear flow to a circular cycle of value and materials. Understand the whole materials cycle, all the process steps and everyone who gets impacted. Then continuously remove impediments to minimise waste. Design products to be pulled by the customers when ready rather than pushing them into the market. Finally, do not design the solution upfront. Iterate and experiment continuously using small batches.



Sunil Malik,
Managing Director,
RACE (Recycling and
Circular Economy)

“Circular economy helps sustain national economy & resources”

The concept of circular economy is like that of ‘water-clouds-water’. A circular economy represents an end-to-end process of uses and reuses while ensuring nothing is wasted. Imagine the dinosaur was drinking the same water that we use today. It saves foreign exchange and helps the national economy to sustain for long and sustains resources for development activities while giving the earth a chance to save itself. Collecting, recycling, reusing and recreation of waste are essential components of a circular economy. In such cases, producers, brand owners, manufacturers and importers are responsible for making the recycling of products sustainable and viable to achieve a circular economy concept. It begins from the mindset of attaining zero wastage, reducing carbon footprint & recreating.

Rajeev Mittal,
Regional Director -
India & SAARC,
Autodesk In



“Focus on better design, better use of data and better materials”

A circular economy is a closed-loop system that doesn't generate waste. Recycling is just one part of the circular process: It starts with product design and includes the business model and infrastructure that supports that product, from the supply chain to waste management. For manufacturing companies, with its closed-loop system, the circular economy can help increase profitability while reducing dependence on natural resources. A circular approach in our manufacturing systems can be immensely beneficial in India, creating a US \$624 billion annual value in 2050. The application of Circular Business Models (CBMs) is key to realising the circular economy. In manufacturing, circularity begins with design, and digital technologies, such as AI and ML, can enable a model that allows goods to be designed for extended use. To achieve circularity, we focus on three main areas – better design, better use of data and better materials. With 10 billion people soon to be living on the planet with finite resources, designing for a circular economy is the only way forward.

Ranjeet Koul,
VP & Country Manager,
APAC MEA,
Aeris Communications



“Circular economy provides ‘business opportunity’ worth \$1000 billion per year”

In a new paradigm that prioritises the need to take a comprehensive view of products and processes, a circular economy is an economical approach to eliminate waste and the continuous use of resources. It provides a 'business opportunity' which is estimated to be worth \$1000 billion per year. A circular economy path taken by India could result in significant annual benefits, as well as substantial reductions in congestion and pollution, which would have a snowball effect on the economy. There is a growing agreement among manufacturers that the only way forward for sustainable production and development is to transition from a linear model to a circular economy, thereby contributing to a more environmentally responsible and socially equitable society. Numerous leading organisations worldwide have successfully adopted circular business models and leveraged disruptive technologies to demonstrate the business case for circularity. Industries like infrastructure, plastics and agriculture are critical in the transition to a circular economy, and businesses in these industries can also improve their processes to make a difference.



Ramesh Ramadurai,
Managing Director,
3M India

“Start with thinking of the environmental and societal impact of operations”

For more than 150 years, our economy has been linear. The circular economy framework rethinks growth strategies that have a far-reaching impact on the environment and society. It moves from a consumption model to designing for reducing waste, recycling and ensuring that the waste doesn't go back into the environment but is reused and restored. Manufacturing companies continue to be the centre of focus in embracing the circular economy initiatives. It reckons to drive zero waste entitlement, maximising utilisation of all resources across each of its processes to minimise impacts to the ecosystem by adapting sustainable product designs through economically sustainable manufacturing processes. Businesses that want to be more sustainable need to start thinking of the environmental and societal impact of operations right through their value chain. First, analyse what the company is already doing. Second, review the materials used and make sure that the impact of each material is maximised, and the least amount of waste is created. Lastly, partnerships with other businesses can create the biggest environmental impact.

Karthik Natarajan,
Executive Director,
President & COO,
Cyient



“Leveraging digitally-enabled platforms usher an inclusive, sustainable economy faster”

In principle, circular economy practices ensure that non-renewable items cycle through closed product loops at their highest utility for as long as possible. Taking a circular approach in business saves time, raw material and money. It opens opportunities to innovate, diversify and create new revenue streams. The premise of building a circular business is based on moving toward sustainability without compromising profitability. As we move towards connected factories or Industry 4.0, companies can easily monitor, optimise and maximise their operations with IoT and sensor technology. It would enable higher profits and a much lower carbon footprint – a start to decarbonising the world. There are greenfield and brownfield opportunities for it in India. For companies that haven’t adopted a circular economy, the most important step is to adopt a mindset of change and willingness to commit to specific ESG/SDG goals. Leveraging digitally-enabled platforms to co-create in ways that reduce costs, drive innovation and embrace environmental objectives can minimise negative impacts, maximise resource utilisation and usher us into a truly inclusive, sustainable economy faster.

Chandan Trehan,
Lead Strategist and
Business Development –
Blockchain,
Bosch Engineering and
Business Solutions



“Circular economy should be considered a tool to build financial control”

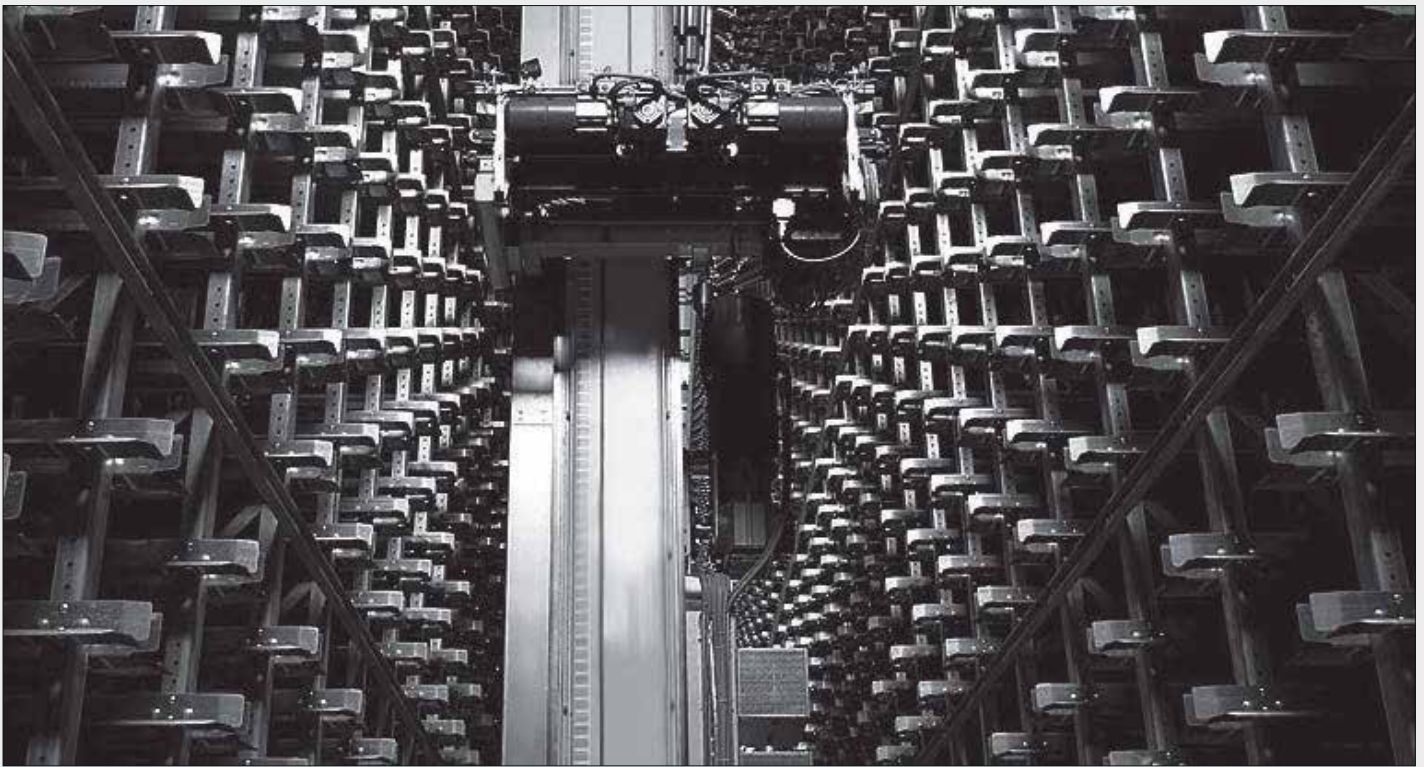
A circular economy is a closed-loop system that aims at minimising waste and maximising reusability. It is different from the recycling initiatives by the companies because recycling requires waste, and waste is the most fundamental thing that a circular economy aims to reduce or eliminate. Indian manufacturing companies can look at the circular economy as an opportunity to collaborate and create circular supply chains with an incentivisation model that promotes repair, reuse and refurbishing of products. Companies that want to adopt a circular economy should first start with one product or one region and learn and grow from there to all products lines. Secondly, companies should approach it collaboratively, rather than trying to solve the entire puzzle by themselves. Thirdly, technologies, like blockchain, enable creating a collaborative trusted network with a proper incentivisation mechanism to make products a part of the circular economy. Finally, a circular economy should be considered a tool to build financial control for arresting cost escalations, thereby helping companies increase their market share and not just a means to achieve sustainability goals.



Satyanarayana P,
Director - VI/LFP/RS/DT,
Epson India

“Circular economy provides opportunities to build a sustainable society”

A circular economy is a systemic approach to economic development designed to benefit businesses, society and the environment. It aims at eliminating waste and the continual use of resources by gradually decoupling economic activities from the consumption of finite resources. The material at the end of its use returns to the cycle with the same quality, which might not always apply in recycling. Its benefits to the manufacturing companies include reduced strain on the environment, improved efficiency, greater appeal to the public, shareholders & investors, better employee retention and reduced risk of losing market share to fast-moving challengers. India faces resource and energy consumption challenges, and a circular economy model offers vast opportunities for companies in building a sustainable society by developing recyclability & sustainable resources. Companies should aim to reduce waste, provide solutions for the collection and treatment of e-waste, remanufacture materials and add value to the supply chain. We encourage the efficient use of limited resources by making products that consume less power, require less replacement parts, are compact and also by collecting and recycling products.



Cold storage automation: Leveraging advanced technologies to meet increasing demand

With the cold storage industry growth projected at 4.5% by 2023 due to increased consumer demand, food producers are under a lot of pressure to evaluate where their products are produced versus where they are consumed. The farther away from the consumer, the more points in the supply chain before being consumed. By leveraging the right material handling automation, the future of the cold chain will be transformed and will assist in increasing efficiency. This article details specifics involved in considering automation as well as which automation technologies might be best.

A cold chain comprises a network of food producers as well as storage, transportation and distribution providers which ensure that fresh & frozen food reaches consumers. Automating a cold storage operation has common considerations, such as the unique operational requirements, technology selection and building design.

Market considerations

Analysts expect the cold storage sector to grow at a compound annual growth rate of 4.5% by 2023, as the demand

is ever increasing. Details show that frozen sales saw a large spike of 70% in March when news of the pandemic and ‘stay at home’ orders were implemented.

What does the data mean for cold storage?

Automation technology only further helps to meet the fast demand and achieve accuracy where errors mean product loss. Frozen or refrigerated returned goods likely cannot be resold because it’s unknown if or for how long the products had been in ambient temperature, creating quality control risks.

Key criteria for cold storage automation

Many items specific to cold chain's unique operations can impact the ability and level to which companies can automate.

- Do you have multiple temperature storage zones you need to maintain?
- How many shifts or hours do you need to run?
- What does your typical order profile look like?
- Are orders primarily in full pallet quantities?
- Do you have full layer orders and the need for mixed layer building?
- What about case level orders?

Breaking down each area of concern

Location and site selection

Facility location is an important factor. The location can greatly impact the access to the necessary labour market. Labour costs can be a huge driver toward automation, as the low temperature environment means associates have a limited amount of time in the freezer. Productivity and efficiencies in general become much lower compared to a conventional warehouse due to the limited time they can spend in the freezer environment. A facility's location can also influence the type of automation system configuration it can house.

Temperature

Another consideration in cold storage automation is that equipment might experience condensation build up, freezing or fogging based on where it is located within the facility. There can be temperature gradients at locations near doors, and it might require heated lenses or heated enclosures to ensure optical sensors work properly.

Technology & automated systems

When it comes to technology suited for cold storage automation, nearly all typical equipment in a conventional warehouse can be found in freezer warehouses. However, the equipment is specially designed with the temperature environment in mind, which does mean it's almost always more

expensive. Depending on the operation, goods might be stored in static racking within a low-bay conventional freezer building. If the throughput or inventory is high enough, the pallets might be stored with an Automated Storage and Retrieval System (ASRS). This system can utilise unit-load cranes or potentially pallet shuttles to facilitate the storage & retrieval of products. For smaller, lighter goods, a mini load crane or case shuttle might be used. These can help rapidly retrieve and sequence items as they are fed to downstream processes for mixed case palletising and order fulfilment.

- **ASRS unit-load cranes:** These are cost-effectively engineered to handle unitised loads in and out of high-density storage
- **Pallet shuttles:** These use a cart system to transport pallets quickly through deep-lane storage units
- **Mini-load shuttle:** Designed to store and retrieve small items in less space and time, they include lightweight alloys that increase speed & offer lower costs associated with installation, operation and maintenance
- **Automated forklifts (AGFs):** A massive facility overhaul comes with large costs that some operators might not be able to budget. Analysis and studies also realise that inventory might not move fast enough to fully benefit from an automated storage and retrieval system. An automated forklift on the other hand can be a great improvement for these operations without requiring massive overhaul or investment.
- **Robotic picking and palletising:** Full layer picking is another strategy that has made its way into cold storage environments. Robots can strategically pick one or more layers off a pallet to build what is often referred to as a 'rainbow pallet' or 'mixed SKU' pallet based on the customer's order.

Intelligent software

In a cold storage environment, efficiency encompasses energy use, reducing movement in and out of freezer areas to maintain temperatures, strategic packing to reduce product loss, inventory tracking, optimal workflows for employee comfort in cold zones, and the overall order fulfilment process. Integrated software is the key to a successful automated material handling system.

Warehouse software can give you the visibility needed to make the decisions that are crucial, particularly in a freezer



Dynamic optimisation through real-time inputs allows operators to apply knowledge gained from reports to optimise operations in a distribution centre

environment. With a variety of software solution options available, you can combine the existing software or implement a total solution. Either way, you'll be able to better leverage automated technology for a smarter and more cost-efficient cold storage warehouse.

- **Warehouse Management System (WMS):** WMS provides a suite of applications that enable an operation to plan processes within the warehouse, increasing efficiency. This software can manage receiving, returns, quality control, waving, picking and pack & ship.
- **Warehouse Control System (WCS):** The WCS system works to orchestrate material and information flow, organising order fulfilment & material handling equipment processes. It provides a single central interface to host the entire system from any variety of vendors and will react to feedback from automation & equipment to adjust workflows.
- **Warehouse Execution System (WES):** WES combines WCS and WMS functions to coordinate labour & equipment inside a highly automated facility. Dynamic optimisation through real-time inputs allows operators to apply knowledge gained from reports to optimise operations in a distribution centre.

Consulting: Strategic fulfillment design

Consultants are a key aspect for making decisions around the naturally increased cost of cold chain as well as specific requirements in relation to temperature or municipality requirements. Data collected during consulting is needed when considering every aspect involved in a cold storage operation – from location all the way to technology selection, a Facilities Master Plan will begin with project planning to define requirements and goals, source suppliers and design the system to determine the final layout & validate equipment selection to ensure a strong ROI. The final step is project implementation –

if desired, expert consultants can provide a true 'turn-key' facility by offering project management, review and supervision as well as support upon start up.

If an entirely new facility is not needed, an engineering consulting survey and study will give a customised roadmap for improving the current operation. Once data is gathered, consultants forecast changes based on growth or new requirements and provide recommendations to improve the facility overall. Consultants will define, measure, analyse, design and validate the entire facility.

Meeting market demands

It's abundantly clear that strategic planning for cold storage facilities is absolutely necessary to stay competitive, reduce product loss and make the most of these significant investments. Unlike traditional warehouses, the frigid environments take a tremendous toll on equipment and careful planning of supporting items like pallets or wheels, which can be easily damaged if not properly cold-rated or regularly inspected, is vital.

Knowing exactly what kind of cold storage environment you need for your facility – refrigerator, freezer or both – as well as the type of picking you expect to do – pallets, layers, cases or a combination – also helps to identify optimal layouts, the ideal technology and make adjustments for work needed to ensure operator comfort.

Automation reduces expenses and cost for labour, especially if you run your system in a three-shift operation. Optimising for storage density in the freezer zone is key for clients to have the right amount of inventory within the market area. Automation helps to leverage goods to person technologies, which is needed to help drive those efficiencies. A lot of companies are rapidly adjusting their supply chain to meet the market demands. They need to be out front to grab the market share. □

Courtesy: Bastian Solutions



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Lightweighting in automotive: A systematic approach for metal to plastic conversion

Lightweighting is a familiar term in the automotive industry and has been quite successfully implemented in the passenger car segment to improve fuel efficiency and reduce emissions to meet the stringent BS-VI emission norms by all OEMs across the globe. For any lightweighting programme to be successful, innovation in polymer compounds, part design integration and adaptable product design are required. The objective of the article is to focus on the Systematic Design thinking approach of explore, create and implement, which will provide a new roadmap to approach a new product development programme in an organisation, leading to the ultimate lightweighting solution.



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Autotech Sirmax India

When it comes to lightweighting, the first thing to strike the mind is polymer compounds as they are strong and lightest in weight amongst all the materials. In the recent developments in the automobile industry, the usage of polymers has surged significantly, as polymer compounding companies felt the need to develop innovative materials which are lighter in weight and better in strength than existing polymers. Automotive companies have benefitted from enhanced fuel efficiency and fulfilling

emissions targets and this has emerged as one of the key factors in increasing the usage of polymers.

Any material substitution comes with various challenges, especially when a high strength material, like a metal, has to be replaced with a polymer composite. We analysed various successful metal to plastic conversions in the last two decades and evolved a common methodology or approach to be followed. Below are some application examples commercially

implemented in the four-wheeler industry –

1. Front-end module
2. Air Intake manifold
3. Door modules
4. Engine covers
5. Gears/pulleys
6. Oil sumps

Systematic Design Thinking approach

Explore phase

In a metal to plastic conversion project, selection of a component is an important first step towards the successful implementation of the material conversion project.

Identify material conversion opportunity

There are some important aspects to be considered before selecting the component for replacing the material into a lightweight plastic material:

- **The manufacturing process and the part cost** – What type of material (steel, aluminium, MS, rubber, glass, etc) is used in the present component? What is the manufacturing process (diecasting, forging, sintering, machining, etc) in use? Are there any post treatments required on the component (anti-corrosive coatings, paintings, etc).
- **The key driver for changing from metal to plastic** – Is the cost or is it the improvement in the performance? Is it just lightweighting?
- **The part's function in the assembly** – Is it aesthetic, structural, semi-structural? Can we integrate some other parts in the assembly?
- **The surrounding environment** – Is there any exposure to aggressive chemicals, oils, gases, greases, etc?
- **The operating temperature and peak temperature** – Is the part subjected to any heat radiation from the adjoining systems?
- **The tolerances required in the final part** – Some polymers are hygroscopic and absorb moisture. The dimensions change during its service life.

Nylon 6 absorbs more moisture than Nylon 66 – the dimensional change between dry-as-molded and equilibrium at 50% RH, substantially less for Nylon 6. This implies that in a majority of cases, Nylon 6 would be more dimensionally stable when moisture absorption is the primary concern. This result does not consider factors, such as temperature variations, etc. Finally, these moisture absorption characteristics need to be considered when designing and building moulds to produce parts using any nylon material.

Define material specifications based on end product functionality

Once the part/assembly is selected for a lightweighting project, the next step is to select the compatible and appropriate material of choice which meets the functional requirements.

- The components subjected to repetitive force/pressure loading and unloading undergoes fatigue and after a certain number of cycles, it fails without any warning at a much lower stress than the typical yield stress. Typically represented as S-N curve, it stands for stress versus number of cycles of loading.
- A component under constant force will undergo creep (change in dimensions) over its lifecycle
- In case the temperature exceeds 100 °C, the strain is higher than at room temperature, resulting in higher deformation. The reduction in tensile strength, tensile modulus & impact strength at high temperatures should be considered along with stress strain curve of the polymer at higher temperatures.

Prepare techno-commercial value proposition of the opportunity

Estimate the cost economics by understanding the manufacturing process of the metal component. Numerous times, the post-process is cumbersome and expensive.

1. Any additional investment required
2. The cost of scrap and wastage
3. The cost of tooling and assembly jigs & fixtures
4. Any post processes
5. Metal inserts for strengthening

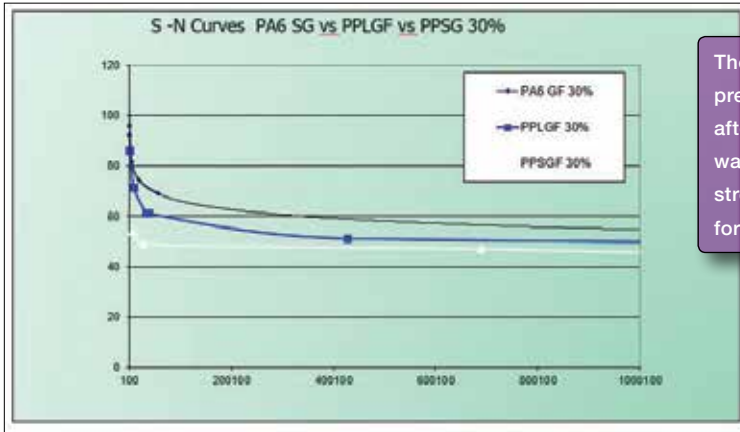
The scrap produced in a blow moulding process is particularly very high. For a part weighing around one kg, the scrap produced is 40-70% of the actual part weight. Higher the parts produced per year, lower will be the part cost and, break-even in the additional investment can be achieved earlier.

After completion of all the three steps, we can assess the actual cost of producing the part and the Return on Investment, in case there is higher investment required on the project.

Create phase

This is the creative phase in which the primary product requirements/specifications are documented and solution concepts are evolved. It starts with identifying primary, secondary and hidden requirements of the identified opportunity by listing them priority wise. These requirements are further sub-divided and solution concepts are created.

For the product concept design, benchmarking of product specifications and prototyping with this solutions template,



The components, when subjected to repetitive force/pressure loading and unloading, undergo fatigue, and after certain number of cycles, they fail without any warning at a much lower stress than the typical yield stress. Typically represented as S-N curve, it stands for stress versus number of cycles of loading.

we use the Systematic Inventive Thinking (SIT) templates on the final solution concept. The closed world condition is crucial for SIT’s methodology. The first step in using SIT is to define the problem world. Once defined, the problem solver knows that all the building blocks for the solution are right there in front of him/her and that the solution simply requires the reorganisation of the existing objects. This adds great focus and power to the method. It can also turn every real problem into an amusing puzzle.

The closed-world condition deals with the resemblance between the problem world and the solution world. The condition stipulates that in the development of a new product – or when addressing a problem – one must utilise only elements already existing in the product/problem or in the immediate environment. This condition forces us to rely on resources already at our disposal rather than ‘importing’ new external resources for the solution. Thus, the closed-world condition sets us on a collision course with our fixedness, allowing us to arrive at solutions which are both innovative (different from the usual) and simple (since based on existing and known elements).

Based on the above, we arrive at a final solution concept, Design of a Door module, which fulfils all the functional requirements. From here on, we move towards the prototyping stage. Conventionally, prototyping of a new product design was done after the CAE design validation stage, which fulfilled all the product specifications.

Rather than starting out with a detailed analysis of technical & user requirements and development of specifications, a typical process involves developing at quite an early stage in the process, a wide range of low-fidelity prototypes from which to learn. In this phase, the designers try to find multiple solutions to the same problem & go on improvising by making low fidelity prototyping solutions during the initial development stage and use them as learning tools to quickly test the key features of a product.

Basically, the product development happens by making and testing smaller versions of the bigger product by deploying only key features in the quickly made prototype.

These are made from inexpensive and accessible materials — such as paper or card, foam core or wood models or cost-effective 3D Printing or even soft tools. Through trial and error, we evolve and refine ideas to integrate multiple elements of design by gradually moving towards more real & expensive prototypes.

Implement phase

The last and final step is the ‘Detailed Part Design’, Accurate Tool design with proper gate location and cooling layout with aid of a flow simulation software, CAE and endurance testing in the above application conversions.

- a. This design needs to be validated structurally by simulating the pressure, forces etc, acting on the part by conducting CAE simulation to verify and optimise its strength.
- b. Part design modifications: Thickness optimisation, ribs, bosses, weldlines control at critical locations.
- c. Part and system level endurance testing which is the responsibility of the OEM & Tier-1s and is extremely critical to establish the functionality, fitment, durability and reliability of the part.

For any part to be converted from metal to plastic, the part has to be redesigned for equivalent strength and this can be achieved by using high strength polymer composites with geometrical modifications to achieve the similar strength as the original metal part.

Effective implementation of Systematic Design Thinking approach

To summarise, the Systematic Design Thinking approach has led to many breakthrough developments of applications in the field of polymers and has given us so many new innovative designs. In the future, the success of a new concept in polymers will depend upon how effectively the design thinking approach is implemented to create new innovation in material and application. □



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YOURSELF

2

QUALIFY

1. Select a title that is most appropriate for your position

- 01. Corporate / General Management
- 02. Director, Supervisor
- 03. Group Leader, Project Leader
- 04. Manager, Specialist
- 05. Engineer, Technocrat
- 06. Other

2. Select a title that describes your principle job function

- 01. Management
- 02. IT
- 03. Safety & Security
- 04. Risk Management, Accident Management
- 05. R&D
- 06. Design Engineering (Plant Engineering)
- 07. Project Planning, Production Planning
- 08. Laboratory, Test, Field Service
- 09. Explosion Protection, Fire Prevention
- 10. Manufacturing, Production
- 11. Quality Assurance
- 12. Reliability, Evaluation, Services
- 13. Energy & Environment Technology
- 14. Facility Management
- 15. Sales, Marketing
- 16. Purchasing
- 17. Warehouse, Transportation, Logistics
- 18. Consulting / Advisory
- 19. Education
- 20. Other

3. Select the industry which best describes your company's primary business activity

- 01. Industrial Machinery
- 02. Electrical & Electronics equipment
- 03. Communication & Information Technology
- 04. Power & Energy
- 05. Automotive Manufacturing
- 06. Steel / Metal
- 07. Optics & Precision Mechanics
- 08. Chemical & Pharmaceutical Industry
- 09. Bio- & Environmental Technology
- 10. Mining, Oil, Gas
- 11. Wood, Paper, Printing
- 12. Food & Beverage
- 13. Textile, Leather
- 14. Building Automation
- 15. Technical Consulting, Engg. & related services
- 16. Machine Tools
- 17. Plastics & Polymers
- 18. Construction
- 19. University, Education
- 20. Other

4. What is the approximate number of employees in your company?

- 1 to 9
- 10 to 19
- 20 to 49
- 50 to 99
- 100 to 199
- 200 to 499
- 500 to 999
- 1,000 to 2,999
- 3,000 & more

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Lean manufacturing: From shop floor to top floor growth for streamlined manufacturing

The pandemic has had a phenomenal effect on the shop floor functioning, and with it, the concept of lean manufacturing has started to gain prominence. The article explores the idea of lean manufacturing, key principles and how it can enable proficient supply chain management and growth.



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The buzzword in recent times has been COVID-19. The pandemic's impact has been phenomenal across the globe, with millions of people losing jobs and industries & enterprises pulling down their shutters. In spite of this, many organisations have been able to withstand and also perform better than others.

Manufacturing sectors have adopted unnumberable changes to fight out the pandemic's impact. This drives us to the focal point of having efficient manufacturing systems, and that's where the concept of lean manufacturing takes centre stage.

The history & value of lean

History indicates the birth of lean manufacturing to 1980

in Japan, under the umbrella of Toyota Production System (TPS), a concept brought in by Taichi Ohno and Eiji Toyoda. Just in Time (JIT) and JIDOKA (autonomation), being the two basic pillars of TPS, focus on the development of a lean manufacturing approach to provide the customer with the best quality, working on the reduction of inefficiencies in the manufacturing process.

Toyota Production System (TPS), also referred to as the Toyota Way, has been implemented and followed across the globe not only by Japanese companies but many other organisations. The TPS banks on the four important principles:

1. Long-term philosophy

In lean thinking, one key to eliminate waste is to make sure that the product or service has a complete and uninterrupted flow



2. Right process and right products: Sometimes referred to as Rhyohin Joken
3. People or human development: Invest, encourage and empower people
4. Problem-solving approaches at all levels

Lean manufacturing encompasses the above principles with a concept of minimising waste and maximising productivity with an objective to deliver high value to the customer.

Lean is also defined as a systematic approach to identify and eliminate waste (non-value-added activities) through continuous improvement by flowing the product at the pull of the customer in pursuit of perfection.

Waste: The term 'MUDA' in Japanese means waste. Primarily, there are seven types of waste that are the focal points in lean manufacturing:

1. Inventory
2. Overproduction
3. Over-processing
4. Motion
5. Waiting
6. Transportation
7. Rework (for defective parts)
8. Unused talent (recent addition)

Elimination of waste revolves around the activities leading to the reduced lead time and meeting the customer needs much ahead of the market, creating a wow feeling in the customers. Activities of cost reduction and optimisation through streamlining of operations give the desired results.

Key principles: The following important aspects support the success story of lean manufacturing:

1. **Elimination of waste:** In the process and supply chain

2. **Built-in quality:** Zero defect approach to the next process
3. **Knowledge enhancement:** Training and skill upgradation
4. **Employee empowerment:** By teamwork, respect and involvement
5. **Speed:** Delivering ahead of times
6. **Resources optimisation:** Man, material and energy optimisation approach

The success of lean manufacturing comes from various manufacturing concepts. Here's an insight into a few of them.

- a) **5S:** The 5S is defined as a methodology that results in a clean, uncluttered, safe and well-organised workplace to help reduce waste and optimise productivity. It's designed to help build a quality work environment. It is based on a framework that emphasises using a specific mindset and tools to create efficiency and value. It involves observing, analysing, collaborating and searching for waste and also involves the practice of removing waste.
- b) **Value stream mapping:** This is the process of studying the entire process flow and the supply chain to identify the wastes, inconsistencies, abnormalities, non-value-added works, duplication activities, etc and make an action plan for the elimination of waste & optimise the resources for efficiency improvement.
- c) **Pull system:** This system works on customer demand-based production and capacity planning. It promotes the production ignition based on customer pull or order bringing in the JIT scenario and is a key aspect of small lot productions. Production is based only on requirements, which is triggered by customer demand, through the Kanban system.
- d) **Kanban:** This is an essential tool that brings the pull system and JIT approach. Kanban in Japanese means

signboard, which is a visual tool controlling and indicating the product or the part process flow.

- e) **Continuous improvement:** Kaizen is a Japanese terminology for continuous improvement. It's about small and incremental changes in every process across all levels of employees. These can be spread in areas of safety, quality, cost reduction, productivity, etc. The improvements can be individual-based or as teamwork. Kaizen is promoted and followed in many companies as a motivational activity at the grass-root level. The same concept has spread across non-manufacturing sectors like banking, schools, etc.
- f) **Single Minute Exchange of Dies (SMED):** This is a process for dramatically reducing the time it takes to complete equipment changeovers. All activities related to reducing the MUDA of waiting take parallel actions to enhance changeover much faster and with shorter lead time between product changeovers. The SMED concept is based on the concept of 'pit stop' used in Formula 1 racing, wherein the four tyres of cars are changed in a few seconds with standardised activities, done with perfection. This is widely used in injection moulding, press shop & similar industries, where die changes are done in less than a minute.
- g) **Visual management:** Lean manufacturing metrics, such as lead time, cycle time, throughput, rejections, productivity and cumulative flow help organisations measure the impact of their improvement efforts. The process of collecting, analysing, visualising and acting through displays on board and monitors across the Gemba (shop floor) is a common practice in lean systems.
- h) **Built-in quality:** Rhyohin Joken (good condition for a good product) is a built-in quality concept, which relies on establishing complete poka-yoke from raw materials to finished products, including the skill of man to overcome any errors and produce a non-defective part. All the controllable factors of the process shall be made mistake-proof (by poke-yoke system) to avoid any defect outflow to the next process.
- i) **Standardisation:** The success of TPS lies in the strong platform of standardisation concepts or establishing standards and practising them. TPS emphasises identifying the specific standards of each & every process

and follow them to ensure repeatability and, therein, bring reliability to the process. Every action in Gemba is based on careful validation of the process parameters and establishing the same for mass production. Every member, at all levels, is trained to follow the standards from the shop floor to the top management.

- j) **Nichijo Kanri (daily management):** The important aspect of a systems' sustenance is about the ways of shop floor management, wherein daily management is the key. The NK concept talks about identifying specific activities (quality systems, poka-yoke systems, etc) of the day (Monday to Friday) to be carried out in respective areas with time and member responsibility; thereby, the system management can be monitored effectively. Its review shall be done by the engineers, managers and plant heads as well. It's about the maintenance and sustenance of standard work procedures and systems.
- k) **Genchi Genbutsu:** Go and see yourself. This practical approach of Japanese companies, where the members of the top management are encouraged to go to the work area to see, check and identify areas of improvement, is a powerful tool in the implementation of the lean system. The visual management, poka-yoke approach, pull system, etc, all need careful review and monitoring at periodic intervals. At the same time, whenever any abnormalities happen, the responsible person rushes to the spot of the incident/abnormal area, etc, to understand the situation, give direction suggestions and take actions.

This term was coined by Taichi Ohno at Toyota Motor Corporation to enable understanding the reality of the situation.

Lean supply chain management: In lean thinking, one key to eliminate waste is to make sure that the product or service has a complete and uninterrupted flow. Carefully designed flow across all parts of a supply chain will minimise waste and increase value to the customer. The use of technologies, like RFID tags, IoT, etc, has been at the forefront of establishing the lean principles across the entire supply chain, not only in the manufacturing process but also in the process of supplier partners. Handholding of suppliers and supplier development is important in establishing an effective and smooth flow, with the least inventory and quality products. Lean supply chain

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practices include examining their routings and their bills of materials, which is an extensive list of raw materials, components and assemblies required to construct, manufacture or repair a product or service.

It's always a challenge when it comes to implementing good manufacturing practices, and lean is no exception. Many organisations have understood and implemented lean manufacturing but have been struggling to sustain the same. Therefore, it's important for us to have a specific roadmap to have an efficient and effective lean manufacturing organisation.

The key steps in transforming a company to the lean approach are:

- Establishing a **steering team** — Conduct a strategic planning session
- Training the steering team and the model line team in the disciplines of lean
- Performing **Process Flow Analysis (PFA)**
- Identifying **value streams** — Select a value stream
- **Value stream mapping** the model line — Assemble the current state map
- **Balancing the line** — Assign the standard work
- Establishing **standard WIP** (inventory levels)
- Testing the system (virtual cell) — document the results
- Conducting 5S event — **Apply TPM** techniques
- Establishing **visual signals** — Reduce paperwork
- Exploring **alternative flow patterns**
- Developing **block layout**
- Developing **detailed layout**
- **Executing the final layout**
- **Following PDCA** approach and test for three months

Lean for growth

Lean manufacturing is a methodology that can help streamline and improve manufacturing processes or other services in order to provide enhanced benefits for customers while saving time & money by eliminating waste. As a methodology, lean is best applied across the entirety of an organisation, with continual monitoring and improvements being applied, with the support of employees at all levels. A strong, efficient shop floor with simple, lean management practices lay the foundation for the company to be flexible enough to accept new challenges. New technology integrations will bring in an exponential growth of the organisation and contribute to a better economy of the nation. □





Distribution centres – The epicentre of supply chain transformation

The dynamicity of supply chains is constantly evolving, especially with customer shopping expectations changing. The new-age supply chains must embrace the new way of thinking about growth and profitability and change the optimisation circuit of warehouse and inventory management. The article explores embedding modern Warehouse Management Systems (WMS) with Warehouse Execution Systems (WES) to keep productivity & customer satisfaction high and cost low.



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Customer-focused digital marketplaces have changed shopping expectations for consumers and, in turn, forced retailers to think differently about their business models. They have responded by starting new fulfilment methods, such as Buy Online Pick-Up in Store (BOPIS), in-store fulfilment and the likes. In this highly competitive and connected economy, the lines between online and offline shopping are blurring. Customers expect a seamless interaction with brands, regardless of the channel, whether they walk in, buy online and pick up in-store, want a curbside pickup or take advantage of any one of the store-based fulfilment experiences.

Modern warehouse management systems

Modern retailers must be able to profitably facilitate demand being fulfilled in new ways across the store network.

They must embrace a new way of thinking about growth and profitability through the changing lens of warehousing and inventory optimisation.

The Warehouse Management Systems (WMS) are at the heart of supply chain innovation. They help orchestrate inventory management, execute order fulfilment and maximise the utilisation of every warehouse resource – associates, robotics and automation. The right WMS maximises warehouse resources by assigning work the moment an asset is available. Through optimisation algorithms and Machine Learning, it monitors people, equipment and inventory in real-time. Instead of using guesswork, the solution knows exactly when the work is finished and assigns new tasks immediately. Modern Warehouse Execution Systems (WES) need to be embedded within a WMS to efficiently and seamlessly orchestrate workflow across the full spectrum of resources.

Fulfilment options like next-day and same-day shipping – coupled with the continuous flow of online orders – mean warehouse priorities must constantly shift. With wave-only technology, it's extremely difficult to change or add anything once work is released. A truly advanced WMS utilises waveless order fulfilment, i.e., order streaming, to enable a level of agility and flexibility that traditional technology can't offer.

Order streaming includes built-in intelligence to reprioritise on the fly. The ability to rearrange tasks, shift resources and put urgent work at the front of the line is critical. Keeping productivity and customer satisfaction high and costs down requires a warehouse that is constantly dynamic.

Leveraging automation to improve warehouse and fulfilment centre operations

The increasing prevalence of e-commerce and Direct-to-Consumer (D2C) fulfilment, coupled with challenging labour markets, are putting immense pressure on companies to improve fulfilment centre operations. Companies are increasingly investing in flexible automation enabled by modern Autonomous Mobile Robotics (AMRs).

Historically, meeting peak demand workflows meant flexing capacity by throwing bodies at the problem. The more people in the warehouse and/or fulfilment centre, the more capacity increased. However, this becomes both a significant challenge and a very expensive proposition in today's labour market. The scarcity of workers today has increased competition for the available labour and driven up temporary labour costs.

AMRs address this challenge by completing tasks humans traditionally would have handled, such as pushing carts or, in some cases, picking from shelves. This allows people to focus on other, higher-value activities. And because many of the AMR vendors are willing to provide their robots 'as-a-Service', customers can now deploy additional robots on demand. So, companies can scale their operation without the need to increase capacity through labour. Most AMRs are not designed to replace people. Rather, they augment the existing labour pool and drive greater performance & efficiency. In fact, it has been found that over 70% of the time, commercial service robotic technology delivered double-digit improvements to productivity, efficiency and capacity.

Optimising inventory with Radio-Frequency Identification (RFID)

As the customer demand for flexibility and convenience increases, retailers are looking for new ways to optimise their existing assets to satisfy rising consumer expectations. For instance, turning retail stores into fulfilment centres to provide BOPIS, and shipping from store options is one of the options that retailers are leveraging.

Radio Frequency Identification (RFID) makes near real-time and highly accurate inventory visibility as well improved order fulfilment possible. A study found that retailers who used RFID technology to optimise inventory management and reconcile product shipments were capable of achieving 99.9% order accuracy. RFID-enabled inventory enables DCs and retailers to confidently offer flexible fulfilment options that meet today's customer expectations while improving profitability.

Unlock efficiency by orchestrating man & machine

In recent years, the pace of change for the supply chain has continued to accelerate, bringing forth new challenges that require new innovations and radical thinking. Rising e-commerce and omnichannel fulfilment, combined with labour volatility and cost constraints, have created more pressure on the supply chain than ever before.

While the use of technology in the warehouse is increasing, it is important to remember that more human capital is being used than ever before. With the infusion of WES capabilities within the WMS, it is now possible to orchestrate workflows across both man and machine. This ensures that supply chain leaders get the best of both worlds – the power of repeatable and predictable process and the ability to pivot & think innovatively while still retaining full control.

Coordination & collaboration across discrete and individual pieces of advanced automation in the warehouse only become more powerful when those systems are connected to and are aware of each other. More than ever, warehouse management must be approached from a perspective that considers any combination of human and automation capacity together. This approach enables and ensures the maximum utilisation of all resources, flexibility for automation growth & total visibility. □



Enhancing technology at every turn

2020 was the crisis year due to the COVID-19 pandemic. But Studer ended 2020 on a positive note, thanks to an excellent order input at the beginning of the year and above all, due to a strong year-end spurt. To discuss the company's various activities, progress through the pandemic, production and more, the online press conference 2021 of Fritz Studer AG was recently held, its theme this year being 'Studer Fight Club'. A post-event report...



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Due to worldwide travel restrictions, protective measures and in the spirit of digitalisation, this year's Studer press conference took place online. Around 120 participants from more than 30 different countries participated in the event. This year, the event came with the motto 'Studer Fight Club'.

The last Motion Meeting took place over a year ago, and although Studer had experienced a decline in sales at that time, the company still recorded the third-best year since its founding. The company has reacted to drops in sales with the proven annual work-hour model and where necessary, with short-time working. Numerous group projects from 'UNITED GRINDING Digital Solutions™' play a key role in connection with digitalisation. Structural alterations and investments in new products,

machinery and equipment have also been considered. "Studer invested in 2020 and will continue to do so this year. All in all, we consider ourselves to be well-positioned, which is a decisive advantage, particularly in the current competitive environment," said Jens Bleher, CEO, Fritz Studer AG.

Apprentices at Studer

While also affected by the pandemic, even in these times the company has stuck to its tried & tested vocational training. Bleher explained, "The number of Studer apprentices remains high and they make up over 11% of the workforce." The company was also able to always ensure professional training.

Sales, service and marketing activities

Studer's start to the year 2020 was promising until the point in March when one country after another around the world implemented drastic and strict lockdown measures. The company was able to start the last year with a good backlog, thanks to the positive order intake from the previous year. "Thanks to the very good order intake towards the end of last year, particularly from Asia and Latin Europe, but also in some cases from Central Europe, we generated a substantially higher order volume than during the last major crisis in 2009," cited Sandro Bottazzo, CSO, Fritz Studer AG and continued, "Many of our customers are expecting a stronger second quarter or second half of 2021 in particular, which is precisely why many grinding machines were still ordered in December." He further added that another key factor of Studer's success is the broad portfolio of different universal external, internal, production and conventional cylindrical grinding machines. The new S33 launched in 2019 was by far the best-selling STUDER cylindrical grinding machine last year, followed by the internal grinding machines as well as the new S31 and the new favorite.

Summing up the market in general, the order situation in Germany in particular was low compared with previous years. The order intake in 2020 from Asia, North America and north-eastern Europe remained at a very pleasing level. However, Latin Europe was also quite positive. Bottazzo explained that in total, they sold their grinding machines in over 40 different countries worldwide in 2020. Plus, another key success factor over the past year was STUDER Customer Care. Studer has also further developed its portfolio of digital services. Customers can now purchase the complete UNITED GRINDING Digital Solutions™ retrofit package with a maintenance contract at a special price.

Insights into Studer production

The United Grinding Group has also developed a digitalisation roadmap, which Studer is now implementing step by step. "In addition, we use all the technologies that we offer to our customers in our own production," revealed

Stephan Stoll, COO, Fritz Studer AG. UNITED GRINDING Digital Solutions™ can be mentioned as an example.

At the heart of Studer – Technology development

At the STUDER Tech Center, innovations are created and customer-specific requirements are put through their paces. Digitalisation is also a key issue in technology development. "Today and in the future, we need a transparent yet secure connection, so that process information can be easily transferred to external systems", mentioned Daniel Huber, CTO, Fritz Studer AG and went on, "These are precisely the advantages offered by the STUDER OPC-UA solution. In the Tech Center, all the machines are also connected by means of OPC-UA to our UNITED GRINDING Digital Solutions™ applications according to the umati universal machine tool interface standard and are equipped with additional sensors."

One technology innovation is the laser measuring technology with STUDER LaserControl™. The latest generation of the STUDER laser measuring system, the LaserControl™, is suitable not only for the contact-free measurement of tool cutting edges in the toughest conditions but also for rotating workpieces.

Outlook for EMO Milan & Studer Award 2020

What's more, the company is working on *the* innovation for EMO 2021. Studer and the whole United Grinding Group look forward to surprising one with several innovations at EMO in Milan, on October 4-9, 2021. The Studer Award 2020 was also announced, which went to Dr Mirko Theuer from the Institute for Production Engineering and Machine Tools at Leibniz University Hannover. He convinced the entire jury with his study entitled 'Continuous generating grinding of cutting tools'.

Standing tall

Despite the COVID-19 pandemic, Studer has managed to come above it triumphantly and show success in its operations. And more so, it plans on continuing to do so this year and the years to come, with its continuous technological developments and prospering customers. □



Moving on: A shift to the better future for manufacturing

The manufacturing industry faced a real slump when it came to the COVID impact. While surviving it was difficult, it gave a new outlook towards the existing problems and brought unprecedented solutions. To understand how the manufacturing industries can make a shift to the new normal while keeping intact its founding values and attain maximum benefits from the latest technology, Publish Industry India, in association with Digital Transformation Partner – Siemens Industries Software, Connectivity Partner - Tata Teleservices, Industrial Safety Partner – Mallcom India, Knowledge Partner – BDB India and Association Partner – SME Chambers India, organised the virtual Manufacturing Business Forum 2021. Excerpts of the virtual conference...



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What doesn't kill you makes you stronger, and COVID-19 has been proving it quite literally. The pandemic unfolded a series of unprecedented events clashing with a rather underprepared/unprepared manufacturing industry. To understand and set precedents for the future, Publish Industry India, in association

with Digital Transformation Partner – Siemens Industries Software, Connectivity Partner - Tata Teleservices, Industrial Safety Partner – Mallcom India, Knowledge Partner – BDB India and Association Partner – SME Chambers India, organised the virtual Manufacturing Business Forum 2021, which discussed the



From L to R: Gautam Maini, MD, Maini Precision Products; Neeraj Bisaria, MD & CEO, Premium Transmission and Kranti Tata, MD – Manufacturing, GE Multi Modal Facility, GE Aviation during the fireside chat on 'The big picture post-pandemic'

big picture post-pandemic for the manufacturing industry and the big ideas defining the year ahead. The event witnessed an amalgamation of industry stalwarts who indulged the audience with different perspectives on how the manufacturing sector can accelerate, ameliorate and automate.

Make more, earn more

The event began with Chandrakant Salunkhe, President, SME Chambers India, who opened with an address on 'The big picture post-pandemic for SMEs'. "As our honourable PM said, we need to create world-class SME manufacturing units, which work in such a way that they can fulfil the requirements of the world market. Therefore, the SME sector and the manufacturing industry should focus more on how to tap the international market, how to avail the support services, incentives and schemes, how to go for trade finance and acquire the latest advanced, patent technologies and affordable technology for improved productivity," he suggested. Next, Amitabh Pant, Vice President, BDB India, gave a keynote speech on 'Performance Linked Incentives and its impact on the industries'. Explaining the key highlights of the PLI scheme, he expressed, "The incentive would help the existing facilities and customers to increase their capacity. It will not only increase the green field investments but also speed up the capacity expansions across all industries."

Today meets tomorrow

Taking over was Nitin Malvadkar, Country Technical Manager – Mainstream Engineering, Siemens PLM Software, who elaborated about 'Product development for SMB using digitalisation'. Discussing the business imperatives of adopting

digitalisation, he mentioned, "There are three business imperatives that customers must embrace – first, maximising digitalisation by using digital twin; second, adopting a solution that is modern and can be personalised based on one's requirement and third, working in an ecosystem that is open and flexible."

A break from the presentations was the fireside chat on 'The big picture post-pandemic' that followed. Moderator Shekhar Jitkar, Publisher and Chief Editor, Publish Industry India, started the tête-à-tête with a question to the interlocutor Gautam Maini, MD, Maini Precision Products, on the post-pandemic industrial scenario. "The pandemic has reset the thinking process of most individuals. It has given time for the industry to rest, too. Organisations that have utilised this time to bring efficiency into the system will have a huge advantage now," Maini responded. Retorting to Jitkar's question on the big ideas in the year ahead for manufacturing to catch up with the growth momentum, collocutor Kranti Tata, MD – Manufacturing, GE Multi Modal Facility, GE Aviation, averred, "People are going to be very critical. As we go into the future, companies need to have a multi-scaled workforce to gauge their single points of failure and eliminate them. So, investing in people, empowering people and having empathy will be important. Also, what would be important is diversifying both customer and industries." While commenting on the factors one should keep in mind while managing and sustaining growth in the coming years, panellist Neeraj Bisaria, MD & CEO, Premium Transmission, explained, "The first important thing is agility, second is the speed of adoption, and the third important thing is how competitive we are. We need to shift our focus internally to health & hygiene, making employees more agile, making monitoring/supervision more IT-enabled and increasing our productivity & first pass with competitive prices."



From L to R: Vijay Kalra, Head – Mahindra Institute of Quality & Chairman – Central Safety Council; Sirisha A, GM, Head of Industrial Engineering, Continental and Thej Kumar, AVP - Operations, Toyoda Gosei South India during the panel discussion on 'New normal for manufacturing operations'

Next, giving a technology presentation was Kathirvel Dhandapani, Deputy General Manager – SME Cluster Sales – Enterprise, Tata Teleservices. Elaborating on smart office solutions, he mentioned, “Smart office helps one set-up voice and data communication on a subscription model without having to invest on high Capex.”

A reroute from the presentation run was the panel discussion on 'New normal for manufacturing operations'. Moderator Juili Eklahare, Features Writer, Publish Industry India, set off the conversation with a question on change in manufacturing operations post-pandemic in the new normal aimed at Vijay Kalra, Head – Mahindra Institute of Quality & Chairman – Central Safety Council. He remarked, “In the near future, while the problem may stay, we all will learn solutions to live with the problem. We, or rather businesses, have become binary, what will change due to the pandemic is that – one will either win or lose. And second, change is coming very fast, the sense of urgency, agility, flexibility to respond, etc will become important.” Next, elaborating on the technologies and trends defining manufacturing in the post-covid world, Sirisha A, GM, Head of Industrial Engineering, Continental, highlighted, “Due to COVID, decision making of the management has become critical. Proper decisions can be only made with the relevant data. So, as long as one has connected systems, data-driven decision making will now help in a very big way.” Suggesting on the dos and don'ts for the manufacturing professionals to emerge successful in the new normal, Thej Kumar, AVP - Operations, Toyoda Gosei South India, gave a tip, “Strategising or the HR approach, in terms of skill and the overall viewpoint, right from the top management to the shop floor people, there needs to be a dynamic shift in the way the people are considered in terms of upgrading the skills, of course, but also in human connect. So, dos will be

more on human flexibility and human connection.”

Elevate, corroborate, resuscitate

Lastly, closing the event was the virtual interview of Kishore Jayaraman, President, Rolls-Royce, India & South Asia, led by Jitkar. Reverting to the question on the big picture in the post-pandemic industrial scenario, Jayaraman asserted, “When it comes to manufacturing, we will need to look at productivity, efficiency and most importantly, we will have to analyse what we did good before, how do we optimise, legitimise, etc as we go through 2021.” Adding on if the growth momentum exists and if it is sustainable, he cited, “The growth momentum does exist. People are making sense of the situation and are starting to become more confident and show some energy patterns which is driving the consumption pattern, which is driving the revival of the economy.” And lastly, commenting on the changing role of manufacturing leadership, Jayaraman highlighted, “Irrespective of the sector, today, it is important for leaders to have empathy than ever before. Considering the pandemic has affected health not just physically but mentally too, having an empathetic way of leading will have more effect rather than an outcome-driven leadership style.”

Outcome-driven for the future

The forum, all in all, highlighted the importance of having a rejuvenated perspective to run a manufacturing floor. The discussion heightened the importance of people, having an empathetic outlook, having technology on the front line of the shop floor and how companies, irrespective of their size, can move on despite the slump. □

Tooling solution for knurling components

LMT Tools recently developed the EVOLine tangential knurling system to meet the individual requirements for knurling and at the same time enable fast, economical & reliable production. It is a robust monoblock tool with individually designed knurling rollers. The sturdily designed rolling head body with its force flow-oriented component structures ensures high rigidity and guarantees precise knurling profiles for top component quality. The chipless forming process and the precision of the roller also contribute to the high-profile accuracy. The integrated cooling and flushing nozzles are manually adjustable and reach the effective zone in a targeted manner.



EVOLine knurling system

The user also benefits from high cost-efficiency, which is result of short production times and high process reliability. Installation of this system is quick and error-free because of the defined installation positions and a labelling system with specific product information. Tools are not required for installation and removal. The roll diameter can be set very easily and precisely, thanks to fine adjustment with accuracies in the μ -range. Rolls can also be changed in just a few simple steps. The compact design of the knurling system also allows integration into many existing processes.

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Flat-bottom drill for structural aerospace parts

Kennametal recently introduced the FBX drill for flat-bottom drilling of structural aerospace parts. The patented FBX drill delivers superior stability and up to 200% higher metal removal rates when machining high-temperature alloys, stainless steel and other materials. Once the drill has shaped the basic structure of the component, roughing and finishing with indexable and solid end-mills are the next process steps. Its four effective cutting edges provide stability in challenging applications, like chain hole drilling, while large chip flutes ensure a hassle-free chip evacuation. Supported by a series of exchangeable coolant nozzles to help eliminate the heat build-up, the drill point is characterised by a centre insert with two effective cutting edges and chip splitters for maximum feed capabilities. The drill bodies are available in diameters 60, 75 & 90 mm and come in a long & short version (150 mm & 95 mm). This modular drill connects to the company's Bolt Taper Flange (BTF) mount adapters, available in various spindle connection styles. The FBX is ideally suited for drilling into solid, chain hole drilling & plunging in a variety of materials, such as high-temperature alloys, stainless steel, steels & cast irons.



FBX flat-bottom drill

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Mill programming software solutions

Mastercam recently introduced the Mastercam Mill, which offers expanded machining flexibility and an increased emphasis on speed & automation. Some of the significant highlights and new functionality in the Mastercam Mill are:

• Multiaxis improvements

The controlling climb and conventional cutting for morph, parallel, unified, project curve and flow toolpaths provide a constant control of climb or conventional cutting even in complex areas that would require the use of both sides of the tool.

The new 3+2 Automatic Roughing toolpath makes multiplane 3-axis toolpaths for roughing automatically. Multiaxis Roughing has been enhanced and renamed to Multiaxis Pocketing and includes new options such as undercut roughing, wall finishing and floor finishing.

The new Unified Multiaxis toolpath allows user to select multiple pieces of input geometry to generate the toolpath pattern. Then, using those geometry choices, the toolpath picks the best algorithm to calculate the path.

• 3D enhancements

By applying automatic and custom angles to raster toolpaths, the mill automatically sets different angles to maximise the length of the cut pattern



Mastercam Mill

and/or minimise the connecting moves

• 2D enhancements

The Advanced Drill, a new toolpath, is a customisable multi-segment drill cycle useful for spot drilling, deep hole drilling and back spot facing. Each segment of the drill cycle can be defined in a table, and for each segment, the user can customise any or all conditions.

Additional improvements in the Mastercam Mill that benefit efficiency include:

- Improved toolpath processing time & surface accuracy for many multiaxis toolpaths
- Toolpath Hole Definition has multiple new enhancements
- A new function, Check Tool Reach, can check user's tool and holder against selected model geometry to view where the tool can and cannot reach
- In 2D Dynamic Mill, users can skip pockets based on tool diameter or pocket size
- Contour enhancements, such as additional spring pass improvements and profile ramping for lead-in/out moves
- Setting separate feed rates for entry and exit linking moves

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Highlights - June 2021



» **Aerospace Manufacturing**
The near-term growth outlook for the aerospace industry is very positive; leading aero manufacturers have billions of dollars' worth of orders placed by airlines from growth markets as well as those looking at replacing aging fleets. The next issue discusses how the aerospace industry can profitably leverage the convergence of the digital forces of mobility, Big Data and analytics, cloud computing and more. Also, reimagines the operations excellence for the aerospace manufacturing sector.



» **PLM/Digital Manufacturing**
Digital manufacturing is an integrated suite of tools that work with product definition data to support tool design, manufacturing process design, visualisation, simulation and other analyses necessary to optimise the manufacturing process. The upcoming edition explores the development of the latest trends in digital manufacturing.

» **Solid Carbide Tools**
Solid carbide tools are essential and are required in multiple industries. For resisting early failures, they must have properties, such as, high hardness, increased stiffness, manufacturability, accessibility and reduced cost. The subsequent issue discusses the challenges of solid carbide tools and how to overcome them.



» **Renewable Energy**
India today stands among the top five countries in the world in terms of renewable energy capacity. In fact, as of November 2020, 38% of India's installed electricity generation capacity is from renewable sources. The next issue will discuss the renewable energy for sustainable development in India and the current scenario in India vis-à-vis developed countries.



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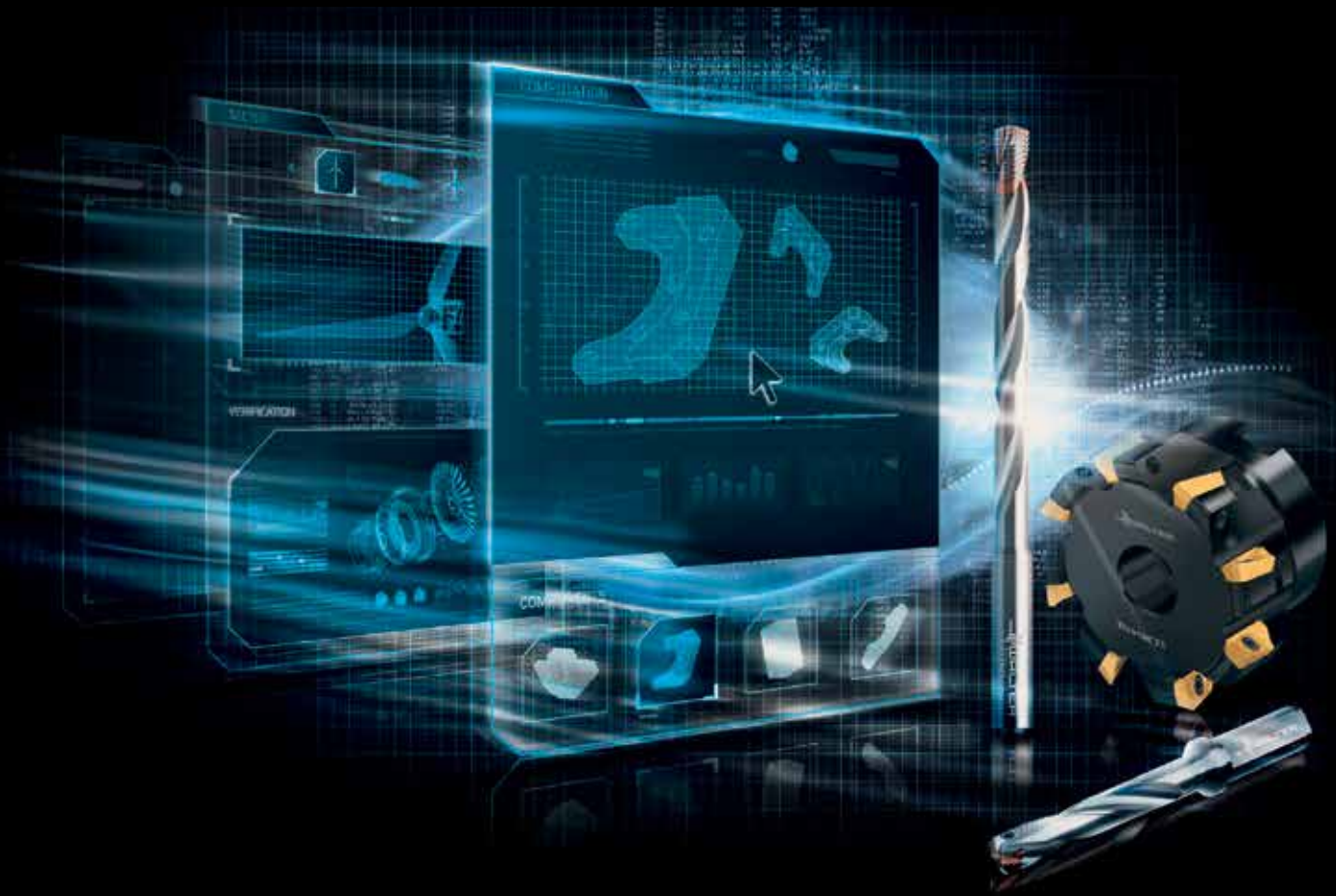
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