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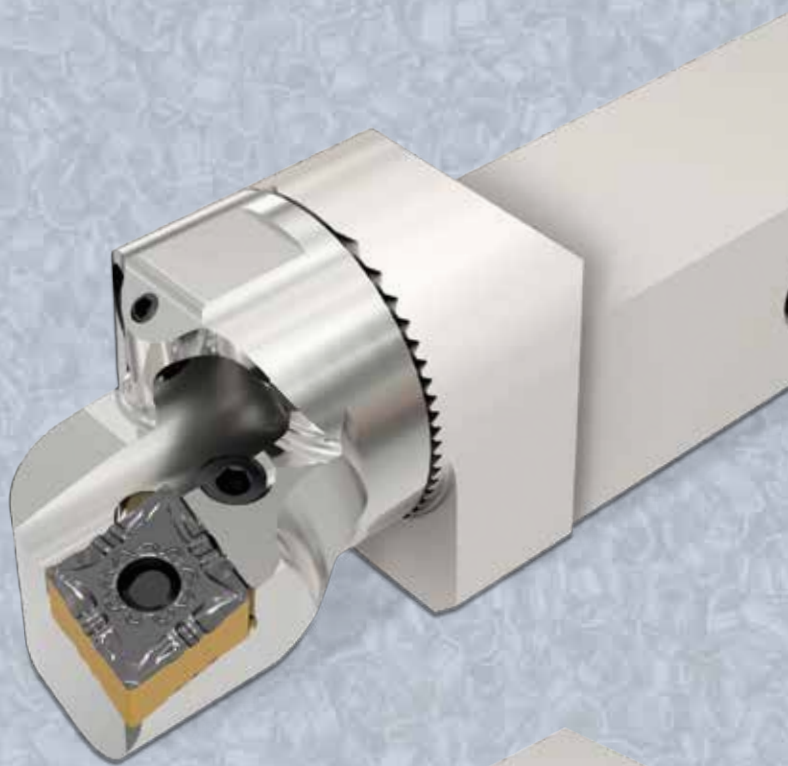

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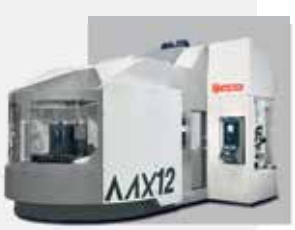

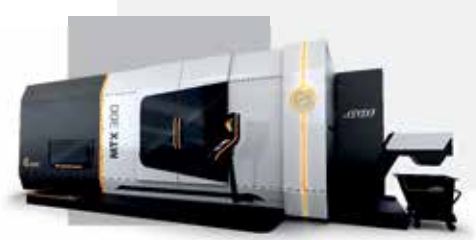

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"Innovation Powers Tomorrow's Connectivity"

Neha Basudkar Ghate
Joint Editor, neha.basudkar@pi-india.in

Shaping tomorrow's connectivity landscape

India has rapidly grown its infrastructure in the last few decades. Today, sustainable products play a crucial role in shaping our future, from renewable energy to eco-friendly building materials. These products drive innovation and reshape how we interact with the world. Harmonising these elements is key to a thriving and sustainable industry, enhancing the human experience. This trend is evident in the wires and cables industry, where sustainable practices and products are becoming more common.

The wires and cables industry is vital for powering our modern world, supporting homes, businesses, and communities. However, this growth has increased our carbon footprint, contributing to greenhouse gas emissions and climate change. Our Cover Story explores the industry's dynamic growth, trends, and innovations, addressing challenges and highlighting its impact on crucial sectors like renewable energy, automotive, railways, distribution, consumer electronics, and telecommunications.

The Industry Focus of the month directs our attention to the critical domain of EV Charging Infrastructure. Simultaneously, the Technology Focus articles shed light on Titanium Machining and the utilisation of Drones in Manufacturing. As a Special Feature, this edition expounds on MRO (Maintenance, Repair, and Operations) technologies—a domain of paramount importance in sustaining the longevity and functionality of industrial systems. □

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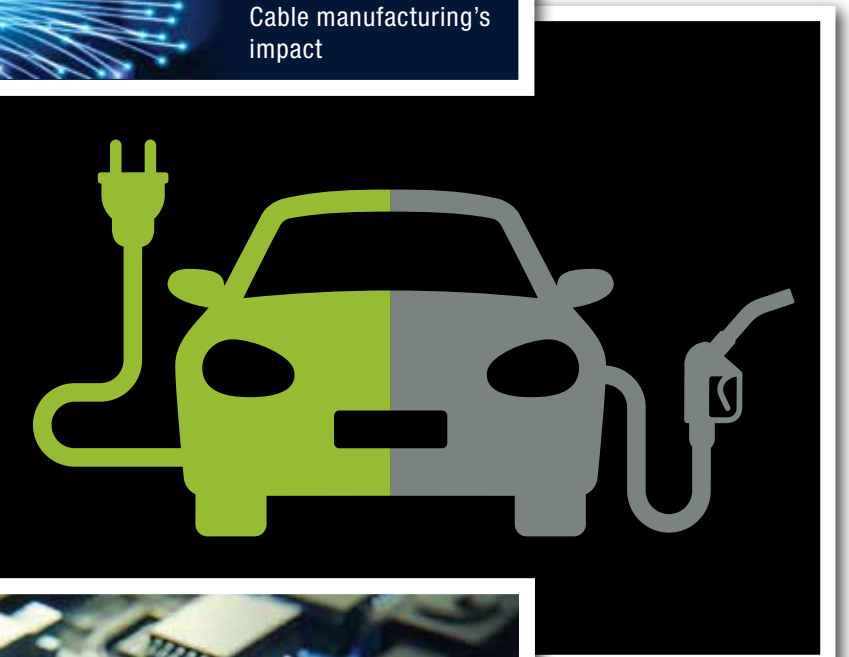

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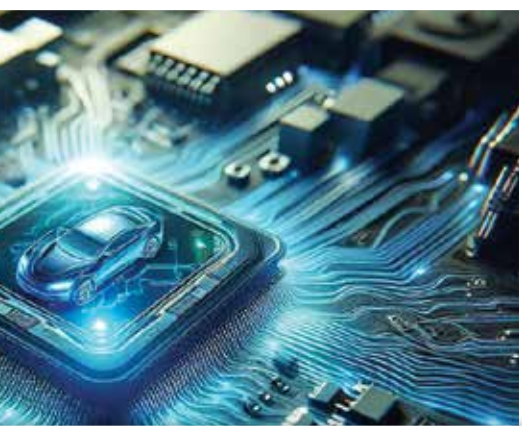

45
SEMICONDUCTOR IN AUTOMOTIVE
Chips on wheel- The backbone of vehicle

SPECIAL FEATURE

NEW PRODUCTS

Columns

Neha Basudkar Ghate

Joint Editor

Manufacturing in 2024:

Navigating the Future Landscape

The manufacturing industry is experiencing a transformative shift in 2024, marked by the widespread adoption of smart factory technologies, an increased focus on sustainability, and the integration of artificial intelligence. As we delve into the key trends shaping the sector, it becomes evident that manufacturers are not only adapting to technological advancements but also responding to global challenges, such as supply chain disruptions and the need for enhanced employee safety. This feature explores the top trends influencing the manufacturing landscape and how companies are positioning themselves for success.

Talk

"In navigating the future manufacturing landscape, companies must embrace technological advancements, prioritise sustainability, and adapt to changing consumer behaviours. Whether it is the rise of smart factories, emphasis on data-driven practices, or reshaping of supply chain strategies, manufacturers who embrace these trends are poised for success in 2024 and beyond".

- **The Rise of Smart Factories:**
  Manufacturing facilities are reaching a tipping point in smart factory adoption. Newer machines equipped with onboard sensors and monitoring tools, coupled with decreasing costs of smart technology, are driving manufacturers to embrace comprehensive systems. This shift is motivated by the pursuit of proactive maintenance, improved process efficiency, and reduced operating costs.
- **Sustainability and Carbon Neutrality:**
  With ESG concerns gaining prominence, manufacturers are placing a heightened focus on sustainable practices and carbon neutrality. Beyond regulatory requirements, commercial customers are increasingly demanding environmentally responsible processes, pushing manufacturers to adopt eco-friendly measures.
- **AI and Virtual Processes:**
  The integration of technologies like AI, machine learning, AR, and VR is revolutionising manufacturing by enabling remote monitoring, servicing, and equipment operation. Dark Factories, entirely automated facilities, are becoming more common, providing enhanced efficiency and safety in manufacturing processes.
- **Data-Driven Maintenance:**
  The utilisation of sensors, IoT, and 5G networks is driving data-driven maintenance practices. Predictive maintenance, facilitated by faster communication and increased bandwidth, is crucial for minimising unplanned downtime and achieving cost savings.
- **Employee Safety and Health:**
  New monitoring technologies are being adopted to ensure employee safety and health. Advanced equipment tracks employee locations, movment, and temperatures, contributing to a safer work environment.
- **3D Printing Advancements:**
  Rapid advancements in 3D Printing technology offer greater accuracy, flexibility, and cost-effectiveness. This innovation facilitates rapid prototyping, customisation of products, and quicker maintenance and repairs.

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Volkswagen backed automaker unveils first EV with innovative battery chemistry

Volkswagen is backing a new Chinese EV brand called Yiwei, and the company has debuted the first electric vehicle powered by sodium-ion batteries. Yiwei, from JAC Group, was established in early 2023. The company's new EV, the Yiwei 3, uses HiNa Battery's sodium-ion cylindrical cells. Yiwei also announced another sodium-ion-powered vehicle, the Sehol E10X, which can recharge from 10 percent to 80 percent in 20 minutes, according to Electrek. JAC says that sodium-ion batteries have faster charging speeds, increased durability, and longer overall life spans than their lithium-ion counterparts. JAC says that sodium-ion batteries have faster charging speeds, increased durability, and longer overall life spans than their lithium-ion counterparts. Xia Shunli, Chairman, Yiwei Tech, said, "Sodium-ion batteries will become an important battery type, complementary to LFP batteries, and a low-cost solution that promotes the popularisation of mass electric vehicles among the masses".

Quantum Energy partners with Battery Smart to enable swappable batteries for last mile mobility

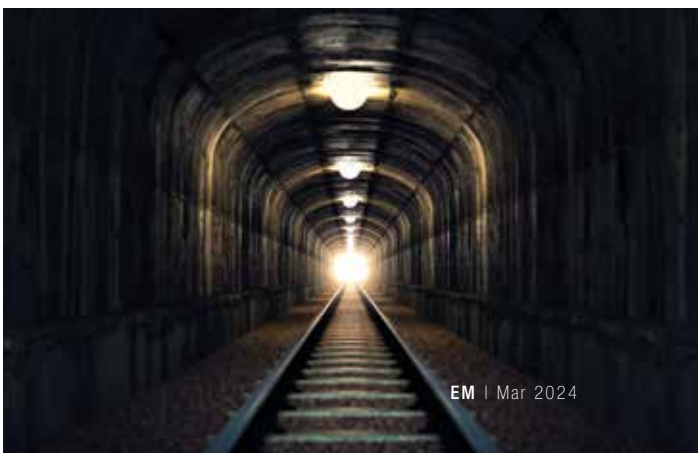
Quantum Energy, recently announced a strategic partnership with Battery Smart. Through this collaboration, Battery Smart's network of over 900 swap stations across more than 25 cities will support battery swapping for Quantum's electric scooters, enabling users to gain seamless access to fully charged batteries within two minutes. This partnership will allow ride-hailing, last-mile delivery, and connectivity companies that utilise Quantum's electric fleet vehicles to eliminate concerns over range anxiety and long charging downtimes. With Battery Smart's quick swaps, drivers can spend more time on the road and complete more deliveries. Battery Smart's battery-as-a-service model will also reduce the cost of replacing batteries at the end of their life, thus lowering the total cost of owning a Quantum Electric scooter. Chetana C, Director, Quantum E-Scooters, said, "Our partnership with Battery Smart supports our vision to accelerate the transition to electric last-mile transportation. By enabling easy battery swapping for our commercial fleet customers, we can reduce their EV ownership costs and give them the confidence to scale their electric fleets across India".

Sodion Energy launches India's first Sodium-ion battery

Sodion Energy recently unveiled its Sodium-ion batteries (NIBs – Na+ Ion Batteries), marking India's pioneering venture in this domain. The company also introduced a diverse range of applications utilising its Sodium-ion batteries, including UPS, starter batteries, and battery packs. Additionally, Sodion Energy has introduced its proprietary Battery Management System tailored to optimise NIB cell performance. Bala Pachyappa, Co-Founder, Sodion Energy, emphasised the potential of sodium ion-based batteries as a sustainable, safe energy storage solution for the future. These batteries are poised to challenge the dominance of lead-acid and lithium-based battery technologies in various markets. Anticipating a fivefold increase in the demand for power storage by 2026, especially with the widespread adoption of electric vehicles, Sodium-ion-based batteries are positioned as a crucial component in facilitating this burgeoning power storage sector. NIBs offer several advantages over other battery types, including enhanced safety, cost-effectiveness, and prolonged lifespan.

Siemens provides electrification for Indian Railways' longest rail tunnel

Siemens is privileged to have provided rail electrification technologies for a 42-kilometre-long stretch, including the longest rail tunnel (12.8 kilometres) at Pir Panjal range, on the Udhampur-Srinagar-Baramulla Rail Link. The project is part of the Jammu-Udhampur-Katra-Quazigund-Baramulla Railway line of the Indian Railways, the largest construction of a mountain railway line since India's independence, with a length of 345 kilometres and a height of approximately 1,700 metres above sea level. Siemens's scope included the design, engineering, supply, installation, testing, and commissioning of 25 kV overhead equipment and associated works. Gunjan Vakharia, Head, Mobility Business, Siemens, said, "We are extremely proud to be associated with this project, which is of national importance. The installation team overcame challenges such as extreme temperatures and unexplored terrain to ensure the successful execution of the project. We would like to thank the Indian Railways for their continued trust and support of Siemens".



GrindingHub 2024 shines the spotlight on grinding technology

GrindingHub is set to open its doors for the second time to grinding experts from all over the world from May 14 to 17, 2024. Over 460 exhibitors from 31 countries will be presenting their latest grinding technology solutions in Stuttgart, now in four exhibition halls for the first time. The event will be about more than just technical products and innovations, as Dr Markus Heering, Managing Director of the organiser VDW (German Machine Tool Builders' Association), reports: "Automation and digitalisation, skills shortages, new customers and markets, the promotion of young talent—the industry is facing multiple challenges and opportunities.

As the meeting place for the grinding technology industry, we want to offer the community a platform for swapping ideas and picking up information. I am convinced that we will succeed in this, thanks to the increased number of exhibitors, the impressive supporting programme, and the international and sectoral diversity, which is now even greater".

GrindingHub is keen to address the needs of the next generation and emphasise how it is combating the shortage of skilled workers and promoting young talent with the 'Grinder of the Year' competition. It will put the theoretical knowledge and practical grinding skills of young talents from Germany, Austria, and Switzerland to the test. Also to be won, alongside the 'Grinder of the Year' 2024 title itself, are training vouchers of up to 3,500 euros in value. The finalists from the preliminary round will then demonstrate their skills live during the GrindingHub in Stuttgart.

Martin Göbel, Head of Trade Fairs, VDW, said, "We are particularly pleased to be presenting even more aspects of the grinding process chain than in the first event. More exhibitors, greater internationality, and more product diversity. There is clear growth in all key areas compared to the premiere in 2022".

The supporting programme is rounded off by the Specialist Forum (Fachforum) on Stand E80 in Hall 10, which provides a platform for exhibitor presentations of all kinds. Companies will be giving live, 20-minute presentations, informing the audience at first-hand about what's new in the world of grinding technology.

Maharashtra MSME Defence Expo 2024 concludes on a high note

The first MSME Defence Expo 2024, marking Maharashtra's debut in hosting a defence expo, wrapped up after three power-packed days, unveiling India's capabilities in indigenous defence production and forward-looking defence technologies. The expo highlighted key MoUs, including those between the Maharashtra Government and Max Aerospace, SBL Energy, and a collaboration between Nibe and Munitions India. Panel discussions delved into the current defence ecosystem, addressing challenges and opportunities in India's journey to self-sufficiency in defence manufacturing.

Furthermore, the event was graced by discussions led by Vivek Ram Chaudhari PVSM AVSM VM ADC - Air Chief Marshal; Admiral R. Hari Kumar PVSM AVSM VSM ADC - Chief of Naval Staff; and Gen. Manoj Pande PVSM AVSM VSM ADC - Chief of Army Staff. They engaged with students about challenges and opportunities in the defence sector, addressing inquiries with passion and insight. Also, the Chief of Defence Staff (CDS) of the Indian Armed Forces, Gen. Anil Chauhan PVSM UYSM AVSM SM VSM, joined virtually.

The expo, which witnessed over 2,00,000 visitors, showcased defence equipment from leading entities such as DRDO, L&T, Solar Industries, Bharat Forge, Nibe, and Tata Advanced Systems, among others. Key players in the defence industry displayed an extensive range of products at the event, spanning from small arms weapon systems to diverse military vehicles and advanced air-defence and missile systems. Notable exhibits showcased the Advanced Light Helicopter Dhruv, the Light Combat Helicopter Prachand, the powerful Dhanush artillery gun, the precision Field Howitzer 77 Bofors gun, T-90 Bhishma, and Arjun Tanks, alongside the Infantry Carrying Vehicle BMP-II. Additionally, attendees had the opportunity to view the Indian Air Force's (IAF) Make in India manufactured Samar II and the Akash surface-to-air weapon system.

"Inspiring component OEMs to focus on data-driven insights"

says **Kamal Rupareliya,** Co-founder and CEO, Intuions. In an interview with **Neha Basudkar Ghate**, he explains how his company is contributing in shaping up vehicle reliability and efficiency.

What inspired the development of Intuions, and what market gap does it aim to address?

Intuions was developed to address specific challenges in the electric vehicle sector. It aims to bridge the need for more harmony between software and hardware, a major issue marked by fragmented firmware and subpar software integration. Additionally, the platform targets the often-neglected Tier 2 and 3 city markets, recognising that mass adoption in these areas is crucial for real growth. By addressing these gaps, we seek to synchronise the rapidly evolving hardware landscape in the EV industry.

What specific benefits can OEMs expect regarding predictive and preventive maintenance insights from the platform?

We offer a unique approach for vehicle OEMs by providing component-level insights. This bottom-up strategy allows OEMs to deeply analyse the health of individual components and understand their impact on the overall vehicle's fitness. With granular data and firmware-level integration, the platform enables OEMs to identify and address issues more precisely. This focused approach helps significantly reduce maintenance expenses as it pinpoints specific areas that need attention.

How does Intuions address potential challenges in ensuring seamless integration with diverse EV components and OEM systems?

Intuions not only facilitates seamless integration with diverse EV components and OEM systems but also plays a pivotal role in educating OEMs about the importance of considering software during hardware design. The platform inspires component OEMs to focus on data-driven insights, enhancing efficiency, productivity, and profitability. Additionally, we encourage these OEMs to build brand recognition and trust in the market, motivating them to prioritise both the quality of their products and their relationship with buyers and end-users.

Given the sensitive nature of data in the EV ecosystem, how do you address concerns related to data security and privacy?

With over 15 years of experience in software system development, we understand that security and privacy are foundational, not afterthoughts. Our system is designed with these priorities at its core. The platform, while open, gives data origin stakeholders, whether they are component OEMs, vehicle OEMs, or end-users, complete control over their data. They can decide who accesses their data and for how long, ensuring a high level of security and privacy.

Can you share insights into your future development plans and any upcoming features or enhancements?

Intuions' future development plans involve seeking allegiance from an increasing number of OEMs. The focus is on catalysing the 'Make in India' initiative by encouraging OEMs to prioritise software in their EV component and vehicle design decisions. This strategy aims to integrate software considerations deeply into the manufacturing processes. ☐

"India transforms automotive landscape, embraces eMobility"

… says **Amit Kekare,** Vice President and Head - eMobility, Smart Infrastructure, Siemens. In an interview with **Neha Basudkar Ghate**, he outlines the significance, hurdles, and trends in the eMobility sector, harnessing India's technological prowess to present a holistic Make in India portfolio.

Can you share insights into how Siemens eMobility business, under your leadership, is contributing to the transformation of the eMobility market in the Indian region?

India is experiencing a significant shift towards eMobility, with efforts to reduce vehicle emissions for improved air quality. The eMobility market is expected to grow at a 50 percent CAGR from 2023-30. Siemens has invested in an EV charger manufacturing setup in India to meet the demand, strengthen its presence, and create an export hub. This move allows Siemens to offer a comprehensive Made in India portfolio, catering to specific market needs with a range of low and high-power ratings, parallel charging, and multiple charge-points, ensuring cost-competitive infrastructure with reliable technology and a sustainable supply chain.

In eMobility, what challenges does Siemens tackle, and how will they transform into growth and innovation opportunities?

The eMobility sector faces challenges like implementing interoperable charging infrastructure, offering a comprehensive portfolio across vehicle segments, and ensuring resilience and quality. We leverage our technological strength to address these challenges, partnering with customers on various topics. Our established grid technology portfolio aids in managing reliable power supply, which is crucial for the growing electricity demand in the eMobility sector.

What eMobility trends will impact the market, and how is Siemens positioning itself to stay ahead?

Some of the emerging trends in the EV charging domain include high-power charging using Automated Charging Devices, wireless charging, bi-directional charging, megawatt charging, and energy-storage integration with charging stations. We are at the forefront of these technology trends, having already developed and deployed products & solutions with these technologies globally. We are also working closely with leading OEMs to demonstrate its applications in the Indian ecosystem based on relevant use cases.

What are the company's plans for further market expansion in the eMobility sector in India?

Siemens, a global leader in eMobility technology, has pioneered the revolution with technology implementations worldwide. With over 150 years of presence in India, Siemens emphasises local manufacturing for dynamic competitiveness. Its world-class manufacturing and R&D facilities cater to both local and global markets. The Indian talent pool actively contributes to global eMobility R&D, and a Network Operating Center (NOC) supports the global installed base with advanced remote monitoring and expertise. □

"Adjusting strategies to meet evolving customer needs"

…says **Suman Nelluri,** CEO, Greaves Technologies. In an interview with **Neha Basudkar Ghate**, he explains how virtual engineering and changing customer demands have an impact on their industry approach. Excerpts from the interview…

Q What are the milestones in the strategic roadmap that demonstrate your commitment to sustainable mobility solutions and a seamless transition to green transportation?

Our core mission is to facilitate swift and efficient transitions to sustainable mobility solutions for enterprises. The company's expertise spans the entire Product Development Life Cycle, offering services in design, virtual engineering, embedded hardware and software development, software architecture, verification and validation, digitalisation, IoT integration, and analytics. With a focus on sustainable mobility, Greaves Technologies addresses challenges across domains, including product design, simulation, testing, and manufacturing optimisation. Our strategic alignment emphasises meeting product development objectives by deploying skilled engineers for advanced design, quality assurance, adherence to industrial standards, and enhanced productivity.

Q How would you define virtual engineering today?

We believe that the realm of automotive engineering is not only about pioneering future technologies but also revolutionising the way we approach our work. Virtual engineering stands as a cornerstone in our product development process, gaining paramount significance as vehicles evolve into intricate systems. One of the advantages of virtual engineering is its capability to empower our engineers to detect and rectify potential design flaws and errors before implementation. This proactive approach significantly mitigates the risk of costly design and tooling changes and rework downstream in the development process.

Q How does your company adapt to the ever-changing demands of the automotive industry? Can you share some examples?

To stay ahead, we monitor and analyse the latest trends and developments, allowing us to proactively adjust our strategies and offerings to meet the evolving needs of our clients. Our commitment to adapting to industry demands is exemplified by our embrace of new technologies. For instance, as the automotive sector gravitates towards electrification and autonomous driving, we invest in the development of AI and ML solutions tailored to these emerging trends. We also foster robust partnerships with leading companies and experts in the automotive industry.

Q Can you tell us more about the embedded systems?

Our commitment to pushing the boundaries of innovation in embedded systems has consistently propelled us to the forefront of technology integration, both organically and by forging partnerships and collaborations. A prime example of our transformative work lies in our approach to Advanced Driver Assistance Systems. By meticulously orchestrating elements such as hardware design, sensor fusion, feasibility studies, traceability, verification and validation, machine learning, AI, HMI integration, communication protocols, over-the-air updates, functional safety, redundancy, integration with the vehicle network, and regulatory compliance, our engineers have revolutionised automotive safety systems by bridging the gap between hardware and software.

Q How do you leverage your expertise in AI and SAP solutions to ensure that businesses remain at the forefront of technology, and how does this contribute to the overall success of your clients?

The initiation of the Digital Centre of Excellence marks the beginning of a mission to empower businesses, particularly in the automotive and engineering sectors, to uphold their competitiveness. To illustrate, in partnership with a prominent automotive manufacturer, we intend to integrate cloud-based manufacturing systems and digital supply chain management. This initiative aims to enable the customer to optimise production scalability, diminish operational costs, and improve supply chain efficiency through a more streamlined approach to inventory tracking and management.

Furthermore, the integration of IoT solutions and applications of AI and ML provides the customer with the capability to gather and analyse real-time product data, yielding valuable insights for product improvement and predictive maintenance scheduling.

Q The tech industry is known for its rapid changes. How do you stay adaptable to industry shifts, especially in the context of emerging technologies, regulatory changes, and shifts in customer preferences?

In the dynamic landscape of the tech industry, adaptability is crucial for sustained success. Our proactive approach involves staying abreast of emerging technologies, anticipating regulatory changes, and understanding evolving customer preferences. Through consistent investment in research and development, we ensure that our skill set aligns with the latest advancements.

Recognising the significance of customer preferences, we place a strong emphasis on engagement and feedback. By actively listening to our clients, conducting market research, and understanding their evolving needs, we tailor our products and services to align with their expectations. As a comprehensive engineering, R&D, and digital solutions partner, our adaptability is rooted in a holistic understanding of the industry. By combining continuous innovation, regulatory vigilance, and a customer-focused mindset, we can navigate the complexities of the tech industry with confidence. This multifaceted strategy positions us to not only survive but thrive amidst the rapid changes and challenges that characterise the dynamic tech landscape. □

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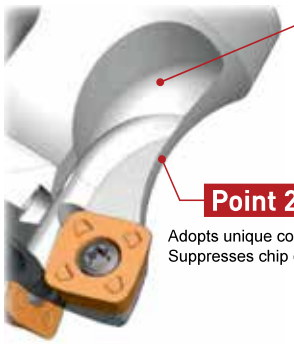
TR4F type to meet specific challenges posed by high-efficiency cutting

Issue
01

Although high-feed cutting is performed for shaping,
resulting severe chip clogging and biting may reduce shaping efficiency.

Proposed solutions

Adopts new body shape to enhance chip removal.
Suppresses chip clogging, even when cutting long overhangs.



Point 1

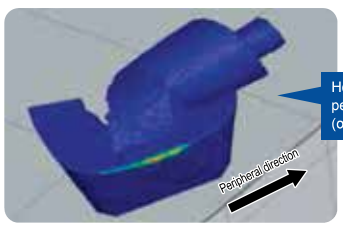
Offers excellent chip removal performance thanks to large open pocket, thereby eliminating clamp pieces.

Point 2

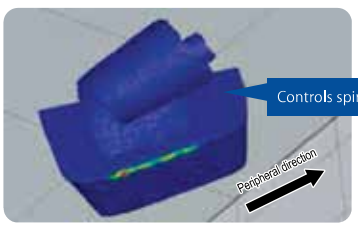
Adopts unique constricted shape.
Suppresses chip clogging between tools and wall surfaces

Point Suppresses chip clogging.

Optimizes cutting edge design to achieve smooth chip removal flow; keeps chips away from wall surfaces.
Suppresses clogging from the time chip generation starts.



Conventional



TR4F type

Breaker type is added to the inserts (1 item, 4 grades)

Lineup of holders are added. (φ32, 40, multi-flutes type total 14 item)

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YOUR GLOBAL CRAFTSMAN STUDIO

Wired for efficiency:

Cable manufacturing's impact on major industries

Hemant K Mehta,

Chairman and Managing Director,
Elegar Kerpen Kabel India

Wire and cable manufacturing, vital for infrastructural development, plays a pivotal role in today's interconnected world. As the industry adapts to global demands and stringent regulatory standards, manufacturers strive for innovation, sustainability and adherence to international quality processes, emphasising the crucial role of wire and cable solutions across diverse industries. This Cover Story explores the wire and cable industry's dynamic growth, trends and innovations, addressing challenges and highlighting its impact on crucial sectors such as renewable energy, automotive, railways, distribution, consumer electronics and telecommunications.

Wire and cable manufacturing is among the most crucial components of infrastructural development. In our interconnected world, wires and cables have an indispensable role, which has evolved drastically as the industry navigates its journey from simple copper wires to modern fibre-optic cables. Starting from advancement in design, use of material and integration of technology to the advanced manufacturing process, all have collectively paved the way for the global wires and cables industry to undergo massive growth.

A report shared by Fortune Business Insights projected that the global wires and cables market size would touch $294.73 billion in 2029, up from $200.3 billion in 2022, recording a CAGR of 5.7 percent. Similarly, the domestic electric wire and cable market is expected to grow by $2189.92 million between 2022 and 2027, marking a CAGR growth of 4.63 percent. Much of the projected growth will be driven by the country's burgeoning energy consumption in domestic and industrial segments and the need for innovation in the wire and cable sector. Additionally, with the growing urban density, the demand for multi-layered, fire-resistant and flexible domestic cables is increasingly rising as more entities prioritise safety norms to eliminate the risk of accidental electrical fire hazards.

In the last decade, the wire and cable manufacturing segment has emerged as a core industry whose increasing growth is a direct result of the soaring demand from the infrastructure, renewable energy, oil and gas, automobiles and defence sectors. As more industries and global cities push for efficient and capable transmission of data, the wire and cable industry continues to leave a notable impact on crucial industries.

Latest trends and their impact on the industry

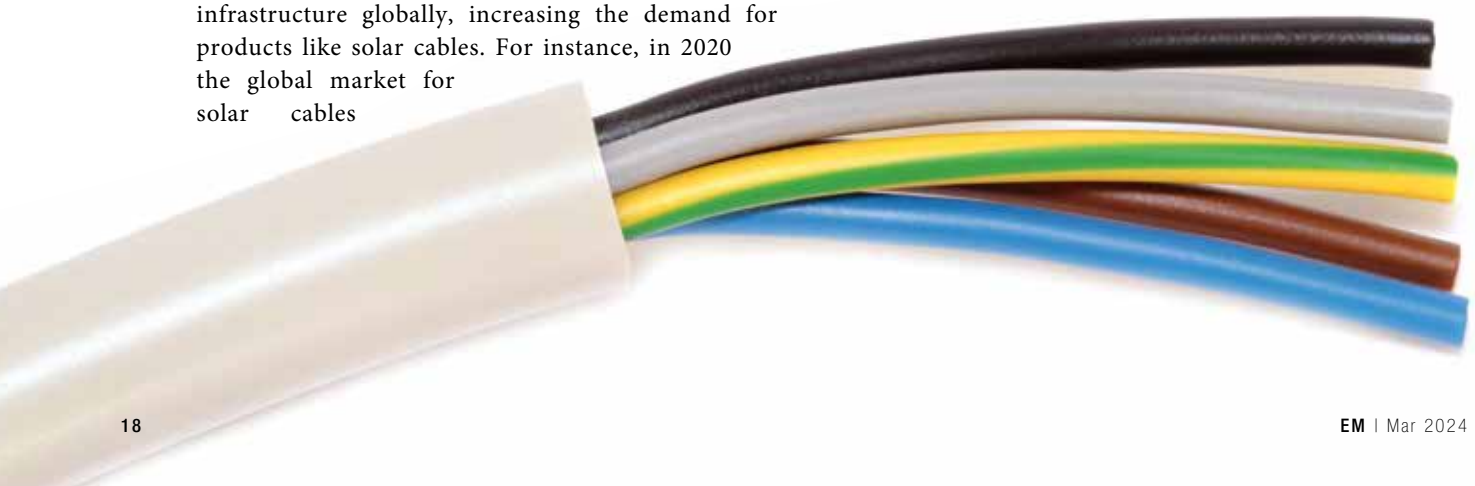
The industry has undergone several processes and innovations in the last couple of years, which have helped improve the sector's manufacturing operation. Industry players who have been quick in identifying and implementing new sector-specific trends and innovations have remained ahead of the curve and relevant in the domain. Below are some of the latest trends and innovations that are shaping different sectors, including the wire and cable industry:

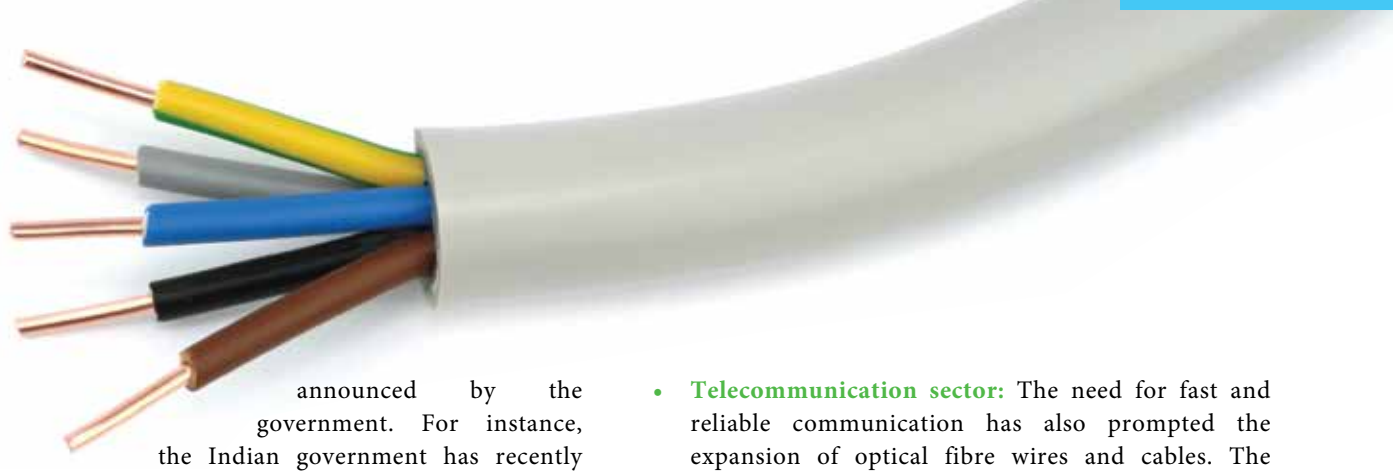
- **The wire and cable sector:** The global economy is on the brink of a new industrial revolution that is focused on the use of digital technology to enable automation of production processes. This comes as several industry players switch to automation to enhance their manufacturing potential. Wire and cable manufacturing companies are transitioning into smart factories by increasingly using automated machines and robotics to boost efficiency and lower the cost of production. This smart technological integration is helping the manufacturing potential of companies by enhancing their precision and minimising the room for human error. Many wire manufacturers are embracing the Industry 4.0 principles on a broader scale by incorporating digital technologies, such as the Internet of Things (IoT), AI and Big Data analytics at every level to optimise the manufacturing process significantly. In the next few years, AI will play a more comprehensive role in processes such as packaging, coiling and logistics, while manpower will continue to ensure efficiency at every step.

- **Renewable energy sector:** With a sharp rise in awareness about climate issues across the globe, there's a massive push to urgently adopt renewable energy sources to phase out reliance on fossil fuels. According to data shared by IRENA, the global renewable energy capacity grew to 2,802,004 MW in 2020, up from 2,542,035 MW in 2019, recording a 10.23 percent increase YoY. This substantial uptick in solar and wind energy projects has accelerated the demand for specialised wires and cables that cater to the unique requirements to support sustainable energy drives. This demand arises from the fact that renewable energy sources, such as solar and wind, require suitable infrastructure supported by wires and cables to integrate them into the power grid. Notably, the growing reliance on renewable energy sources, such as wind and solar energy, has also prompted a massive development in renewable energy infrastructure globally, increasing the demand for products like solar cables. For instance, in 2020 the global market for solar cables was valued at $694.76 million and is expected to touch $1686.91 million by 2028. This sharp growth has encouraged the wire and cable sector to innovate products. Since solar cables have special requirements, manufacturers are investing in advanced E-Beam technology to process them. The E-beam technology enhances the resistance of premium solar cables to UV rays, ozone, weather conditions, cracks, oil and chemicals and ageing. It provides superior protection against extreme conditions and high temperatures, helping manufacturers ensure the durability and performance of solar cables. This makes the advanced technology suitable for complex solar power systems.

- **Automotive and EV sector:** The rise in EV adoption has necessitated the wire industry to adopt custom-built cables to address its specific electrical and efficient charging requirements. Since India is the third-largest emitter of carbon dioxide in the world, there will be a massive surge in activities to lower the carbon footprint and active zero emissions goals on a broader scale. This will put India's renewable energy sector at the centre, requiring the wire and cable manufacturing players to cater to the bulk requirements. The Indian government is also proactively trying to accelerate the adoption of EVs by strengthening the segment's infrastructure and the public's access to subsidies to support their purchase. As the rate of adoption of EVs in the country grows, there will be a rise in the demand and number of EV charging hubs as well. Interestingly, this EV trend also calls for the availability of necessary power cables to support the charging requirements, signalling the need for high-performance and sustainable wire solutions.

- **Railway sector:** India Railway Network Cables Market size is projected to reach $999 million by 2028, witnessing a CAGR of 12 percent between 2021 and 2028. One of the factors that can be credited to this growth would include the upcoming projects





announced by the government. For instance, the Indian government has recently approved 7 multi-tracking rail projects worth ₹ 32,500 crores, which will cover 35 districts in 9 states, including Uttar Pradesh, Bihar, West Bengal, Odisha, Andhra Pradesh, Telangana, Gujrat, Maharashtra and Jharkhand. These projects will increase the existing network by 2339 kms, create ample employment opportunities and raise demand for more efficient trains, infrastructure and rolling stock requirements. Another emerging factor is the increasing popularity of the high-speed railways market in India. In September 2023, the Indian government flagged nine more Vande Bharat, the mid-distance high-speed trains, to boost connectivity. Notably, such advanced train models need sophisticated operating systems to function smoothly. Simultaneously, the advanced infrastructure calls for a reliable and uninterrupted power supply supported by efficient cables. With more projects on the horizon, the demand for advanced infrastructure is bound to increase to support the anticipated growth. The rise in momentum will directly impact the demand for rolling stock units, including specialised cables.

- **Distribution sector:** The wire manufacturing industry has also taken a cue from the world to digitise its operations. The sector is seeing a surge in demand for smart grids designed to handle the unique flow of data and robust connectivity levels. It has pushed manufacturers to upgrade their products and processes to ensure the successful integration of advanced systems.

- **Consumer electronics sector:** The trend of compact and lightweight devices is currently dominating the market. This has prompted the need for thinner and much smaller cables and wires in the industry. The cable manufacturing industry players should take this as an opportunity to design and develop cables that facilitate seamless installation and functionality to emerge as pioneers in the segment.

- **Telecommunication sector:** The need for fast and reliable communication has also prompted the expansion of optical fibre wires and cables. The demand for the niche product, which is currently an integral part of telecommunication, healthcare and defence, is expected to grow in the upcoming years as technological innovations continue to evolve. Similarly, India is set to roll out a 5G network, which calls for new infrastructure, including new and advanced wires and cables. Such an upgrade would be indispensable to support high-speed data transmission across the country and beyond its boundaries. This also makes it imperative for industry players to adapt quickly to the evolving wire manufacturing requirements and revamp their processes to support technological advancement.

In addition to these trends and innovations, the industry is gearing up to offer more customised solutions to industries that serve as the backbone of the economy. In the upcoming years, companies will expand their expertise to offer tailored solutions that align with sectoral needs and performance requirements. Moreover, with a microscopic focus on waste reduction and sustainability, cable manufacturing companies could adopt more eco-friendly practices and undertake initiatives to lower energy consumption and support a circular economy.

Quest for global acceptance

With the global market in vision, most leading wire and cable manufacturing companies are focused on using high-performance materials to manufacture durable products that meet global standards. Manufacturers are sourcing materials from all over the world to cater to the demand for more efficient, durable, long-lasting wires and cables and the products are designed following national and international quality process standards like ISO 9001, ISO 14001 and ISO 45001 for wider acceptance. Similarly, leading manufacturers are relentlessly working to improve their product quality to avail of globally accepted product compliance certifications such as EAC, CPR, MIL, IS, IEC, JSS, BS, RDSO, DIN, ASTM, EN, UL, VDE and NF.

Today, manufacturers are also focused on producing low-smoke and fire-resistant cable products to match global fire safety and regulatory standards. They are designing fire-resistant cables that do not allow the flame to spread and are equipped to transmit electrical energy even during a prolonged fire. These upgrades and advanced product designs are helping the industry meet the growing demand for wires and cables used in safety-critical systems. Thus, manufacturing companies are focused on becoming more transparent about their products, processes and quality standards they follow.

Filling the qualitative gap in the industry

Manufacturing companies are striving to enhance the quality of their products and their market reputation by sourcing not just raw materials but also machinery. Leading industry players are installing cutting-edge manufacturing units featuring state-of-the-art machinery to build innovative wire and cable solutions. The highlights of the manufacturing facilities are that they support energy-efficient practices and help lower waste through efficient optimisation of resources.

Challenges for manufacturers

Despite providing the essence of today's infrastructure across all major industries, wire and cable manufacturers are regularly met with multiple challenges. Some of the most rampant issues they face include:

- **Fluctuating raw material prices:** Wire and cable manufacturers rely on primary raw materials, such as Copper, Aluminium, PVC, PE, XLPE, XLPO, Steel and more to develop their products. Companies mainly source raw materials from different states and countries to suit varying requirements and specifications. This often raises two challenges: fluctuation in prices of raw materials and supply chain issues. An increase in raw materials like copper impacts the cost of production, which directly influences the manufacturer's profit margin, restraining them from tapping into their full growth potential.

- **Global competition:** Today, every company's ultimate goal is to serve a global audience and support the growth and development of the global economy. This business objective puts wire and cable manufacturers at the centre of intense competition in domestic and international markets. Companies are also under pressure to continuously innovate their product line and improve their offerings to cater to customers' changing preferences while setting competitive prices. While the urge to stay relevant in the market drives innovation and helps design customer-centric products, it often pushes manufacturers to strain their capabilities for profitability.

- **Stringent regulatory standards:** Wires and cable manufacturers are obligated to adhere to strict regulations to ensure the safety of their products. In addition, companies also have to ensure that their production and product processing has minimal environmental impact. These regulations ensure added levels of safety for customers. However, failing to comply with these regulations, costs cable companies in the form of legal or financial repercussions.

- **Initiating R&D:** Manufacturers often face challenges in keeping up with the latest technological trends, such as the Internet of Things (IoT), AI, Machine Learning and the Industrial Internet of Things (IIoT) to remain relevant in the industry. However, keeping up with technological advancements is easier said than done, as it requires companies to invest continuously in their R&D efforts.

The solution

It can be said that the wire and cable sector has a profound impact on all industries. With a projected growth of nearly 100 percent of the country's electricity demand bound to jump in the next few years, the soaring energy consumption rate will drive the industry to witness more demand in newer market segments. Manufacturers must keep up with evolving technologies and refine their manufacturing capacity following global standards to tap the market and remain relevant. ☐

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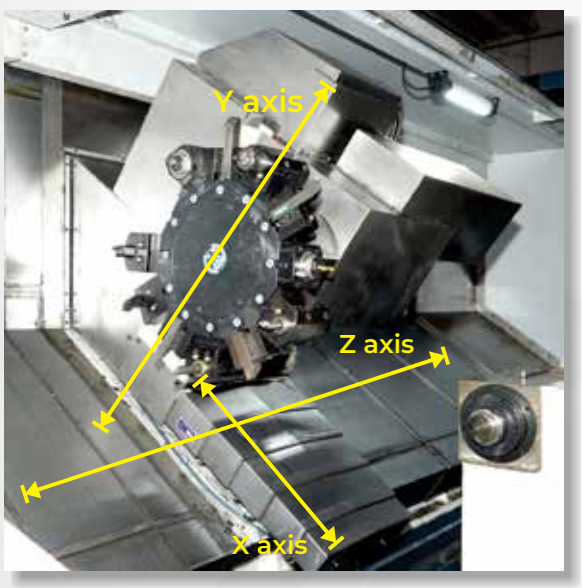

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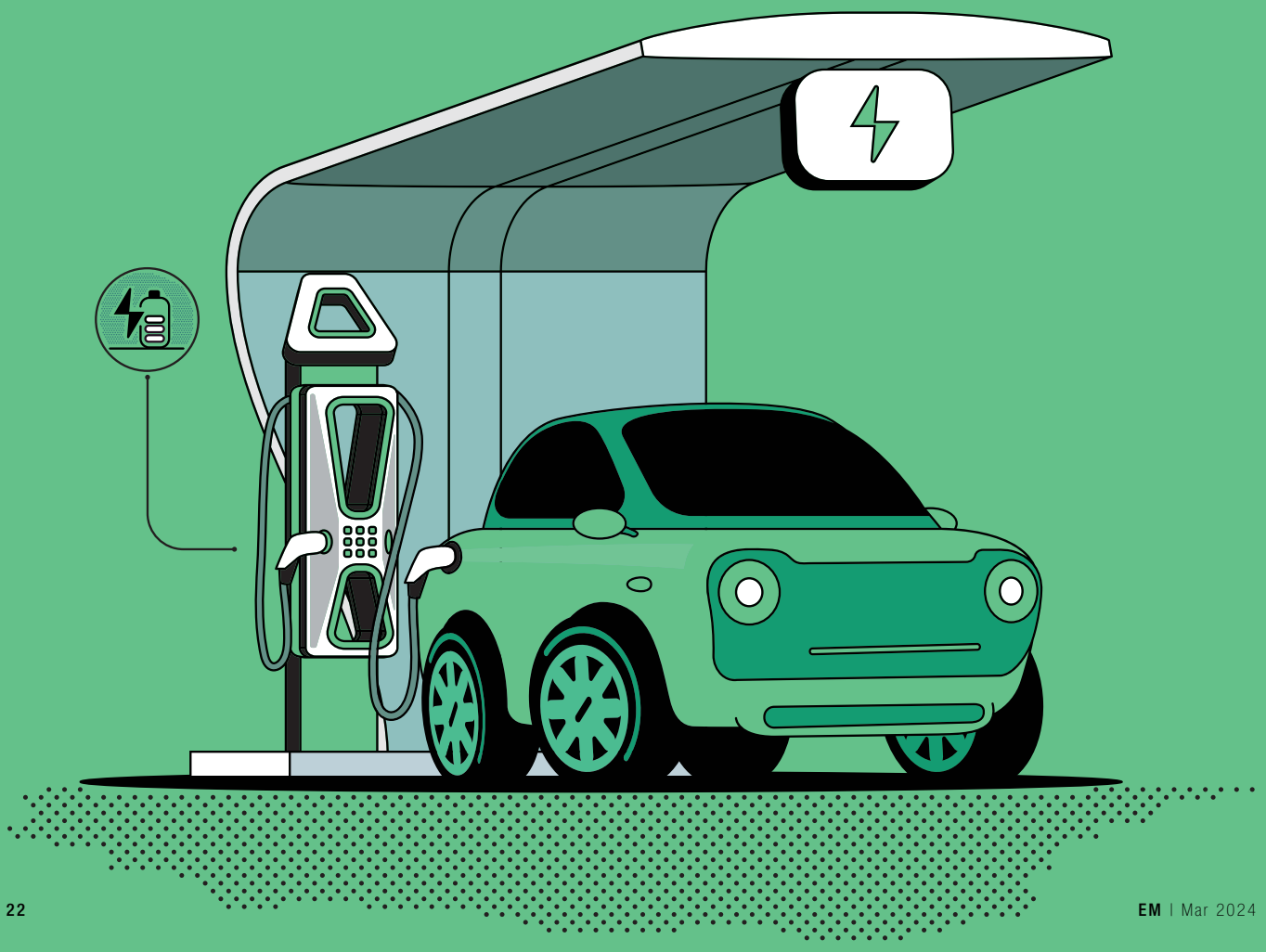
India's electric mobility revolution

As time progresses, there is growing demand for an eco-friendly and sustainable transportation system. The Electric Vehicle (EV) industry is expected to experience significant growth, with the establishment of a suitable and well-matched charging infrastructure being a crucial pre-requisite for vevolving trends of EV adoption in India.

Arjun D Pawar,
Founder,
NIKOL EV



India is undergoing different changes in the EV ecosystem to meet the increasing need to own a convenient, cost-effective, and easy-to-maintain vehicle. A satisfactory and fitting charging infrastructure is one of the major prerequisites that characterise the EV adoption trends in India. These EVs can bear limited onboarding energy in the default battery packs.

Therefore, they must be charged at frequent intervals, ensuring the vehicles don't face any interruptions before reaching their destination. The charging frequency depends on many things, including the type of battery, its size, and its capacity.

To make the operations of EVs easier, charging systems are quite crucial. Charging needs are different for every type of EV, i.e., two-wheeler EVs, three-wheeler vehicles, four-wheelers, and bigger and heavier vehicles like buses. It also depends on the usage and purpose of an EV, whether it is for passenger or commercial transportation.

The Ministry of Power in the Government of India has been powering the EV industry with the FAME1 and FAME2 schemes, primarily focusing on the charging infrastructure. This makes investors and experts interested in the changing charging infrastructure a positive sign of development. As the major OEMs are influencing the EV industry, it lays the foundation for the future of EV chargers, charging stations, and related facilities.

Future of the charging infrastructure in India

Considering the charging infrastructure is the only big support for electric mobility in India, limitations like the shortage of functional public charging stations and lengthy charging processes need to be fixed as soon as possible. The current issue with EV charging is that the number of vehicles, consumers' needs for adopting e-mobility services, and their dependence on such vehicles have increased daily with a poor charging ecosystem. Here is how the prediction of charging infrastructure in India is defined:

Types of Electric Vehicle Charging Systems

- **AC 4-wheeler Charging:** This type of charge is used as a top-up charger. These small units can be fitted inside a car or in a garage as a wall box. As loading time with these is longer, they are ideally fitted at home, work, or the destination point.
- **DC Car Chargers** for Rapid Charging Direct Current or DC is the fastest charging solution for electric vehicles. These are used on the road, like on highways or gas stations. The large volume of production of these charges would be the best solution for slow-charging EVs.

Public EV Charging Stations with Technological Advancements

Public charging stations with state-of-the-art grid connections can add functionality to the EV ecosystem and change the charging infrastructure. There are two major limitations to a public EV charging station. Firstly, the associated cost is higher, and secondly, most people don't need such hubs as they mostly charge their vehicles at home.

Wireless Charging for Electric Vehicles

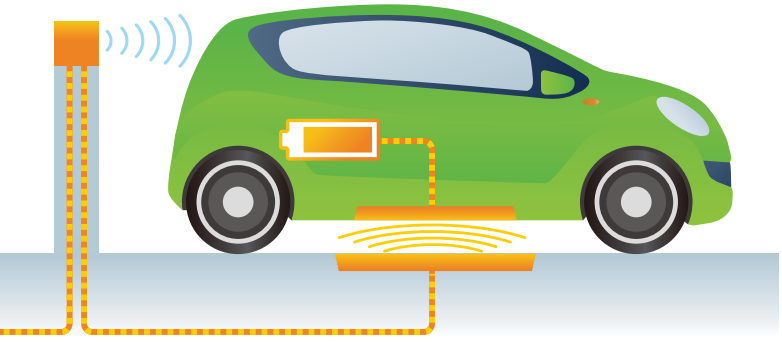
Wireless EV charging infrastructure may look like a fantasy, but once the execution is done, there will be no looking back. Being able to charge your electric car or two-wheeler would be convenient and hassle-free. The only limitation is that a heavier vehicle like a car would require a hefty amount of power to be charged wirelessly, which might negatively impact the environment and involve a considerable expenditure.

Automation in Charging Infrastructure

Autonomous charging does not require any specific input fields, like directions to park at a charging spot. As

the business for autonomous cars that are self-driven rises, the autonomous EV charging system will make a name for itself in the industry. The only limitation that needs to be worked upon is the charging speed. Unlike a wired charging system, autonomous or wireless EV charging lags through the charging process.

India is leading the global shift towards electrification with a significant increase in EV sales, growing by 112 percent YoY to 50,284 units from April to September 2023. Despite this progress, the primary hurdle to EV adoption remains the insufficient charging infrastructure. The urgency to establish a robust nationwide charging network is paramount to



achieving the target of 30 percent EV penetration by 2030. Additionally, as India focuses on sustainability, driven by the government's efforts to reduce fuel imports, EVs have gained prominence. However, challenges such as inadequate charging infrastructure, battery manufacturing, and limited EV model choices continue to impede the growth of electric mobility. Addressing these challenges is crucial for India's swift transition to a sustainable transportation system.

The Indian Government is proactively expanding public charging infrastructure, incentivising private sector involvement, promoting renewable energy adoption, and advancing fast-charging technologies and s mart software solutions.

- **Public Charging Infrastructure:** The Ministry of Power, in collaboration with agencies like the BEE, leads the establishment of EV charging stations across highways, cities, and public spaces under the FAME India scheme. Private entities are incentivised to participate, with benefits extended to businesses, malls, parking lots, and Residential Welfare Associations (RWAs).
- **Renewable Energy Integration:** India's abundant solar, wind, and hydro resources are leveraged to power EV charging stations, aiming to expand renewable energy capacity to 50 percent of total requirements by 2030.
- **Fast-Charging Technology:** With under an hour of charging time, fast-charging stations alleviate range anxiety and enhance EV owner convenience. Their efficiency allows for fewer stations compared to conventional slow chargers. Government subsidies and private investments drive fast-charging infrastructure development.
- **Private Sector Involvement:** The Indian government incentivises private sector engagement in EV charging infrastructure through initiatives like the FAME scheme and 100 percent Foreign Direct Investment (FDI). Oil companies receive funding under FAME, while liberalised FDI regulations further stimulate private sector participation.

These initiatives hold the potential to reshape the future of electric mobility in India.

Impact of EV Infrastructure on India's Future

A robust EV charging infrastructure in India can catalyse the growth of the EV market by alleviating range anxiety and promoting widespread EV adoption. Beyond individual benefits, the transition to electric mobility offers numerous advantages for the environment and the economy.

- **Reduction in Greenhouse Gas Emissions:** Electrifying transportation through EV adoption can significantly reduce emissions. By converting a higher proportion of electrical energy from the grid, EVs further reduce emissions and improve air quality.
- **Increased Utilisation of Renewable Energy:** The integration of renewable energy sources into the charging infrastructure not only reduces reliance on fossil fuels but also promotes sustainability. Direct procurement of green energy by EV owners under the Open Access Rules 2022 facilitates charging with renewable energy, further advancing the environmental benefits of EV adoption.
- **Economic Growth:** Transitioning to EVs and renewable energy can drive economic growth by cutting oil imports and fostering new job opportunities. By 2030, the EV and battery sectors are projected to create millions of jobs, propelling India toward substantial economic progress and fostering a stable, sustainable economy.

The bottom line

As electric vehicle ownership rises, so does the need for efficient charging infrastructure. In India, efforts to overcome slow charging limitations are driving industry growth. However, the challenge of insufficient charging stations looms, with predictions suggesting India will need around 2 million EV charging stations by 2030. ☐

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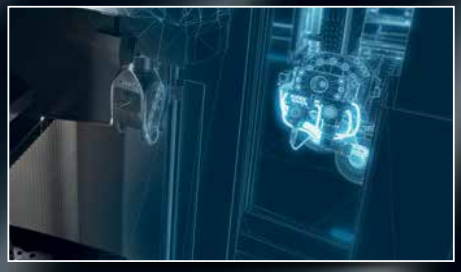

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Green cement- the road to sustainability

Given the prevailing discourse on sustainability, the cement industry must address this demand sustainably, ensuring a harmonious balance between development and environmental goals, thereby achieving both economic and green objectives concurrently.

Arun Shukla,
President and Director,
JK Lakshmi Cement

In the recently concluded G20 Summit under India's presidency, the leaders of the top 20 global economies collectively acknowledged climate change as one of the biggest challenges before human civilisation. The commitment and seriousness of the member nations towards achieving global sustainability targets were also reflected in the historic New Delhi Declaration, in which climate change took a prominent position on the G20 agenda.

The countries agreed to act through partnerships to accelerate strong, sustainable, balanced, and inclusive growth. The outcomes also include the Green Development Pact, which is a collective commitment towards sustainable development or simply an action plan to achieve Sustainable Development Goals (SDGs), promotes transition to sustainable energy, fosters resilience and sustainability in urban development, as well as mitigating disaster risks and bolstering infrastructure resilience for a better future. While the outcomes of the successful G20 Summit act as a roadmap for sustainable development, the collective responsibility now lies on industries to align their efforts and contribute to achieving the green targets.

Currently, India is accelerating its efforts to build a resilient infrastructure to cater to the needs of its growing population and thriving economy. The Indian government is spending on developing infrastructure projects such as affordable housing projects, expressways, highways, roads, economic corridors, and others. Since cement is the key ingredient in infrastructure projects, the acceleration in development initiatives is resulting in the growth of its demand. As per a report, cement demand is expected to rise 10-12 percent year over year to 440 Million Tonnes (MT) in FY24 due to strong offtake from the infrastructure sector. At this critical juncture, it becomes important for the cement industry to ensure this demand is met sustainably without decelerating the pace of development so that both economic and green goals are achieved together.

How is cement manufacturing linked to environmental challenges?

The cement manufacturers have relied on conventional methodologies to manufacture cement, which is a highly energy-intensive and carbon-emitting process. According to estimates, the cement industry accounts for around 7-8 percent of global carbon dioxide emissions. This is largely because cement manufacturing involves the production of clinker, a key ingredient in cement. In the manufacturing process, a mixture of limestone and clayey materials is fed into a kiln operating at temperatures around 1400°C. After this process, the processed material is ground, forming a

lumpy and solid substance called clinker, which is then mixed with gypsum to form cement. This entire process consumes lots of energy and fossil fuels and releases gaseous effluents, which adversely impact the environment and lead to industrial air pollution. Since cement is a widely consumed product for its various applications and serves as the backbone of construction projects, it becomes important to shift to sustainable cement manufacturing to reduce the environmental impact of cement manufacturing.

What makes green cement the future of sustainable infrastructure development?

Simply put, green cement is an eco-friendly cement that is manufactured by following a carbon-negative manufacturing process. A majority of its raw materials are discarded waste from industry, such as slag from the blast furnace, fly ash, and others. Additionally, with the help of technology, the manufacturing process of green cement focuses on bringing down emission levels to resolve serious environmental issues and minimise the carbon footprint of the cement industry.

Also, with the adoption of advanced technologies and innovative techniques, achieving sustainable cement manufacturing has become easier. For example, cement manufacturers can now integrate waste heat recovery systems, high-efficiency coolers and preheaters, and switch to clean energy sources such as solar and wind energy to get higher levels of energy efficiency and lower dependence on fossil fuels for financial and environmental gains.

Additionally, there are equipment and processes that can convert waste into fuel and can be incorporated into manufacturing processes as alternatives to carbon-emitting sources. Also, the implementation of carbon capture, utilisation, and storage methods that involve capturing CO_2 emissions and storing them or utilising them to produce chemicals, concrete, or plastics can prove to be a great alternative to utilising waste and promoting a circular economy.

Emerging trends in the cement industry are shaping its future

The Indian cement industry today has dual responsibilities, including catering to demand coming from infrastructure development and contributing to sustainable development. To achieve this, it is leveraging a host of technological solutions and digital tools, shaping new trends in the industry such as:

- **Automation in manufacturing:** There is no doubt that automation now plays a crucial role in the cement industry. The cement makers are ramping up efforts to automate key operations and processes to achieve higher levels of productivity and efficiency, save time, reduce energy consumption, and become sustainable in the long term. For example, automation systems enable cement makers to oversee and manage various stages involved in the manufacturing process, such as raw material feeding, blending, grinding, kiln and clinker production, and many others.

- **Growing adoption of advanced technologies such as AI, IoT, and others:** Today, advanced technologies like AI, robotics, data analytics, IoT, and others are completely revolutionising various industries, and cement manufacturing isn't left behind in them. By adopting the latest digital tools, backed by high-end technologies, cement manufacturers are achieving hassle-free operations, supply chain resilience, efficient resource utilisation, cost-effectiveness, and faster results. Most importantly, digital solutions are helping them, to inch closer to their sustainability targets by improving the energy efficiency of equipment, optimising temperature and pressure, supporting recycling waste materials, reducing waste, and conserving finite resources used in cement manufacturing.

- **Vital Role:** At present, India is striving to become the third-largest economy very soon and a net-zero economy by 2070. In this journey, the cement industry has a vital role to play. By greening cement manufacturing, leveraging technology, and achieving sustainability, the industry can make sure the goals are met within the set deadlines while making its contributions to building a sustainable future for the present and coming generations. ☐


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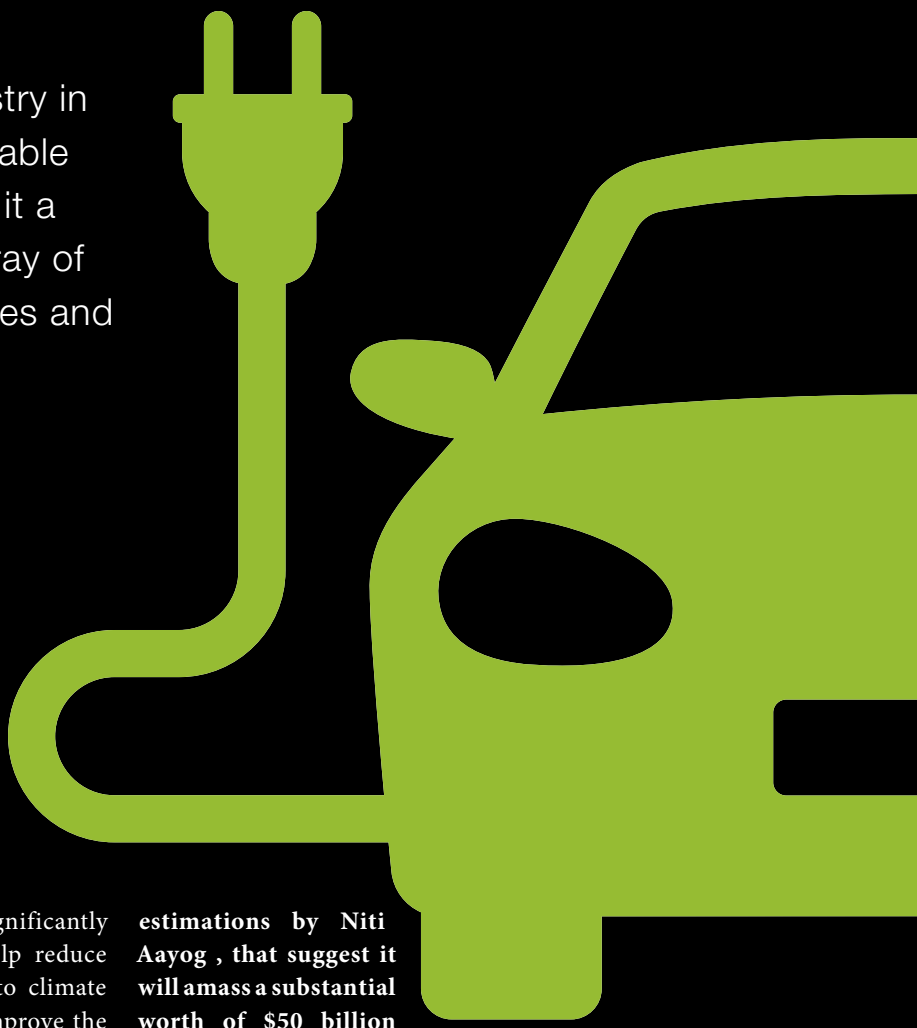
E-mobility: The road ahead

E-mobility, the burgeoning industry in India, has experienced a remarkable surge in recent years, rendering it a highly promising field with an array of potential prospects for businesses and individuals alike...

Anmol Bohre,
Co-Founder and Managing Director, Enigma EV



The potential of electric vehicles to emit significantly fewer pollutants than ICE vehicles can help reduce greenhouse gas emissions that contribute to climate change. Lower emission rates can subsequently improve the air quality index as well as promote public health.

Notably, the industry has enormous economic potential, including the creation of employment opportunities and augmenting investment prospects. Projections put forth in the IVCA-EY-Induslaw report indicate that the electric vehicle (EV) industry is poised to spark an exponential increase in the number of jobs available, with 10 million direct jobs and 50 million indirect jobs expected to be created by 2030. India is currently witnessing the emergence of a formidable EV financing market, with estimations by Niti Aayog , that suggest it will amass a substantial worth of $50 billion by 2030.

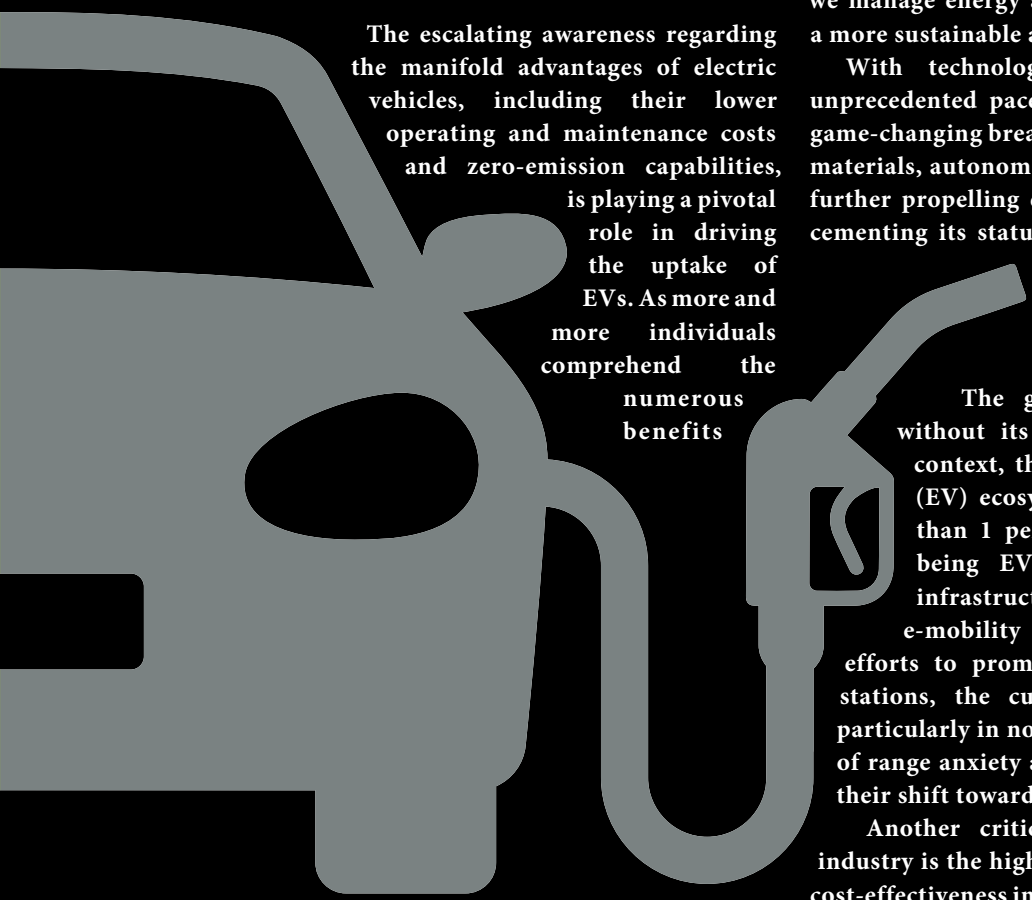
Government's push towards e-mobility

The Indian government has been diligently pursuing the promotion of electric mobility in the country using a multi-pronged approach, with a primary focus on its FAME-I initiative. The policy framework of FAME-I provided a comprehensive range of incentives to both electric vehicle buyers and manufacturers,

thereby expediting the widespread adoption of EVs throughout the nation.

Along with other initiatives, such as the National Electric Mobility Mission Plan (NEMMP) and the Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India (FAME-II) scheme, these incentives have played a pivotal role in accelerating the proliferation of e-mobility in the country. It is noteworthy that these policy measures underscore the government's unwavering commitment towards promoting sustainable transportation and diminishing the country's reliance on fossil fuels.

Rising awareness



The escalating awareness regarding the manifold advantages of electric vehicles, including their lower operating and maintenance costs and zero-emission capabilities, is playing a pivotal role in driving the uptake of EVs. As more and more individuals comprehend the numerous benefits associated with EVs the demand for this sustainable mode of transportation is expected to witness a marked upswing.

The heightened interest in EVs is also indicative of a growing awareness of the ecological impacts of traditional fossil-fuelled transportation and the need to transition towards more sustainable transportation modes. In essence, the trend towards heightened awareness and adoption rates signals a paradigm shift in the automotive industry towards sustainable and cleaner transportation, ushering in a new era of mobility.

Technological innovations in e-mobility

The e-mobility industry has emerged as a dynamic hotbed of technological advancements in recent times, with noteworthy progress in battery technology, electric drivetrains and charging infrastructure. These innovative developments have played a pivotal role in enhancing the efficiency, range and overall performance of electric vehicles, thus rendering them increasingly appealing to both consumers and businesses. Moreover, the advent of intelligent charging solutions and Vehicle-to-Grid (V2G) technology holds the potential to revolutionise the way we manage energy and ensure grid stability, ushering in a more sustainable and interconnected energy ecosystem.

With technology continuing to advance at an unprecedented pace, industry players anticipate further game-changing breakthroughs in areas such as lightweight materials, autonomous driving and Artificial Intelligence, further propelling e-mobility towards new horizons and cementing its status as a crucial player in the future of transportation.

Challenges in the industry

The growing e-mobility industry is not without its share of challenges. In the Indian context, the deployment of the Electric Vehicle (EV) ecosystem is still in its infancy, with less than 1 percent of the total vehicle population being EVs. The lack of adequate charging infrastructure poses a primary challenge for the e-mobility industry. Despite the government's efforts to promote the installation of EV charging stations, the current network remains insufficient, particularly in non-metro areas. This has led to the fear of range anxiety among potential EV buyers, impeding their shift towards electric mobility.

Another critical challenge facing the e-mobility industry is the high upfront cost of EVs. While EVs offer cost-effectiveness in the long run, the initial purchase price is still relatively steep, deterring price-sensitive consumers from considering them as viable options. Furthermore, the sector faces regulatory hurdles, such as the absence of a clear policy framework and inadequate incentives, which hinder its growth prospects. Additionally, the lack of skilled manpower and the need for upskilling and retraining of existing personnel pose significant challenges to the sector's progress.

Moreover, India needs to augment its battery recycling capabilities. Although the government updated its e-waste

management policies in 2018, the rules do not encompass lithium batteries, which predominantly constitute Li-ion batteries. The policy's recycling guidelines apply only to lead-acid batteries. The enforcement of these rules is challenging due to low e-waste generation rates and informal reclamation. It is pertinent to note that nearly 95 percent of valuable materials in Li-ion batteries, which primarily comprise lithium, cobalt, nickel, bauxite, manganese, aluminium and natural graphite, can be recovered. Nevertheless, global studies suggest that 95 percent of Li-ion batteries today end up in landfills, and only 5 percent are recycled and reused.

Research and development

As the e-mobility industry expands, the need for continued research and development becomes increasingly crucial to overcome current limitations and optimise performance. Advancements in battery technology, charging infrastructure and motor efficiency are vital for improving the range, speed and overall performance of EVs. In addition, rigorous research is crucial for ensuring the safety and reliability of EVs, addressing concerns related to battery fires and structural integrity. Governments and private entities must pool their resources to fund research and development, fostering collaboration between industry players and research institutions. The integration of nascent technologies such as Artificial Intelligence and the Internet of Things could further augment the capabilities of e-mobility. Furthermore, research is needed to comprehensively evaluate the environmental impact of e-mobility, encompassing its entire lifecycle from raw material extraction to end-of-life disposal.

Readiness to switch to EVs

The ascendant demand for e-mobility is attributable to its ability to augment and integrate with other technologies, potentially generating new customer relationships and service opportunities. The mainstream adoption of EVs could potentially revolutionise commutes in India. Therefore, it is imperative to prioritise last-mile connectivity and public transportation to facilitate the integration of EVs into the mainstream.

Additionally, authorities should contemplate reducing import and export duties on EVs and charging infrastructure. Relaxing the FAME-II policy's requirements and providing offsetting incentives for non-EV vehicles could prove advantageous in decreasing prices for consumers. This would enable the entry of necessary equipment from outside India into the market.

Future outlook

The future outlook for e-mobility is bright and promising, with an increasing number of countries, including India, embracing this sustainable transportation alternative. The complete transition to e-mobility will lead to a paradigm shift in the Indian automotive industry, necessitating innovative business models and technological advancements. EVs will become more affordable and accessible. As battery technology improves, range anxiety will become a thing of the past. Governments will continue to incentivise the adoption of e-mobility, promoting the establishment of charging infrastructure and investing in research and development to improve battery performance.

The integration of renewable energy sources, such as solar and wind, with EV charging infrastructure will further enhance the sustainability aspect of e-mobility. The emergence of autonomous and connected vehicles will revolutionise the way we commute, making transportation safer, more efficient and cost-effective. Collectively, the future of e-mobility is poised to bring about substantial changes in the transportation landscape, ensuring a greener and more sustainable future for generations to come. □

Data analytics benefitting **manufacturing industry?**

Data analytics is increasingly becoming a key element in the manufacturing industry. With right tools and strategies, companies can gain insights into their manufacturing processes, increasing efficiency, improving quality control, and boosting productivity. The article explores benefits of data analytics in the manufacturing industry.

Vikram Jain,
Practice Director-Analytics and Business Apps, Advaiya Solutions

Data analytics is the process of collecting, storing, organising, processing, and analysing data to gain insights. In the manufacturing industry, data analytics can track and monitor every step of a product's life cycle, from production to delivery. By utilising data analytics, companies can gain valuable insights into their manufacturing processes and identify areas for improvement. This can help them optimise operations and reduce costs. Data analytics can also be used to identify trends in customer demand and preferences.

Companies can use this information to adjust production processes and create products that better meet customer needs. Additionally, data analytics can be used to identify potential risks and opportunities in the manufacturing industry. By understanding the data, companies can make informed decisions and develop strategies to capitalise on opportunities and mitigate risks.

Improving efficiency

Data analytics can help manufacturers identify and address inefficiencies in their production processes. By gathering data from all aspects of the production process, they can better understand how they can save time and resources. This includes tracking production times, identifying bottlenecks in the process, and evaluating the effectiveness of specific operations. By analysing this data, companies can make informed decisions about optimising their production processes and becoming more efficient.

Data analytics can also be used to identify areas of waste and inefficiency. By analysing data, manufacturers can identify areas where resources are being used inefficiently or where processes are taking too long. This can help them identify areas where they can make changes to improve efficiency and reduce costs. Additionally, data analytics can be used to identify trends in production and identify areas where improvements can be made to increase efficiency.

Enhancing quality control

Data analytics can also help manufacturers ensure quality of their products. By gathering data on all components of the manufacturing process, companies can identify any potential quality issues before they become problems. This includes detecting defects in raw materials, examining finished goods for defects, and monitoring production equipment for signs of wear and tear. By utilising data analytics, manufacturers can quickly detect any quality issues and take corrective action to ensure their products meet quality standards.

Data analytics can also be used to track the performance of production equipment over time. By monitoring the performance of machines, manufacturers can identify any potential issues before they become problems. This can help reduce downtime and improve overall efficiency of the production process. Additionally, data analytics can be used to identify trends in customer feedback, allowing manufacturers to make improvements to their products and services.

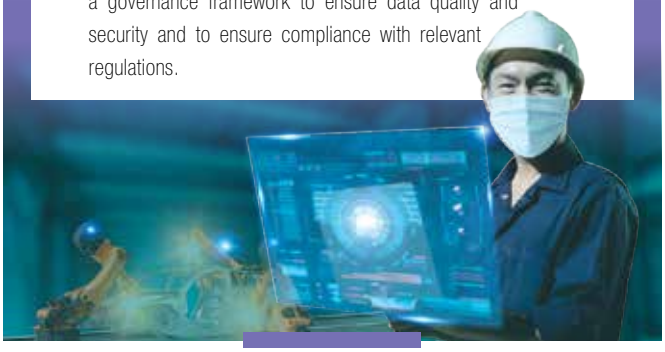
Increasing productivity

Data analytics can also be used to increase productivity in the manufacturing industry. By gathering data on production times, downtime, and overall performance, companies can

STRATEGIES TO IMPLEMENT DATA ANALYTICS

Implementing data analytics in the manufacturing industry can be a complex process, but there are several strategies that organisations can use to make the transition smoother:

1. **Start with a clear goal:** Before implementing data analytics, it's important to have a clear understanding of what you hope to achieve. This can include goals such as reducing costs, improving efficiency, or increasing revenue.
2. **Identify key data sources:** Identify the key data sources that will be used to support your data analytics efforts. This could include data from sensors, production systems, and other sources.
3. **Build a data-driven culture:** Create a culture where data is valued and where employees are encouraged to use data to inform decisions. This can be achieved through training and education programmes, as well as through appointment of data-savvy leaders.
4. **Invest in the right technology:** Select the appropriate technology, including data management platforms, analytics tools, and visualisation tools, to support your data analytics efforts.
5. **Collaborate with partners:** Collaborate with other companies, suppliers, and technology vendors to share data and insights that can help improve your operations.
6. **Continuously monitor and improve:** Continuously monitor the performance of your data analytics efforts and adjust as needed.
7. **Establishing a governance framework:** Create a governance framework to ensure data quality and security and to ensure compliance with relevant regulations.



better understand how they can improve their operations. This includes optimising their workforce by assigning tasks to the most suitable personnel and improving the flow of operations by streamlining processes. By leveraging data analytics, companies can increase productivity and reduce overhead costs.

Gaining insights

Data analytics can also be used to gain insights into how products are being manufactured and how they are performing in the marketplace. Companies can better understand how they can improve their products and services by collecting data on production times, resource usage, and customer feedback. This helps them stay ahead of competition by continuously improving their products and services.

Analysing cost savings

Data analytics can also be used to identify areas where cost savings can be made. By gathering data on resource usage, raw material costs, and other related expenses, companies can pinpoint areas where they could save money. This includes streamlining processes to reduce waste, identifying areas where cost-effective substitutes could be used, and optimising production schedules to reduce disruption.

Enhancing customer experiences

Data analytics can also be used to enhance customer experiences. By collecting data on customer preferences, feedback, and interactions with products and services, companies can gain deeper insights into how customers perceive their brand. This allows them to tailor their products and services to meet customers' needs more effectively. Companies can also use data analytics to identify potential customer segments and develop targeted marketing campaigns to attract more business.

Exploring the potential of predictive analytics

Predictive analysis is an advanced form of data analytics that uses machine learning algorithms to anticipate future outcomes. In the manufacturing industry, predictive analysis can be used to forecast demand for products, identify potential risks in production processes, and evaluate the impact of new technologies. And by utilising this companies can gain a competitive edge by staying ahead of the competition.

Analysing supply chain management

Data analytics also has a significant impact on the supply chain management. By collecting data, companies can gain insight into how their supply chain is performing. With right data analytics tools and strategies, companies can reduce costs, improve delivery times, and enhance customer experiences. This tool provides a huge significance value to the manufacturing companies.

Harnessing Big Data

Big Data is another key element of data analytics which is significant in the manufacturing industry. By leveraging Big Data sets from multiple sources across the organisation, companies can gain deeper insights into their operations. This allows them to make informed decisions quickly that are based on reliable data.

Boosting productivity

By utilising data analytics tools and strategies, companies can gain valuable insights into their operations that will help them increase efficiency, improve quality control, and boost productivity. By harnessing Big Data for smarter decision-making, manufacturers can stay ahead of the competition and ensure they remain competitive in an ever-changing market. ☐

Mastering Titanium Machining

Explore the dynamics of titanium machining, addressing challenges like low heat conductivity and work hardening, with expert recommendations for optimal results.

Neha Basudkar Ghate
Joint Editor

The titanium machining industry is experiencing significant growth across sectors such as aerospace, automotive, and medicine. The demand for high-strength, lightweight components is pushing the boundaries of titanium applications. This article delves into the essential considerations, challenges, and strategies for maximising efficiency and output in titanium machining.

Debunking the myth

Contrary to popular belief, titanium isn't inherently difficult to machine. Understanding its unique properties, including chemical reactivity and low heat conductivity, is crucial. This section explores the factors contributing to titanium's perceived difficulty and provides insights on how to navigate them effectively.

Is Titanium a safety concern in machining?

Working with titanium poses minimal safety hazards as it is inherently a safe metal. With an auto-ignition temperature of 2,200°F in air, the likelihood of ignition during milling with coolant is low. The use of coolants not only mitigates the risk of ignition but also prevents the airborne accumulation of titanium dust. It is crucial to note that the auto-ignition temperature of titanium dust in air is significantly lower at 450°F. In the event of a dry titanium fire, it burns slowly and can be controlled using dry table salt or a type D fire extinguisher. However, caution is advised against using water, as it may lead to an explosive reaction. Additionally, direct contact with titanium does not result in toxic effects.

Versatility and challenges of machining Titanium:

Titanium, recognised for its versatility as a high-strength material with low density and high melting temperatures, presents certain challenges in machining. Its low thermal conductivity contributes to elevated temperatures at the cutting edge, causing rapid wear and plastic deformation of cutting tools. The material's high reactivity further leads to chemical interactions with cutting tools, resulting in crater wear during the machining process.

During machining, titanium undergoes strain hardening, leading to notch wear at the depth of cut. Simultaneously, its low modulus of elasticity, coupled with its high strength at elevated temperatures, makes it uniquely suitable for high-temperature applications such as airplane parts. With an exceptional strength-to-weight ratio, corrosion resistance, high hot hardness, and wear resistance, titanium outperforms steel in strength while being only 40 percent of its weight. In comparison to aluminium, it is twice as strong with only a 60 percent increase in weight. These characteristics make titanium an invaluable material for various industrial applications.

Factors to consider in Titanium Machining:

- **Low heat conductivity:** Titanium exhibits poor heat conductivity, storing energy generated by friction on the cutting edge of tools rather than dissipating it. This characteristic demands lower cutting speeds to mitigate heat generation. Increasing the feed rate on a CNC machine compensates for reduced cutter speeds, maintaining efficiency. A substantial flow of cutting fluid, precisely directed at the cutting point, helps counteract the reduced refrigeration effect caused by titanium's low heat conductivity.

- **High chemical reactivity:** Titanium's high reactivity can lead to combustion in oxygen and nitrogen, resulting in tool damage and potentially disastrous consequences for machined parts. The formation of microwelds and smearing during high-temperature reactions pose challenges. Varying cutting depths can help distribute tool wear, mitigating the effects of chemical reactivity. For further insights into tool wear and common issues, refer to our dedicated page.

- **Low modulus of elasticity:** Despite its appreciated elastic qualities, titanium's low modulus of elasticity poses challenges during machining. Under tool pressure, titanium deflects, causing chatter problems and heat generation. Stiffening the entire machining system, including the CNC machine, spindle, tool holder, and tool, is crucial to minimising chatter and

COMPARING THE MACHINING CHARACTERISTICS OF TITANIUM AND STAINLESS STEEL

Making the right material choice is a crucial decision that requires careful consideration of the key differences between titanium and stainless steel. Here are some essential factors to keep in mind:

1 Corrosion Resistance:

Titanium exhibits superior natural corrosion resistance compared to stainless steel. This characteristic makes titanium particularly suitable for marine applications or environments with exposure to saltwater.

2 Conductivity

Both electrical and thermal conductivity differ between titanium and stainless steel. Titanium, in general, is less conductive than stainless steel in both areas.

3 Strength

Titanium surpasses steel in terms of strength. It boasts a higher strength-to-weight ratio and a lower melting point than stainless steel. Variations in hardness and melting points further distinguish the two metals.

4 Metal cost:

Titanium tends to be more expensive than stainless steel due to its rarity and the challenges associated with machining it. The higher cost is reflective of its unique properties and processing difficulties.

5 Other factors:

Beyond the primary differences, additional factors such as weight, durability, and machinability play crucial roles in the decision-making process. Evaluating these factors ensures a comprehensive understanding of how each material aligns with specific project requirements.

By weighing these considerations, you can make an informed decision when choosing between titanium and stainless steel for your machining needs. Each material offers distinct advantages, and a thoughtful evaluation will guide you towards selecting the most suitable option for your application.

preserving tool life. Explore our waste reduction page for detailed guidance.

- **Work hardening:** Titanium undergoes work hardening during machining, altering cutting angles and leading to thin chips with minimal contact area on the tool face. Dull tooling or inappropriate cutter geometry exacerbates the problem, resulting in plastic deformation and increased tool wear. To prevent work hardening, maintain continuous tool feed throughout the machining process, avoiding sudden stops that could harden the titanium, heat the tool, and cause breakage.

- **Stress in Titanium:** Stress in titanium, often developed during forging, can impact the machining process, especially in high-strength materials like titanium grade 5. Heat treatments applied before machining effectively relieve stress, ensuring smoother machining processes.

- **Stress and mechanical value variation:** Forged titanium may face challenges due to high forge impact, low forge temperature, and poor element mix during ingot meetings, leading to stress or material variation. This complexity can make machining more intricate. Additionally, titanium's tendency to return to its original shape can pose challenges when machining thin walls.

In conclusion, while titanium machining presents unique challenges, understanding its properties and implementing specific measures can optimise the process. From mitigating heat conductivity issues to addressing chemical reactivity and stress, careful consideration ensures efficient titanium machining. As industries continue to demand high-strength, lightweight components, mastering the intricacies of machining titanium becomes increasingly essential for success. ☐

5 ways Big Data and AI have altered manufacturing

Understanding the scope of the fourth industrial revolution is crucial as it impacts manufacturing and extends across all industries. In this article, we delve into how Industry 4.0 and cutting-edge technologies are reshaping the manufacturing landscape.

Shekhar Verma,
Director, Product Marketing, eInfochips

Technological advancements have profoundly transformed every aspect of our lives. The manufacturing industry has also witnessed a technological transformative shift towards Industry 4.0. This paradigm shift is characterised by an exponential increase in the use of technology, particularly with the integration of Artificial Intelligence (AI) and Big Data into manufacturing processes. Various reports also suggest that the growth in AI and Big Data is going to be substantial. The global AI in manufacturing market size is expected to hit the mark of $ 68.36 billion by 2032. The use of technologies like big data in manufacturing has a CAGR of 14.1 percent. The market is projected to be worth $ 9.11 billion by 2026.

Why is Industry 4.0 important?

Industry 4.0, also known as the Fourth Industrial Revolution, represents the next stage in digitising the manufacturing sector. It is driven by disruptive trends like the growth of data and connectivity, enhanced analytics, human–machine interaction and advancements in robotics. The fusion of technology with Industry 4.0 brings forth novel services and products. Utilising portable devices, sensors, robotics and data analysis leads to product enhancements, ranging from streamlined testing and prototyping to integrating connectivity into once-isolated products.

The role of AI and Big Data in manufacturing

In the era of Industry 4.0, manufacturing processes are becoming increasingly data-driven. In such a landscape, harnessing the power of AI and big data solutions is paramount for manufacturers. The transformation of data into actionable insights catalyses the enhancement of efficiency, quality and productivity. Big data and AI have a significant influence on manufacturing across multiple dimensions. This article delves into the top five ways they impact manufacturing processes.

1. Supply chain improvement

According to a recent McKinsey report, supply chain management and logistics have greatly improved using AI. This illustrates the industry-revolutionising potential of AI-enabled supply-chain management as well as its significance in today's business climate. Here is how AI can tackle and enhance supply chain optimisation below.

- Managing data: Ensuring that data is logged or appropriately classified is a challenging part of supply chain management. Large data sets are analysed and responses are sent to AI for training. As it does so, an AI system "learns" and improves in terms of speed, sophistication and ability to process this data through procedures known as machine or deep learning. Thus, it makes sense that supply chain data management might be used to train AI systems, improving their capacity to recognise trends, detect discrepancies and flag possible issues.

- Productivity: Productivity is crucial to supply chain optimisation. Supply chains are interrelated, so when anything goes wrong or is delayed in one area of the network, it affects other areas of the network significantly as well. Artificial Intelligence (AI) has a significant productivity advantage over people and other computer-based systems, enabling it to resolve problems as soon as feasible.

- Reformation: Although firms should carefully design supply chains to prevent inconsistencies or inefficiencies, the truth is that these processes can seldom run smoothly. To uncover methods to improve a supply chain, an AI system can take a more comprehensive approach. For example, it can identify faster or less expensive ways to transfer materials between two locations within the network or it can combine several providers of a certain product into one supplier.

2. Cost optimisation

Algorithms using generative AI can optimise designs taking manufacturing costs into account. Through cost

analysis of various production procedures, materials and assembly stages, generative AI can suggest design, material, assembly and packing iterations that lower total manufacturing costs. This might include finding cost-effective substitutes, reducing material waste, streamlining part consolidation, improving assembly processes, recommending JIT procurement schedules and many other tasks.

3. Predictive insights

The use of AI has made predictive maintenance in the industrial sector a game-changer. AI in manufacturing analyses sensor data from machinery and equipment to provide predictive maintenance. This enables producers to plan for equipment failure and carry out necessary repairs before a breakdown happens. Systems driven by AI can:

- Gather and handle massive data from shop floor sensors, such as GPS, audio and video.
- Assist in identifying irregularities or inefficiencies in equipment to avert unexpected equipment failure; this can be an unusual noise coming from the engine of a car or a problem on the production line.
- Reduce expenses and increase manufacturing productivity by preventing unscheduled equipment downtime.

Furthermore, it is less expensive to repair individual component problems than to replace the complete system.

4. Quality assurance

Manufacturing relies heavily on quality assurance, and AI is revolutionising this field. Businesses are reinventing quality control by utilising AI and ML in production to ensure better levels of accuracy and consistency. These devices are capable of quickly and precisely inspecting goods to find flaws and deviations from required standards. Automating quality control helps producers cut down on the amount of manual inspection that is required, as well as on rework, scrap and customer returns. This results in better products at lower costs.

5. Product development

AI integration in the industrial sector has resulted in creative solutions and efficient procedures that are completely changing how businesses develop and launch new goods. Manufacturers can obtain information from competitive analysis, consumer preferences and market trends by utilising ML algorithms. This enables them to build goods that meet market expectations and make data-driven decisions. Before launching production, manufacturers can test their ideas using Augmented Reality (AR) and Virtual Reality (VR) simulations created by AI-based product development. Consequently, manufacturers can:

- Cut the expense of trial and error
- Reduce the time to market
- Assist their engineers in anticipating issues and resolving them before the product's release.
- Simplify the upkeep and debugging procedure.

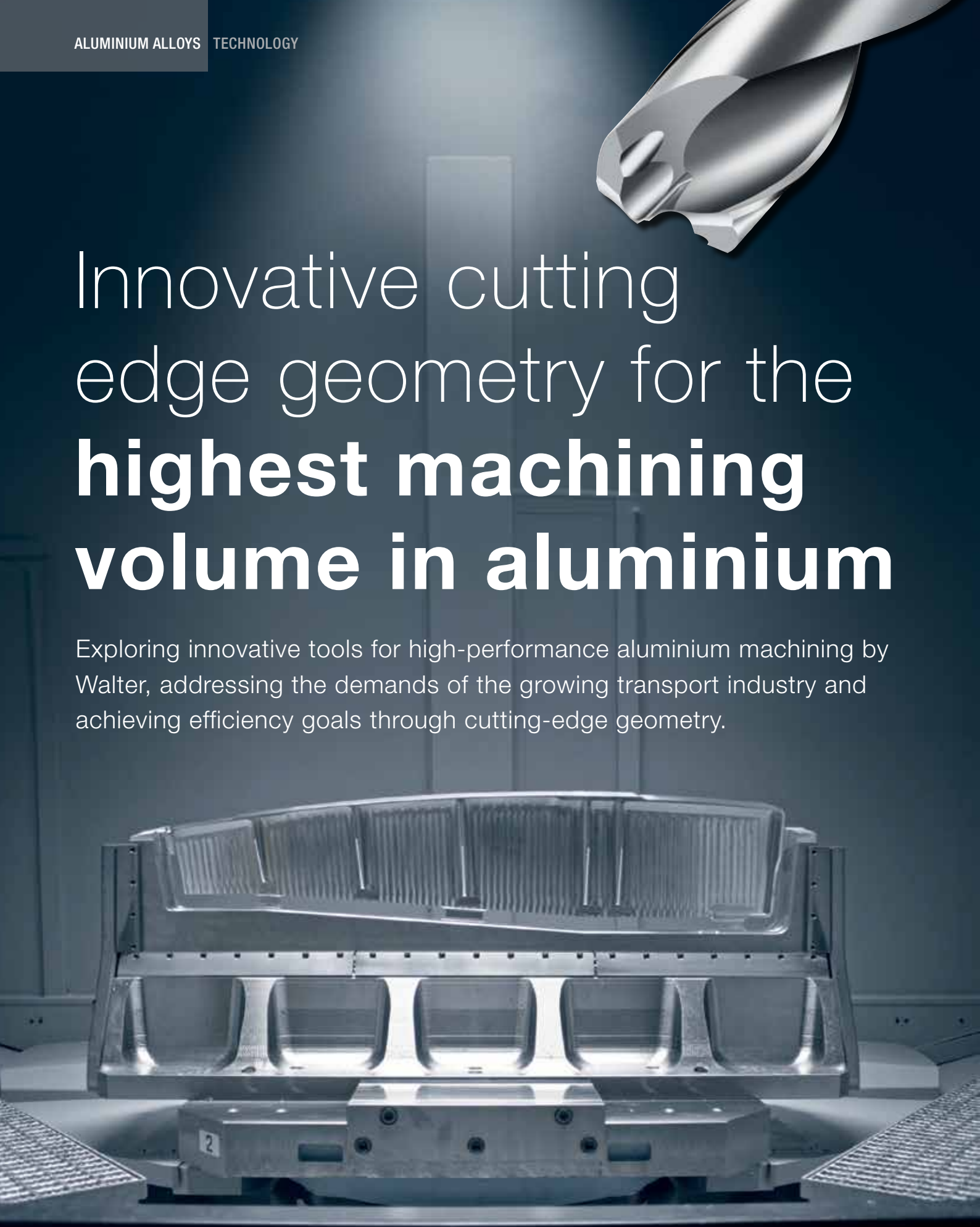
Wrapping up

AI's widespread adoption is destined to become as common as the prevalence of smartphones in today's world. Huge chunks of data that were previously isolated get new levels of visibility and insight when coupled with operational data from ERP, supply chain, customer service and other business systems.

The path forward is clear: manufacturers that harness the potential of AI will not only thrive but lead the way in this new era of innovation and efficiency. As we move forward, the only question is, will you be at the forefront of this transformative journey? ☐

Innovative cutting edge geometry for the **highest machining volume in aluminium**

Exploring innovative tools for high-performance aluminium machining by Walter, addressing the demands of the growing transport industry and achieving efficiency goals through cutting-edge geometry.



According to a study by the International Aluminium Institute (IAI), global aluminium demand will grow by 40 per cent by 2030, from 86.2 million tonnes in 2020 to 119.5 million tonnes in 2030. An important sector here is the transport industry – from bicycles, to cars and trucks, right through to aircraft construction. Machining specialists such as the Tübingen-based manufacturer Walter have been addressing this dynamically growing market for some years now with a special range of products.

High-performance machining systems are making new demands

Aluminium alloys are used particularly in areas where relatively high toughness of a component and a low weight have to be reconciled. Lightweight construction is therefore booming, especially in the mobility sector. However, this special combination of material properties also makes machining demanding. The high ductility of wrought aluminium alloys, for example, leads to build-up on the cutting edge, and long chips can impair process reliability. In aircraft construction above all, components are also often milled out of the solid material. The machining volume here can be up to 95 per cent of the blank. In addition, many components are also relatively large and complex in shape, which makes clamping difficult. For this reason, large, cost-intensive machines or machining centres with very powerful spindles are often used in aluminium machining, with which the required metal removal rates can be achieved economically. Today, values above 80 kW are standard – the latest generation of machines has a spindle output of around 130 kW.

However, power alone has not yet made any machining process fundamentally more efficient. The cutting tool that is used is an important factor in actually applying the theoretical machine performance to the component. Only with the appropriate tool and a well set-up process can the potential of a modern high-performance machining system with spindle outputs of up to 130 kW actually be used economically and reliably.

With a sophisticated range of high-performance tools for aluminium machining, Walter has been helping customers to achieve their efficiency goals for years. In recent years, the company has invested heavily in the aluminium range. The MD265 Supreme and MC268 Advance solid carbide milling cutters, for example, have only been on the market since October 2022. They were specially developed for high machining volumes of ISO N materials like aluminium alloys.

Innovative new micro-geometry increases process reliability

For the two new solid carbide milling cutters, the Walter developers have placed particular emphasis on optimising the micro-geometry of the tool cutting edges. The special "V-shaped centre cutting edge with two clearance angles" is typical of both milling cutters – a Walter development that is so far unique on the market. The new cutting edge makes it possible to plunge into the workpiece at an angle with low heat generation and with process reliability. This prevents structural changes in the material that can occur when using conventional milling tools. At high machining rates, localised temperatures up to 480 °C can be generated under Minimum Quantity Lubrication (MQL). This can affect the electrical conductivity of the material and lead to it being disqualified during quality testing. With the new centre geometry, the temperature remains below 140 °C. In addition, the cutting edges, Kordel or RAPAX profiles and flutes are so finely polished that hardly any machined material adheres to them. The special micro-geometry enables smooth cutting, which significantly improves process reliability. Users can also work with a reduced cutting force – which saves on spindle output and maximises the efficiency of the output used.

With its Kordel profile, the MC268 Advance is designed as a universally applicable roughing tool. The MD265 Supreme with RAPAX profile is designed for a

maximum metal removal rate, and enables a metal removal rate of up to 9.2 litres per minute in 24/7 operation in components made of Al7075. This metal removal rate is achieved with an MD265 Supreme with a diameter of 25 mm at 33,000 revolutions per minute and a feed per tooth of 0.15 mm, as well as a depth of cut and width of cut of 25 mm each. The required spindle output is about 120 kW. The maximum value of current machine tools is optimally utilised.

Thirty per cent productivity increase in aluminium: The Walter DC166 solid carbide drill

The DC166 Supreme solid carbide drills have been on the market since April 2023. Designed for mass producers who need to drill many holes in an aluminium alloy workpiece, the drills make productivity increases of about 30 per cent possible.

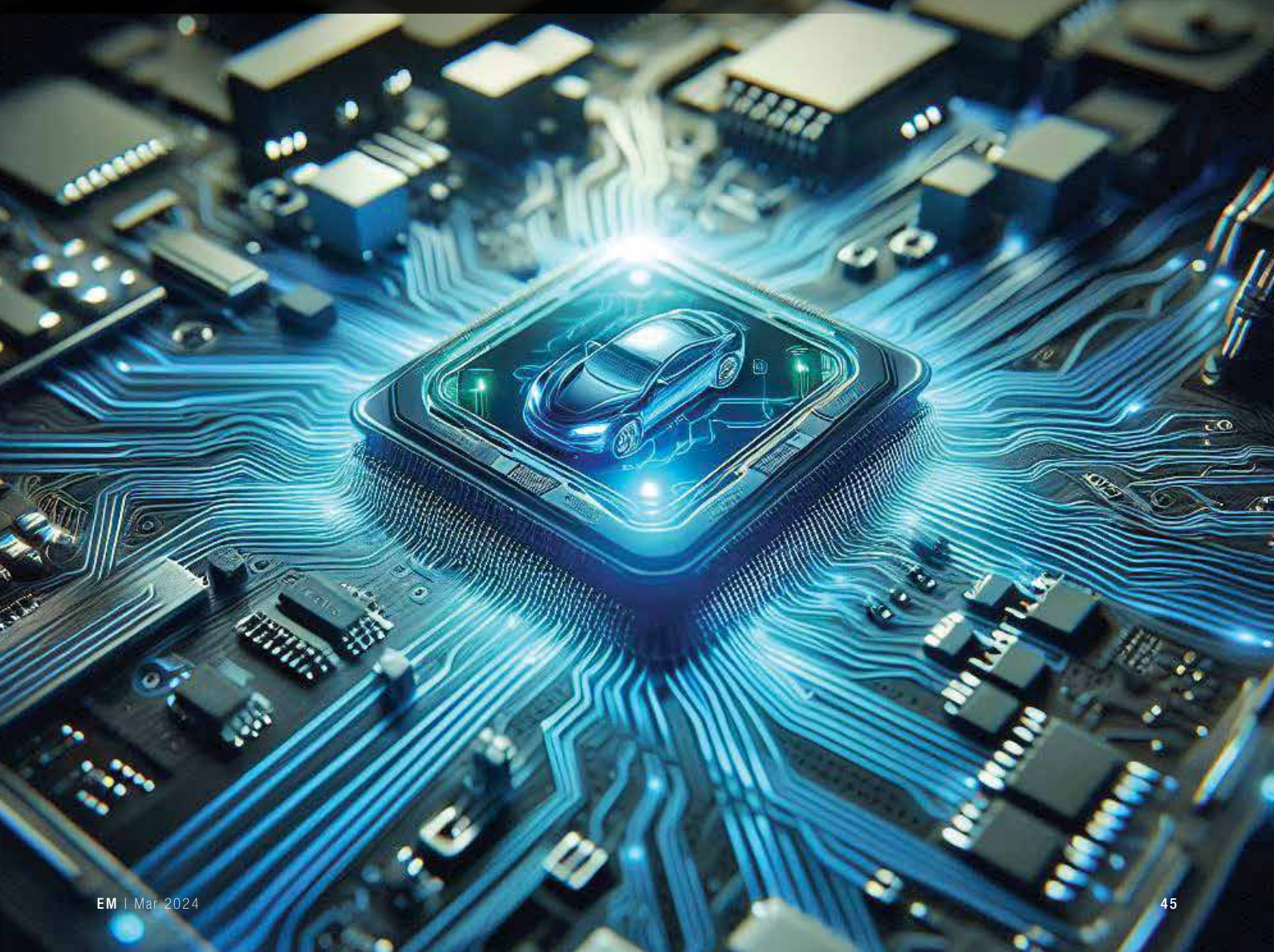
Due to the optimised cooling towards the centre and the strong thinner web as well as the polished flutes, a significantly higher feed rate can be operated with the DC166 drill. In some cases, the machining time can thereby be halved. In addition, tool life is increased due to the reduced built-up edge. This standard tool with through coolant is specially designed for Minimum Quantity Lubrication (MQL) and cooling with emulsion. □

Courtesy- Walter India

Chips on wheel- The backbone of vehicle

Cars talking to each other, talking to home appliances, talking to the service bay at the workshop, talking to the OEM for diagnostic solutions – these are not the future, these are already here. As cars increasingly become computers on wheels, the demands on semiconductors are growing.

Kamal Goyal,
Technical Advisor,
Rimaco Group of Industries



Your car is a computer on wheels, a modern car is one of the most complex, software-driven gadgets in the world. Have you ever wondered a chip, the size of a thumbnail can make it run or stop it, how at the touch of a button the car window opens and closes, how if another vehicle comes closer your car's sensors start beeping, how a slight push to the accelerator pedal can enhance the power delivery of the engine in a fraction of a second?

How are semiconductors helping the car industry?

Semiconductors are now driving the future development of in-car technology which have evolved over the last few decades to find use in nearly every corner of our everyday lives. As the car industry demands ever-more automation and sophistication, semiconductors will be increasingly incorporated in onboard systems for a wide variety of applications.

Where are chips in cars?

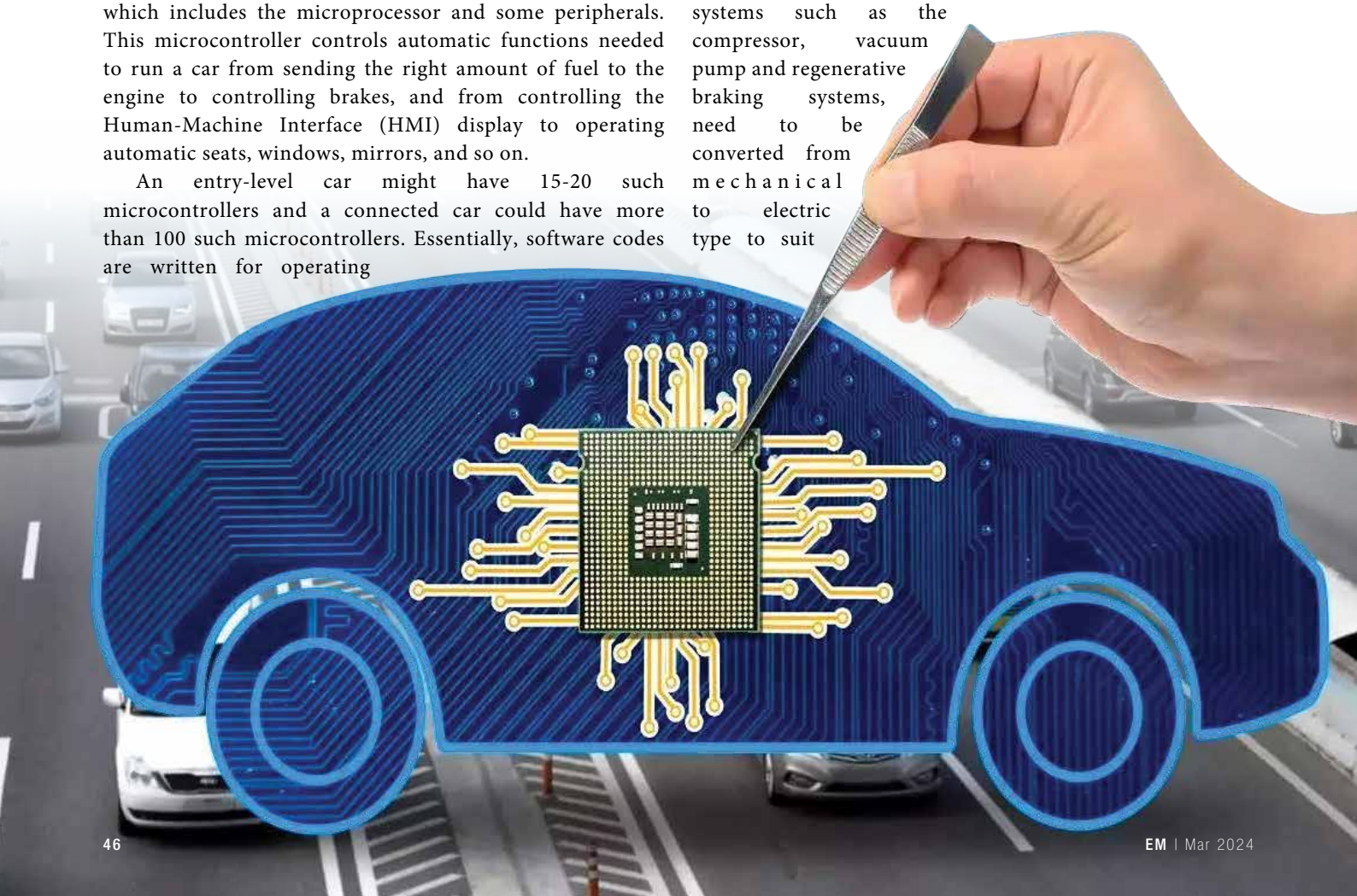
There is something working deep inside a car, software codes that make these physical acts possible. That software runs on a microprocessor. Then there is the microcontroller, which includes the microprocessor and some peripherals. This microcontroller controls automatic functions needed to run a car from sending the right amount of fuel to the engine to controlling brakes, and from controlling the Human-Machine Interface (HMI) display to operating automatic seats, windows, mirrors, and so on.

An entry-level car might have 15-20 such microcontrollers and a connected car could have more than 100 such microcontrollers. Essentially, software codes are written for operating a particular function of a car and the microcontroller makes that code interact with the physical control. Presently, petrol/diesel cars use semiconductors in almost all functional areas, such as powertrain, body control, steering system, braking systems, airbag system, infotainment and vehicle telematics system and so on. The usage of chips is also increasing due to the rising popularity of connected cars in India. These cars have an inbuilt eSIM, and offer features such as voice-based navigation, voice-assisted phone calls, in-car air quality monitoring, remote engine start, and are also capable of over-the-air software updates.

So, the next time you observe your car responding to your voice or the AC maintaining the cabin temperature or the anti-lock braking system helping avoid an accident, do remember that software running on a tiny chip the size of a thumbnail is helping the car do that.

In context of electric cars

It will further go up with the mass arrival of electric cars, in addition to the above, usage of various controllers for managing the electric powertrain including the battery, motor, inverter and the charging system require additional electronics and semiconductors. Further, some auxiliary systems such as the compressor, vacuum pump and regenerative braking systems, need to be converted from mechanical to electric type to suit



electric car requirements, leading to additional usage of semiconductors. At present, the share of electronic components by value may range from 10-15 percent, but in electric cars this may be about 1.5 times that in conventional petrol/diesel cars.

How technology is making cars safer and responsible on roads?

We may still not be in the era of fully-autonomous when it comes to cars, but a host of new technologies that come strapped on vehicles are ensuring that your ride is safer, more secure, and lastly, intuitive. With cars becoming more of a 'chips-on-wheels' phenomenon - and by this I mean the intelligent semi- conductor chips - a lot of burden around safe driving is being shouldered by the plethora of technologies that come strapped on to the vehicles.

The good part: with mass commercialisation, much of these have started to come across popular models that are being sold in the market and not just being confined to luxury brands. So, auto companies today offer features that ensure that your ride remains safe and easy, and you get alerts and notification around any possible chance of an accident.

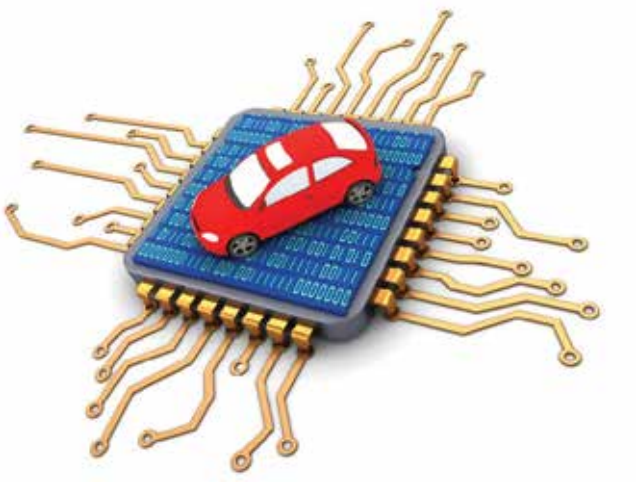
Ensuring safety and security

Vehicle safety is one of the key priorities in the various SUVs that the company offers in the market. "Integrating safety with innovation is not only inevitable but also essential as we move towards a future with connected cars that include advanced safety features. Safety as a core pillar of product development has helped us build a range of products that meet global safety standards.

The safety apparatus goes much beyond the airbags that have become a standard across new Indian cars. Now introduction of body-on-frame SUV in India have secured a full 5-star rating in new testing protocols by Global NCAP, thanks to the comprehensive range of additional safety features including driver drowsiness detection, Roll Over Mitigation (ROM), Hill Descent Control, Hill Hold Control, Vehicle Dynamics Control, and ISOFIX/i- SIZE Compatibility.

The newest generation of stability control and personalised safety alerts are standard in all variants. Automatic headlamps with High Beam Assist dynamically adjust the illumination of dark areas on the road, without blinding oncoming traffic. Safety is further taken care of by tyre pressure monitoring systems, an additional re- verse camera, a driver drowsiness detection system, and stop and go driving function as part of its adaptive cruise control.

Now some companies also focusing on developing and introducing robust safety technologies and features that offer customers a confident driving experience such as Electronic Stability control (ESC), Vehicle Stability Management (VSM), Hill Assist Control (HAC), Automatic Headlamps, Electric Parking Brake (EPB), Multi Collision-avoidance Brake (MCB) and over 60 safety features ensuring utmost customer safety to overcome any hurdles on the road by alerting at the right time.



Preventing accidental hazards

The Advanced Driver Assistance System (ADAS) is a group of safety and convenience functions intended to improve comfort for drivers and road safety and preventing or reducing the severity of potential accidents. ADAS can do all this by alerting the driver, implementing possible safeguards in the vehicle and automating driving controls. Autonomous Level 2 features not just makes driving more comfortable but also keeps your safety at the fore- front.

With level 2, the system can not only perform acceleration /braking functions but can also activate steering control to assist the driving. As a part of Global safety vision, auto car manufacturers are also integrating and layering technology inside their vehicles and striving to achieve Zero Collision Fatalities involving by 2050.

A long road together

With autonomous driving around the corner, increasingly sophisticated semiconductor devices will be a linchpin of the technological advances that make them possible. With the emphasis possibly moving away from the driving experience to the rider experience, there could be a shift to an increasing focus on interiors, comfort and productivity. Undoubtedly, the semiconductor and automotive industries are traveling a long road together. ❐

Indigenous Drone manufacturing advances in design and efficiency

The indigenous drone manufacturing industry is on the brink of pushing the boundaries of design complexity, efficiency, and overall performance as these technologies evolve. The sector is also geared towards delivering modern solutions through advanced technology.

Capt Nikunj Parashar,
Founder and CMD,
Sagar Defence Engineering

The manufacturing of various autonomous and unmanned systems, such as Unmanned Surface Vessel (USV), Unmanned Aerial Vehicles (UAVs) and Autonomous Underwater Vehicles (AUVs) aka 'drones' involves a combination of advanced technologies and intricate engineering processes, along with precision in design and assembly, to meet the needs of various sectors and solve the complex challenges of today. The manufacturing process begins with the conceptualisation and design, during which engineers use specialised software to create detailed 3D models, considering factors such as hydrodynamics, aerodynamics, and weight distribution of these various types of unmanned aerial, maritime, and terrestrial systems. Prototyping these designs is crucial, wherein a physical model is created to test and refine the design, as this iterative process helps in optimising the drone's performance and capabilities.

Precision, assembly, and integration

The drones are typically manufactured using lightweight materials to ensure agility and energy efficiency, such as carbon fibre and 3D-printed parts. As these drones have numerous components, the assembly process involves integrating these components with precision. Hence, automation is used to ensure consistency and efficiency, and skilled technicians oversee the process to address any issues during manufacturing. Since these drones rely on advanced electronics for navigation, communication, and control, the integration of flight controllers, GPS modules, and communication systems is a critical phase. Indigenously designed miniaturised electronic components are carefully installed and connected to ensure seamless communication and accurate control during operations. Further, they are fitted with reliable power sources, and integrating the power system involves ensuring the correct voltage, capacity, and energy efficiency. The placement of batteries is strategically planned to maintain the drone's balance and stability.

Evolving Drone manufacturing technologies

The manufacturing process for drones is not static; it evolves with advancements in technology and continuous improvement efforts focused on enhancing drone performance and incorporating new features based on the complex challenges being addressed. Cutting-edge technologies, such as 3D Printing, Computer Numerical Control (CNC) machining, and Vertical Machining Center (VMC), play a significant role in various stages of drone manufacturing. CNC machining is crucial for manufacturing drone components with exceptional accuracy. Components that require precision milling, such as motor mounts, landing gear, and structural elements, are often crafted using CNC machines. These automated machining processes ensure uniformity and adherence to design specifications, resulting in components that meet rigorous quality standards. VMCs are employed for high-precision milling and drilling operations. In drone manufacturing, VMCs contribute to the creation of components that demand tight tolerances. The vertical orientation of the machining centre allows for efficient milling of components like brackets, connectors, and other structural elements, ensuring the overall stability and reliability of the drone. The integration of high-end machines not only enhances precision but also contributes to overall manufacturing efficiency, as automation in CNC and VMC processes reduces manual labour, minimises errors, and speeds up production. This efficiency is also crucial in meeting the varied requirements across the different platforms – aerial, maritime surface, sub-surface, and terrestrial. High-end machines enable the scaling up of production to meet market demands. CNC machines and VMCs, when programmed efficiently, produce large quantities of standardised components with consistent quality.

Precision with 3D Printing

Further, 3D Printing is also done for creating intricate and complex components with high precision. Drones benefit from 3D Printing technology as it produces lightweight and durable parts. Indigenously Designed, Developed and Manufactured (IDDM) components like drone frames are customised and manufactured using 3D Printing, contributing to both design flexibility and structural optimisation. 3D Printing is particularly valuable during the prototyping phase, as the design engineers rapidly produce prototypes of various drone components to test and refine the design. This iterative process allows for quicker development cycles, facilitating the exploration of multiple design iterations before finalising the production model. By adopting this hybrid manufacturing approach, combining traditional manufacturing methods with cutting-edge technologies, the synergy between advanced manufacturing technologies and traditional assembly techniques positions drones as not just innovative products but also showcases the integration of state-of-the-art engineering in their creation. As these technologies continue to evolve, the indigenous drone manufacturing industry is poised to push the boundaries of what is possible in terms of design complexity, efficiency, and overall performance, along with providing modern solutions through advanced technology. ☐

Trends and innovations driving construction machinery

India's Earthmoving and Construction Equipment (ECE) industry has thrived, largely attributed to the nation's rapid economic development, now ranking as the third-largest construction equipment market globally. This article investigates how the advancements in construction machinery have propelled the sector towards greater success in the country.

Subhashis Kar,
Managing Director,
MCOS Global

The construction machinery sector is a key player in infrastructure projects, with significant growth anticipated in the Indian market. Construction machinery is crucial in infrastructure projects, with the Indian market at $5.2 billion in FY22 and expected to grow at a robust 8.9 percent CAGR, reaching $8.7 billion by 2028. Sales are projected to increase to 165,097 units by 2028. The earthmoving sector saw 85,385 units sold in FY2022, reflecting growing demand in tandem with infrastructure development.

Evolution of construction machinery

The development of construction machinery in India has closely mirrored the nation's changing construction landscape, adapting to the needs of a growing, modernising industry. Starting from manual labour and basic tools like spades, India's construction machinery evolved through steam-powered engines, advanced materials, computerised systems and automation, greatly enhancing efficiency and precision. Factors such as urbanisation, population growth, government policies and a focus on sustainability have driven this evolution, positioning India as a significant player in the global construction machinery sector.

Trends in Construction Machinery

The Construction Machinery Industry in India has experienced significant growth, driven by both globalisation and the nation's pursuit of progress. Throughout the years, a range of notable trends has emerged, reshaping the industry's landscape:

- **Automation:** One of the prominent trends in construction machinery is automation. Automated machinery and equipment are gaining traction due to their potential to enhance efficiency, safety and precision on construction sites, eg, autonomous construction vehicles developed to perform tasks such as excavation, grading and material transport.

- **Electric machines:** The construction industry is showing a growing interest in electric construction machinery, driven by environmental concerns and the need for more efficient power sources. They produce lower emissions, have reduced operating costs and are quieter than their diesel counterparts. Major construction projects, such as metro rail systems, are transitioning to electric machinery to minimise pollution.

- **Green machines:** Sustainability has become a central focus in the construction machinery sector, with a push for greener and more environment-friendly equipment. These machines are not only sustainable but also cost-effective over the long term. They reduce the reliance on fossil fuels and lower the carbon footprint of construction activities.

Innovations in construction machinery:

India has embraced innovative approaches within the Construction Machinery sector. Through the adoption of these new practices, the industry has led to more efficient, sustainable and effective construction processes.

- **3D Printing:** 3D print construction is a cutting-edge technology that utilises 3D printing techniques to create full-scale buildings and structures. The process involves the layer-by-layer deposition of construction materials to construct walls and structural components. This method is more efficient, requires less labour and is faster. An illustrative example of its speed and potential is the construction of India's first 3D-printed Post Office in Bengaluru in 2023.

- **Sustainable fuels:** There is a growing interest in alternative and sustainable fuels to power construction machinery, aiming to reduce the environmental impact. Even Union Minister Nitin Gadkari emphasises the need for the construction and equipment industry to cut fuel costs by adopting alternative fuels to reduce pollution.

- **Telematics and IoT:** Construction equipment manufacturers employ technologies such as IoT, telematics with sensors, data analytics and robotics

to create advanced machinery, leading to enhanced operational efficiency.

Innovations and trends: Challenges and advantages

On one hand, the integration of innovations and trends in the construction equipment industry brings forth a multitude of benefits, both for the sector and broader society. These advancements result in enhanced efficiency, as automation, robotics and IoT-driven technology increase the operational efficiency of construction machinery, as the adoption of sustainable fuels and electric machines helps reduce the environmental impact of construction operations, aligning with global efforts to combat climate change. Notably, these often result in cost-effective construction.

Additionally, advanced control systems enhance precision and accuracy in construction tasks, leading to higher-quality output and fewer errors in project execution. The innovations also provide room for customisation and flexibility, with technologies like 3D printing and advanced materials allowing for the construction of highly customised structures that meet specific project requirements and design demands. This emphasis on environmental responsibility with green construction machinery contributes to eco-friendly practices, reducing carbon emissions. Predictive maintenance, enabled by telematics and IoT technology, helps reduce machinery downtime, ensuring that construction projects progress smoothly.

On the contrary, the adoption of advanced technologies and environment-friendly equipment in India's construction industry presents some challenges. First, substantial initial investments are required, posing financial constraints for smaller construction businesses and contractors. Second, operating and maintaining modern construction machinery demands a higher level of technical expertise. Bridging the skill gap among the workforce is crucial to fully leverage these innovations.

Moreover, the successful implementation of electric and automated machinery hinges on reliable power supply infrastructure. In numerous regions across India, issues related to inconsistent power supply and inadequate charging infrastructure for electric equipment persist. These infrastructural challenges add complexity to the adoption of eco-friendly and advanced technologies, necessitating not only financial investments but also significant improvements in power infrastructure and workforce skills to realise the full potential of these innovations in the construction sector.

Future landscape

The Indian Construction Equipment (CE) sector, with ambitions of becoming the world's second-largest by 2030, has seen remarkable growth, with a year-on-year increase of 25 percent in FY23, marking the second consecutive year of surpassing 100,000-unit sales. This growth can be attributed to the industry's adoption of sustainable practices, along with embracing innovations and trends, solidifying its standing in the global market. These advancements not only facilitate the incorporation of contemporary infrastructure techniques but also pave the way for forthcoming technologies and progress.

The innovations and practices concerning technology as well as government policies serve as the foundation for the future of the construction machinery industry. The key lies in determining how to seamlessly incorporate these changes, enabling India to evolve its traditional approaches to utilising construction equipment. This transformation promises to yield substantial benefits, not only for society as a whole but also for individuals within the construction sector and the broader infrastructure landscape. ❐

The Future of MRO practices in the age of Industry 4.0

The article discusses MRO (Maintenance, Repair, and Operations) in manufacturing, essential for efficient operations. It covers routine maintenance, unexpected repairs, and supplies, minimizing downtime, ensuring safety, and optimizing costs.

SANJAY JADHAV
Assistant Editor

In the world of manufacturing, MRO stands for Maintenance, Repair, and Operations, encompassing everything that keeps the wheels turning, but isn't directly involved in making the final product. This includes routine maintenance of machinery and facilities, repairs to address unexpected breakdowns, and the day-to-day supplies needed for production, like lubricants, tools, and even office supplies. MRO is crucial for efficient and cost-effective manufacturing because it minimises downtime from breakdowns, extends the lifespan of expensive equipment, ensures consistent product quality, promotes safe working conditions, and ultimately helps optimise costs by streamlining inventory and reducing the need for emergency repairs.

Traditional practices

Traditional MRO practices, while familiar, can be a significant roadblock to efficient production. Reliant on "run-to-failure" maintenance, they lead to unplanned downtime due to unexpected equipment failures and costly repairs. This disrupts production schedules, hinders delivery times, and increases operational costs. Inventory management struggles further exacerbate these issues, with overstocking tying up capital and understocking causing delays due to part shortages. The combined effect is a vicious cycle of unplanned downtime, missed deadlines, and decreased productivity, impacting both customer satisfaction and employee morale. To overcome these challenges and achieve efficient and reliable operations, organisations need to embrace modern MRO practices that prioritise preventive maintenance, proactive inventory management, and data-driven insights for optimised production planning and cost control.

Emerging Trends

MRO technologies are experiencing a paradigm shift, revolutionising how manufacturers approach maintenance and operations. Predictive maintenance, powered by data analytics and AI, predicts potential equipment failures before they occur, enabling proactive interventions and minimising downtime. Condition monitoring continuously tracks equipment health using sensors, providing real-time insights for timely maintenance. The Internet of Things (IoT) integrates sensors with centralised systems, collecting vast amounts of operational data for trend analysis, optimising maintenance schedules, and even automating tasks. AI-driven analytics play a crucial role, processing this data to uncover hidden patterns, identify root causes of failures, and recommend intelligent maintenance strategies. These advancements enable a shift from reactive to proactive maintenance, extending asset lifespan, improving operational efficiency, and reducing overall costs. Data-driven decision-making empowers managers, while improved diagnostics and automation, facilitated by technologies like AR and robotics, enhance safety and efficiency. As these technologies continue to evolve, the future of MRO promises even more intelligent and sophisticated tools for optimising maintenance and operations across industries.

Integration with Industry 4.0

The rise of Industry 4.0 and smart manufacturing ecosystems demands a shift in maintenance practices. MRO technologies, encompassing Maintenance, Repair, and Overhaul, play a crucial role in this transformation. By interconnecting machines, sensors, and central information hubs, MRO evolves into MRO 4.0, where real-time data on equipment health is collected through smart sensors. This data, combined with historical records and production schedules, fuels powerful analytics powered by AI and ML. These insights enable predictive and condition-based maintenance, minimising downtime, optimising resource allocation, and ensuring interventions only when necessary. Ultimately, MRO technologies, integrated within Industry 4.0 and smart manufacturing, empower manufacturers with data-driven proactive maintenance, leading to increased production, reduced costs, and enhanced overall agility in the competitive landscape.

Considerations for Implementation

Embracing advanced MRO technologies like predictive maintenance and condition monitoring systems can significantly improve operational efficiency and cost savings for manufacturers.

However, navigating the adoption process requires careful consideration of several factors:

- **Initial Investment Cost:** While advanced MRO solutions

offer long-term benefits, the initial investment can be substantial. Manufacturers should conduct a thorough cost-benefit analysis to ensure the projected Return On Investment (ROI) justifies the upfront expense. Consider exploring flexible payment plans or leasing options to mitigate the initial financial burden.

- **Integration with Existing Infrastructure:** Evaluate the compatibility of the chosen technology with existing software and hardware. Seamless integration ensures data transfer and avoids creating siloed information systems. Look for solutions that offer open APIs or standardised interfaces for easier integration.
- **Workforce Upskilling:** Implementing new technologies often necessitates upskilling existing employees. Invest in training programs to equip your workforce with the necessary knowledge and skills to operate and interpret data from the new MRO system. This fosters user adoption and maximises the system's effectiveness.
- **Vendor Selection Criteria:** Selecting the right vendor is crucial for successful implementation. Evaluate vendors based on their experience in your industry, the system's scalability and customisation options, level of customer support offered, and data security measures. Look for vendors who provide ongoing training and support to ensure a smooth transition and continued success.

Future Outlook

The landscape of Maintenance, Repair, and Overhaul (MRO) in manufacturing is on the cusp of significant transformation, driven by a surge in technological advancements and industry trends. Let's explore the key aspects shaping its future trajectory.

Emerging technologies like the Industrial Internet of Things (IIoT) and sensor integration promise a future of predictive maintenance. Sensors embedded in machinery will generate real-time data on equipment health, allowing AI and machine learning algorithms to identify potential issues before they become major problems. This shift from reactive repairs to proactive prevention will minimise downtime and maintenance costs.

Digital twin technology will create virtual replicas of physical assets, allowing manufacturers to run simulations and plan maintenance strategies in advance. This will help identify potential issues before they escalate in the real world, further optimising MRO operations. Additionally, Augmented Reality (AR) and Virtual Reality (VR) will revolutionise remote diagnostics and training. Technicians can receive real-time guidance through AR overlays, while VR simulations can provide safe and immersive training environments.

However, these advancements also hold the potential for disruption. As technology advances and data becomes central, MRO services may transition from traditional ownership models to pay-per-use models. This could provide manufacturers with greater flexibility and cost-efficiency. Additionally, the rise of the "as-a-Service" (aaS) model could offer comprehensive maintenance coverage for a fixed fee, simplifying budgeting and potentially improving service quality. Lastly, increased automation of MRO tasks using robots and drones could improve safety and efficiency, but also potentially impact human jobs in the sector.

In this dynamic landscape, MRO will evolve from a cost center to a strategic differentiator for manufacturers.

Conclusion

In conclusion, the world of manufacturing is undergoing a profound transformation in its Maintenance, Repair, and Operations (MRO) practices, driven by advanced technologies and industry trends. Traditional MRO approaches, reliant on reactive maintenance and inefficient inventory management, are no longer sufficient for today's rapidly evolving market landscape.

To stay competitive, manufacturers must embrace advanced MRO technologies that prioritise preventive maintenance, proactive inventory management, and data-driven insights.

While the adoption of advanced MRO technologies requires careful consideration of factors such as initial investment costs, integration with existing infrastructure, workforce upskilling, and vendor selection, the benefits are substantial. Improved operational efficiency, reduced downtime, and optimised maintenance practices pave the way for increased production and enhanced agility in the competitive landscape. ❐

Driving self-reliance for SMEs

While there are many challenges faced by SMEs in India's manufacturing sector, it is important to emphasise their role in achieving self-reliance, especially for national economic growth…

Rajesh Shah,
MD and Chairman,
Euro Panel Products

India's manufacturing sector plays a vital role in driving economic growth and generating employment opportunities. Within this sector, Small and Medium Enterprises (SMEs) form the backbone of the Indian economy, contributing significantly to production, exports and innovation. The industry leaders in the manufacturing sector here are key contributors to a wide range of products. These products include consumer goods, industrial equipment and components and intermediate goods that cater to the domestic market and actively participate in global supply chains, helping our export competitiveness.

It is interesting to witness how, in India, SMEs in the manufacturing sector are breeding grounds for innovation. They have the agility and flexibility to adapt to market demands, experiment with new ideas and develop innovative products and processes. These enterprises play a crucial role in fostering indigenous research and development, thereby promoting technological advancement.

Challenges for SMEs

- **Limited access to finance:** One of the major obstacles faced by SMEs is the limited availability of affordable finance. Traditional financial institutions often perceive SMEs as high-risk borrowers, making it difficult for them to secure loans or investment capital. This hampers their ability to invest in technology, infrastructure and skilled labour, restricting their capacity for growth and innovation. Additionally, the rise in start-up culture has made investors disrupt the market to grow faster instead of assisting SMEs that are trying to develop a more secure and structured way of growing, making it even more difficult for these segments to sustain the competition.
- **Lack of technological upgradation:** Many SMEs in India struggle with outdated technology and production processes. Inadequate access to modern machinery, equipment and advanced manufacturing techniques limits their productivity and efficiency. Moreover, it hinders their ability to compete with larger enterprises and meet the evolving demands of the market.
- **Skill gap and training:** SMEs often face challenges in attracting and retaining skilled workers. Limited resources and training infrastructure make it difficult for them to provide adequate skill development programs for their employees. This skill gap poses a significant hindrance to the adoption of advanced manufacturing practices and emerging technologies.
- **Infrastructure bottlenecks:** Inadequate infrastructure, including transportation networks, power supply and logistical facilities, poses significant challenges for SMEs, making manufacturing processes costlier and time-consuming. These infrastructural bottlenecks increase production costs, hamper timely delivery and impede the overall competitiveness of SMEs
- **Regulatory compliance burden:** SMEs grapple with complex regulatory frameworks and bureaucratic red tape. Compliance with labour laws, taxation, environmental regulations and other legal requirements imposes a heavy burden on SMEs, diverting their attention and resources away from core business operations.

Role of SMEs in self-reliance

Despite the challenges, SMEs play a crucial role in achieving self-reliance in India's manufacturing sector. The following are some key aspects that highlight the significance and need of self-reliant SMEs:

- **Employment generation**: SMEs are significant contributors to employment generation, providing livelihood opportunities for a vast number of people, particularly in rural and semi-urban areas. By fostering entrepreneurship and supporting SME growth, India can address the issue of unemployment and create a robust and inclusive economy.
- **Regional development:** Small enterprises are often located in smaller towns and rural areas, which helps in reducing regional disparities and promoting balanced economic development. By nurturing SMEs, the government can empower local communities, enhance rural livelihoods and uplift marginalised sections of society.

- **Supply chain linkages:** SMEs play a critical role in the manufacturing supply chain and provide essential components, parts and services, fostering interdependence within the ecosystem. Strengthening SMEs strengthens the overall manufacturing ecosystem.
- **Innovation and adaptability:** SMEs are known for their agility, flexibility and innovation. They are often at the forefront of leveraging emerging technologies and introducing innovative products and processes. By nurturing this vibrant sector, India can foster a culture of innovation, enhance competitiveness and meet the evolving needs of domestic and global markets.

Government initiatives

Recognising the importance of SMEs in India's manufacturing sector, the government has implemented several initiatives to address the challenges faced by SMEs

and promote their growth and self-reliance. Some notable initiatives include:

- **Make in India:** Launched in 2014, the Make in India campaign aims to transform India into a global manufacturing hub. It focuses on attracting foreign direct investment, promoting innovation, improving the ease of doing business and providing support to SMEs through dedicated policies and schemes.
- **Credit Guarantee Fund Scheme for MSEs:** The CGS aims to facilitate access to credit for SMEs by providing collateral-free credit facilities. Under this scheme, the government guarantees a portion of the loan amount, reducing the risk for financial institutions and encouraging them to lend to SMEs.
- **Technology Upgradation Fund Scheme:** The TUFS provides financial support to SMEs for technology upgradation and modernisation. It encourages the adoption of state-of-the-art machinery, equipment and manufacturing processes to enhance productivity, quality and competitiveness.
- **Skill India:** The Skill India mission focuses on bridging the skill gap in the workforce, including that of SMEs. It offers various training programs, skill development initiatives and entrepreneurship development schemes to equip workers and SME owners with the necessary skills and knowledge for sustainable growth.
- **Digital India:** The Digital India campaign aims to transform India into a digitally empowered society and knowledge economy. It promotes the use of digital technologies and infrastructure, enabling SMEs to leverage e-commerce, online marketing and digital platforms for business expansion and market reach.

Case studies

- **Keventer Agro:** Keventer Agro, a Kolkata-based SME, transformed from a small dairy farm to a leading food processing company. By leveraging government initiatives and adopting advanced technology, Keventer Agro expanded its product range, established a strong distribution network and achieved significant growth in the domestic and international markets.
- **Loyal Textile Mills:** This Coimbatore-based textile SME embraced sustainability and innovation to overcome challenges. By investing in eco-friendly manufacturing practices and adopting advanced technologies, they developed a niche market for sustainable textiles, catering to the growing demand for eco-conscious products globally.
- **Euro Panel Products:** Established in 2022, Euro Panel Products Limited was the first brand to introduce and import ACP in India. It has witnessed immense growth so far, starting from a local market to expanding nationally. Euro Panel's commitment towards innovation and product quality has helped them expand locally as well as on a global level as a brand that industry professionals can trust with top-notch products and services.

Achieving self-reliance

Even though Small and Medium Enterprises (SMEs) face various challenges in India's manufacturing sector, including limited access to finance, technological upgradation, infrastructure bottlenecks and more. They play a crucial role in achieving self-reliance by generating employment, fostering regional development, strengthening supply chain linkages and driving innovation and adaptability.

Government initiatives are addressing the challenges faced by SMEs and provide them with the necessary support for growth and competitiveness. Case studies like Keventer Agro and Loyal Textile Mills exemplify the resilience and potential of SMEs. Moreover, the Government, industry associations, financial institutions and other stakeholders must continue supporting SMEs through policy reforms, access to finance, technological assistance, and infrastructure development. By nurturing and empowering SMEs, India can build a robust, self-reliant manufacturing sector that contributes to economic growth, job creation and sustainable development. ❐

Reassuring your factory's forklift safety standards

Operating a forklift demands particular expertise due to the rear-wheel steering and hydraulic valve systems it employs. This article provides valuable insight into the required regulations around forklift operations.

Suresh Tanwar,
Head, Audit and Consultancy,
British Safety Council India

Forklifts play a vital role in moving heavy materials over short distances in factory and warehouse settings. Operating a forklift demands particular expertise due to the rear-wheel steering and hydraulic valve systems it employs. Unskilled operations can be dangerous; hence, strict safety regulations are necessary, including certified training courses.

In the UK, forklifts require thorough examinations under safety regulations (LOLER and PUWER). Lack of clarity regarding examination frequency can pose risks. The Health & Safety Executive (HSE) reported 1,300 serious forklift accidents yearly, exceeding Heavy Goods Vehicles (HGV) incidents by 50 percent, with 25 percent of UK workplace transport injuries attributed to forklifts. Safety measures thus need to be prioritised to avoid any workplace and employee mishaps. Here are some safety tips for forklift operators and supervisors:

Training forklift operators

The employer must thoroughly document the operators' training, along with an assessment of their performance while operating the forklift. The training process consists of three key components:

- **Formal instruction:** This can take various forms, including lectures, discussions, interactive computer-based learning, viewing videotapes or studying written materials. Importantly, this instruction can be conducted in any suitable location.
- **Practical training:** This segment involves hands-on demonstrations conducted by the trainer and practical exercises performed by the trainee. This training should be specific to the type or model of forklift the worker will use.
- **Evaluation of training effectiveness:** This entails assessing the operator's performance while working with the forklift. It is crucial to gauge how well the training has been absorbed and applied. This evaluation must be repeated periodically, with a minimum frequency of once every three years, and should be conducted on-site at the workplace.

Demarcation of zones

The zones where a forklift operates should be demarcated so that people do not stray into its path. The vehicle should have anti-slip surfaces, especially on footholds where the operator has to transfer weight from one foot to another. Grab handles must be designed so the operator gets a firm grip while mounting and dismounting the vehicle.

Alertness of operators

A forklift operator must be vigilant and focused. The operator should also be well-composed and drive the vehicle slowly, always looking for potential hazards. He should be thoroughly familiar with the vehicle and its salient features. Forklift operators should avoid consuming alcohol or any substance likely to interfere with their alertness before operating a forklift.

Blades position

The angle of the blades should be adjusted so that if the load slides, it slides backwards towards the forklift and not onto the road ahead. Yet, care has to be taken that the load merely slides backwards and does not bang into the vehicle. The height of the load should be adjusted so that the operator can see where he is driving. A low load also brings stability to the vehicle.

Proper exits

Prior to forklift operation, the operator must clear the path of obstructions. Ensure wide exits for vehicle and load passage, maintain safe height and width clearance under overhead obstacles, secure loads tightly to prevent shifting, apply emergency brakes when stopping and keep personnel away from the vehicle during load lowering.

Regular audits

Internal communication within the organisation is essential. All employees should know the organisation's occupational health and safety policy. Periodic safety audits should be undertaken, and corrective action should be taken

to address anomalies. Occupational health and safety should be a top-down approach. Line managers should ensure that the company's safety policy gets translated into action on the ground. There should be a transparent chain of responsibility and accountability.

Safety training for line managers

Safety training should extend beyond operators. Line managers, despite not operating forklifts, influence workforce behavior significantly. Their training should include hazard identification and corrective action enforcement. Regular safety compliance monitoring should be an integral part of a line manager's role. Companies should invest proactively in staff training, equipping existing employees with essential skills. This approach not only prepares them for challenges but also serves as a motivational tool, aiding talent retention.

Clear standard operating practices

The company should have clear standard operating practices; all staff should know them. Staff should be encouraged to challenge each other and point out instances of careless behaviour. Peer pressure is a good way for employees to internalise best practices. Often, senior management is so target-driven that deadlines become all-important and health and safety tend to get overlooked by 'overzealous' employees. This should be seen as a significant transgression of company regulations. It is better to act against an errant employee before any damage is done than to face long-standing legal issues if an accident occurs.

Move at the appropriate speed

Operate the forklift while adhering to specified speed limits. Avoid abrupt stops, sharp turns, sudden changes in direction or excessive speed during manoeuvres, as these behaviours can result in the tipping of the forklift. If the forklift begins to tilt, it is strongly advised not to attempt to exit the vehicle hastily. Instead, experts suggest remaining inside the vehicle, firmly grasping the steering wheel and stabilising your footing.

Refuel and recharge the forklift

Maintaining equipment in a fully charged and fuelled state is of paramount importance. Ensure proper recharging and refuelling procedures are carried out at designated locations, typically characterised by good ventilation and being free from potential ignition sources. Exercise vigilance by consistently powering off the equipment during refuelling operations.

Maintain a safe operating distance

Maintain constant awareness of the equipment in the vicinity of the worksite. Refrain from operating a forklift close to other machinery unless it is essential. Ensure you maintain a safe distance that provides ample space for a secure stop and the ability to manoeuvre away from other machines that might exhibit unpredictable movement patterns.

Park the forklift at the end of the shift

Concluding your shift, it is imperative to park the equipment within the designated and authorised zones consistently. The construction company must ensure that these parking areas do not impede pathways, hinder entrances/exits or create obstructions. Lower the forks completely until they rest on the floor, engage the parking brake, power down the engine and remove the ignition key.

Concluding…

In conclusion, the safe operation of forklifts is of paramount importance in any industrial setting. With their potential for both productivity and danger, strict adherence to training and safety regulations is essential. The statistics on forklift accidents underscore the need for continuous vigilance and adherence to best practices in the industry. From comprehensive training for operators and supervisors to clear standard operating practices and regular safety audits, a holistic approach to forklift safety is crucial. By following these guidelines and emphasising safety as a top priority, companies can minimise the risks associated with forklift operations, protect their employees and contribute to a safer working environment. ☐

A compact defuse sensor achieves a higher distance

Leuze introduced the new ODT3CL1-2M compact diffuse sensor, achieving an operating range of up to two meters. The 2-in-1 sensor detects the presence of objects and, at the same time, transmits measurement values. Thanks to innovative Time-of-Flight (TOF) technology, the switching and measuring sensor with background suppression has an operating range of up to two meters. This makes the ODT3CL1-2M suitable for all applications in intralogistics where long distances need to be bridged, e.g., in automated guided vehicles for monitoring the position of goods, for controlling robot grippers, or in quality control. Reliable use is guaranteed even under harsh conditions. As a 2-in-1 solution, the ODT3CL1-2M reduces the cost and effort for users in terms of procurement, installation, commissioning, and operation. With its two independent switching points, it is able to perform detection and measurement tasks at the same time. System operators can therefore solve both requirements using just one sensor.

ODT3CL1-2M compact diffuse sensor

Leuze | Pune

Reamer with nine lives

MAPAL launched a series of cylindrical shank reamers with brazed cutting edges. Within the range of monolithic solid carbide tools for reaming, they add a particularly sustainable variant to the existing product series. FixReam 700 reamers are known for their frequent usability, which is achieved by replacing the cutting edges and regrinding. A tool can be reground up to twice before new cutting edges have to be brazed in. After that, it is possible to regrind the tool twice again, replace the cutting edges again, and then regrind the tool twice more. One reamer therefore has nine tool lives. The FixReam 700 reamers are available in two variants for through bores and blind bores. They are available in two lengths, as short or long versions, as is customary in the market. The tools can be configured in a diameter range of 9.9 to 32.2 mm.

FixReam 700 cylindrical shank reamers

MAPAL | Coimbatore

Motor sets standards for device miniaturisation

Portescap recently introduced the 08ECP20 brushless DC slotless motor, a mini-actuation solution ideal for engineers looking to downsize devices and applications without compromising on performance or reliability. The 08ECP20 is the smallest frame size to join Portescap's Ultra EC portfolio. This 8mm motor incorporates Portescap's proprietary Ultra EC winding and an optimised bearing assembly, a design that enables the brushless motor to achieve speeds up to 60,000 rpm. Lower power losses lead to higher efficiency, while the absence of cogging torque results in smoother rotation and an improved end-user experience. The 08ECP20's unique combination of compact design, high-speed capabilities, efficiency, and maximised performance/price ratio positions it as the go-to solution for handheld device manufacturers across various industries. Specific examples include miniature actuators in the aerospace and defence sectors, portable medical pumps, bionic and exoskeleton systems, and optical and laser systems.

Ultra ECTM Motor

Portescap | Mumbai

Heating systems to make battery production more sustainable

TRUMPF Photonic Components recently showcased its latest TruHeat VCSEL product developments for area heating and e-mobility applications. VCSEL-based laser heating systems offer direct, homogeneous, and zone-controllable heat treatment for industrial processes. The drying of electrode coatings is a delicate process and consumes most of the energy in Li-ion battery manufacturing due to the use of very large and inefficient convection ovens. Laser drying offers several advantages, like improved energy efficiency, reduced floor space, and increased process control. Therefore, TRUMPF developed the TruHeat VCSEL laser heating systems to enable the homogeneous drying of very large surfaces with relatively low power densities. TruHeat VCSEL laser heating systems are based on the latest generation of multi-junction VCSEL arrays, and the heating system is optimised for thermal design with highly efficient driver electronics. The wavelength of 980nm is strongly absorbed by all battery electrode materials and therefore supports the high drying efficiency.

TruHeat VCSEL laser heating systems

TRUMPF | Pune

Universal industrial network communication interface

HMS Networks recently launched the Raspberry Pi adapter board, providing industrial device manufacturers with a simplified method to test and evaluate the Anybus CompactCom, a ready-made communication interface that connects devices to any industrial network. While previous adapter boards were designed for testing Anybus CompactCom modules with STM32 or NXP (formerly Freescale) microcontroller platforms, this new adapter board is specifically tailored for use with the Raspberry Pi.

Raspberry Pi adapter board

The new adapter board provides: Compatibility with the widely popular Raspberry Pi; Easy installation and usage; Full compatibility with the free-to-download Anybus Host Application Example Code (HAEC); The Raspberry Pi adapter board is fully compatible with the free-to-download Anybus Host Application Example Code (HAEC). This code includes a reference port designed for the Raspberry Pi, which customers can use with the adapter board, and an Anybus CompactCom module to quickly start their embedded development project.

HMS Networks | Pune

High durability rotor and stator for enhanced reliability

BorgWarner has begun HVH220 eMotor rotor and stator production for XPeng Motors. The product will be used on the X9 MPV as well as XPeng's next electric B-class sedan, with the start of production planned for Q3 2024. The High Voltage Hairpin (HVH) 220 eMotor offers high power and torque density, plus higher efficiency, at a competitive cost. It also provides outstanding durability. The HVH220 eMotor has an operating range of up to 800V, using a stator with an outer diameter of 220 mm and BorgWarner's patented high-voltage hairpin winding technology. It incorporates a permanent magnet rotor and proprietary stator insulation enhancement technologies, providing premium durability and reliability. BorgWarner's HVH220 can produce up to 300 kW in power with a maximum working speed of 18,000 rpm, with peak efficiencies greater than 97 percent. BorgWarner has developed oil-cooled solutions to meet the performance demands of higher-powered motors. Specifically, the gearbox oil cools the motor, improving heat transfer and total heat rejection of the system.

HVH220 eMotor

BorgWarner | Bangalore

Advanced pressure regulators for commercial vehicles

Landi Renzo, in collaboration with Bosch, is starting the development of advanced electronic pressure regulators for mid- and heavy-duty commercial vehicles with hydrogen-powered Internal Combustion Engines (ICEs), marking a big step towards the energy transition and decarbonisation of the mobility and transportation sectors. Both the companies aim to produce and market hydrogen-based fuel systems with a next-gen mechatronic pressure regulator for carbon-neutral commercial vehicle operations. The EM-H mechatronic pressure regulator ensures optimal management and calibration of hydrogen delivery pressure according to the vehicle's requirements, conveyed with high levels of accuracy and efficiency. Designed and manufactured in Italy, two phases govern the functionality of the EM-H regulator: a mechanical input stage that reduces pressure from high to medium; and a subsequent entirely electronic stage that lowers pressure from average to desired value. The system features special valves to ensure the protection of both the pressure regulator and downstream fuel line.

EM-H mechatronic pressure regulator

Landi Renzo | Italy

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» Plastic and Rubber

In today's fast-paced manufacturing landscape, the demand for advanced materials is ever-increasing, driving the evolution of manufacturing processes and product capabilities. From automotive to healthcare, construction to electronics, the versatile applications of plastic and rubber materials are reshaping industries globally. This section delves deep into the dynamic world of plastic and rubber manufacturing, exploring the latest technologies, trends, and transformative advancements.

» Immersive Technologies in the Defence Manufacturing Industry

When it comes to defence manufacturing, innovation is paramount. In this article, we delve into the transformative impact of immersive technologies within the defense manufacturing sector, exploring how they are driving innovation, enhancing training programs, and ultimately shaping the future of defense production.

» High Speed Machining

High Speed Machining (HSM), is a transformative methodology that has redefined the boundaries of what's achievable in modern machining practices. In this feature, we delve into the intricate world of High Speed Machining, exploring its principles, applications, and the profound impact it has had on industrial landscapes worldwide.

» Battery Swapping Technology for E-Mobility

In the landscape of electric mobility, the pursuit of efficient energy solutions is paramount. As the world shifts towards sustainable transportation, Battery Swapping Technology emerges as a transformative innovation, offering businesses a paradigm shift in managing electric vehicle fleets. This article talks about the intricacies of Battery Swapping Technology, exploring its technical prowess and its potential to redefine the future of e-mobility for B2B enterprises.

COMPANY INDEX

EM

IMPRINT

Publisher & Director
Dhiraj Bhalerao
dhiraj.bhalerao@pi-india.in
Contact: +91 9820211816

Editorial Director
Arun Bhardwaj
editor@pi-india.in

Joint Editor
Neha Basudkar Ghate
neha.basudkar@pi-india.in

Assistant Editor
Sanjay Jadhav
sanjay.jadhav@pi-india.in

Digital Content Developer
Anushka Vani
anushka.vani@pi-india.in

Design and Layout
Somnath Jadhav
somnath.jadhav@pi-india.in

Overseas Partner
Ringier Trade Media Ltd
China, Taiwan & South-East Asia
Tel: +852 2369 - 8788
mchhay@ringier.com.hk

Editorial & Business Office
publish-industry India Pvt Ltd
325-326, 3rd Floor, Sohrab Hall
21 Sassoon Road, Pune – 411001
Maharashtra, India
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service.in@walter-tools.com
walter-tools.com

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