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"The Indian automation industry has embarked on a transformative journey"

Navigating transformation and reaching milestones

Industrial automation is significantly influencing global economic transformation by restructuring industries and economies. The integration of automation solutions and technological progress has resulted in heightened efficiency, productivity and competitiveness in diverse sectors. In the Indian economic landscape, industrial automation stands as a vital catalyst for growth, albeit presenting a distinct set of challenges and opportunities.

Indian industries are enhancing their competitiveness on both domestic and international fronts. The industry's engagement and commitment to excellence have propelled India towards becoming a formidable player in the global automation landscape.

The Cover Story of this edition revolves around the topic of semiconductor innovation that is driving high-tech manufacturers and automotive and industrial manufacturing. The issue further deals with the Oil and Gas sector, which is the Industry Focus, followed by Technology Focus articles that enlighten on Robotics and Industrial Automation and Automotive Lightweighting. Furthermore, the Special Feature in the issue throws light on Battery Swapping Technology and its advancements. A&D will continue capturing and circulating the right information, facilitating manufacturing enterprises and applying new strategies to propel the industry towards a brighter future.

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

MANAGEMENT NOTE

With digital technologies advancing rapidly, the manufacturing landscape is experiencing a profound transformation across sectors. In our upcoming issues, we will be guiding you towards these transformative developments. We are thrilled to introduce new digital initiatives that enhance your reading experience. Our interactive comments section enables readers to shape our content, ensuring it meets your needs and expectations.

But that's not all! Our cutting-edge Flip magazine offers an immersive experience, allowing you to watch videos while seamlessly flipping through the pages. Dive into the world of manufacturing innovation like never before. Stay tuned for more exciting updates, including the latest episode of '***Morning Bytes***', our weekly podcast, and engaging video content on our LinkedIn accounts. We are dedicated to keeping you informed and engaged in the ever-evolving manufacturing landscape. Join the conversation and share your insights at www.pi-india.in.

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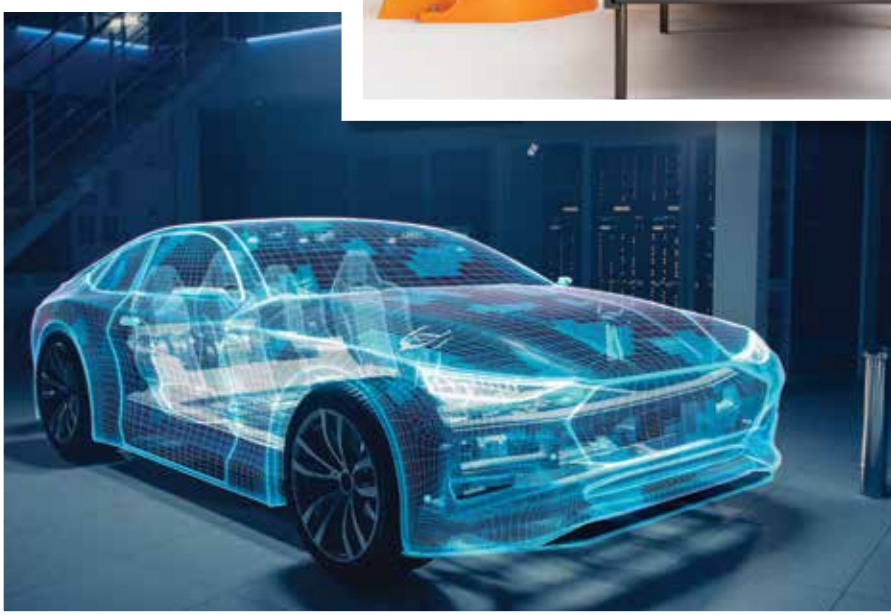
CONTENTS

30
ROBOTICS AND AUTOMATION
Robotics and industrial automation: Empowering synergy with Cobots



43
BATTERY SWAPPING
Battery swapping solutions bring e-mobile revolution

14
COVER STORY
Semiconductors reshaping high-tech manufacturing

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32
AUTOMOTIVE LIGHTWEIGHTING
Future-proofing the automotive industry with lightweighting

SPECIAL FEATURE

NEW PRODUCTS

COLUMNS

Remembering **Aravind K Joshi,** a luminary in computational intelligence

1929–2017

Aravind K Joshi was not only a luminary in the field of computational linguistics but also a beloved figure known for his wisdom and kindness. He received the first ACL Lifetime Achievement Award in 2002 and continued his remarkable journey in research and academia until his peaceful passing at 88 in December 2017.

Born in Pune, India, on August 5, 1929, Aravind embarked on his academic journey when he sailed to the USA in 1954 to study electrical engineering at the University of Pennsylvania. He completed his MSc in electrical engineering while working as an engineer at RCA in Camden, New Jersey, and further pursued a PhD in Electrical Engineering, during which he also served as a research assistant in the Department of Linguistics at the University of Pennsylvania.

Aravind's academic path eventually led him to join the newly established Department of Computer and Information Science (CIS) at Penn, where he served as a full professor and chair.

Remarkably, Aravind Joshi remained the Chair of CIS for an astonishing 13 years, during which he continued to conduct ground-breaking research and take leadership roles in esteemed organisations. One of Aravind's most significant achievements during his tenure as the CIS Chair was co-founding Penn's renowned Cognitive Science Program, which later evolved into the Institute for Research in Cognitive Science (IRCS). This interdisciplinary initiative, funded initially by the Sloan Foundation and later by the National Science Foundation, brought together scholars from linguistics, psychology, computer science, philosophy, neuroscience and mathematics.

Joshi's research contributions were far-reaching and impactful. His work covered a wide spectrum of computational natural language processing, including parsing using finite state transducers, the development of Tree-adjoining Grammar (TAG) formalism, co-operative question answering, discourse prominence and syntax analysis. In particular, Aravind's work on TAG, a 'mildly context-sensitive' grammar formalism, demonstrated its computational power in handling complex natural language phenomena while remaining tractable.

His legacy extended beyond his research. His remarkable inclusivity and the collaborative environment he fostered at Penn left an enduring impact on the field of computational linguistics. His accolades and recognitions underscored his profound contributions to academia. Aravind Joshi's legacy lives on, not only in his pioneering work but also in the generations of researchers he inspired and nurtured throughout his remarkable career. ☐

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Siemens announces a milestone of 100 digital use cases on Siemens Xcelerator

Siemens India recently organised its fourth edition of Siemens India Innovation Day 2023 at Grand Hyatt Mumbai on 10 October, 2023. Siemens showcased various use cases and a range of technological innovations, and customer references on digital transformation through an Ideas Marketplace, Co-Labs and the Siemens Xcelerator Hub.

Tata Consultancy Services (TCS), Koncept Engineers, Safex Technologies and Sonicbolt Technologies were announced as Siemens Xcelerator Ecosystem Partners, a crucial component with a far-reaching impact on the digital transformation of organisations.

The Keynote address was given by Peter Koerte, Chief Technology Officer and Strategy Officer, Siemens AG, in which he outlined the power of the Industrial Metaverse, an always-on world where real machines and factories; buildings and cities and grids and transportation systems are mirrored in the virtual world. It has the potential to solve real-world problems by integrating cutting-edge technologies such as digital twins, artificial intelligence and edge and cloud computing. It will enable users to simulate and test different scenarios and to work on real things together virtually, in real time and from anywhere, whether designing buildings and power grids or servicing machines. This will result in a reduction of costs, emissions and resources.

Siemens achieved a significant milestone for its Siemens Xcelerator platform with the inclusion of 100 India-relevant digital use and reference cases across multiple industries such as Food and Beverage, Data Centres, Commercial Buildings, Power Utilities and others. Siemens Xcelerator is an open and evolving digital business platform that comprises a comprehensive, curated portfolio that includes digital and Internet of Things (IoT)-enabled offerings (software, hardware and digital services) from Siemens and certified third parties. Part of the Siemens Xcelerator portfolio is Industrial Operations X, an open and interoperable portfolio for automating and operating industrial production, and Building X, a scalable digital building platform to digitalise, manage and optimise building operations.

As a Siemens Xcelerator partner, TCS will engage with customers through a consultative process to provide holistic solutions for a Connected Digital Enterprise. These solutions will be based on the expertise of

Peter Koerte, Chief Technology Officer and Strategy Officer, Siemens AG

> "We have made significant progress over the past year with Siemens Xcelerator and growing a powerful ecosystem. With India's economy continuing its high growth momentum and aiming to double its GDP in the next seven to eight years, Indian companies have a unique opportunity to accelerate their digital transformation with the Siemens Xcelerator portfolio, which includes the latest technologies such as industrial AI, industrial edge, digital twin and 5G."

Sunil Mathur, Managing Director & Chief Executive Officer, Siemens India

> We have achieved a milestone of 100 India-relevant digital use cases, which are now available on the Siemens Xcelerator platform. Together with our Siemens Xcelerator Ecosystem Partners, we will be able to support the increasing demand for digitalisation and decarbonisation solutions in India.

TCS in areas such as simulation, industrial automation, IoT, industrial edge, 5G, cybersecurity, product and application lifecycle management, manufacturing execution systems, enterprise resource planning, enterprise asset management and low-code application development. Koncept Engineers, Safex Technologies and Sonicbolt Technologies will provide integrated building management solutions and integration services for HVAC, fire safety and security systems. These include energy optimisation, building information modelling integration, digitalisation, cloud-based offerings and building automation, as well as for Building X.

Regu Ayyaswamy, Global Head, IoT & Digital Engineering, TCS, said, "TCS brings deep knowledge of Industrial IoT and digital engineering across a wide client portfolio and expertise in Siemens Xcelerator solutions. With TCS' 'Bringing Life to Things' framework, enterprises can maximise value from a Connected Digital Enterprise by responding to physical context with digital intelligence, accelerating digital product creation, enabling neural manufacturing and becoming sustainable by design".

Acknowledging the major challenges for India's industry, in its recent paper, Siemens highlighted the five megatrends that are transforming the global economy. These megatrends are seen to be shifting the geopolitical balance of power and profoundly impacting the global workforce: demographic change, urbanisation, glocalisation, environmental change, resource efficiency and digitalisation. Siemens' mission is to present solutions, along with the Siemens Xcelerator partners, for tackling these challenges.

The 6th Symposium on Automation & Robotics held with 200+ industry participants across manufacturing automation

The Indian Machine Tool Manufacturers' Association (IMTMA) organised the Symposium on Automation & Robotics 2023 on 5 and 6 October, 2023, at Hotel TipTop International, Pune. The symposium featured interesting panel discussions and presentations by industry leaders from various industries on automation and robotics. Over 200 delegates from over 80 companies across 15 cities participated in the conclave.

Formed in 1946, IMTMA is the apex body of the Indian machine tool industry and plays an important role in its development through various advocacy measures. IMTMA has supported the setting up of institutions such as the Advanced Machine Tool Testing Facility and Advanced Manufacturing Technology Development Centre and worked closely with the government to set up a first-of-its-kind machine tool park in Karnataka.

The symposium, which was the sixth edition of a coveted event, was inaugurated by Sunil Mehta, President, Automation Industry Association; G Sundararaman, Co-CEO, Wipro PARI; Dr Sadashib Padhee, Director, Samarth Udyog Technology Forum and Rajendra Rajamane, President, IMTMA. The topics of discussion and presentations covered varied topics like artificial intelligence, automation, laser welding, sensors for Industry 4.0, robotics, machine learning for manufacturing, digital manufacturing, use of digital imaging and more. The session highlighted novel developments and their significance in human-centric automation.

Speaking about the symposium, Rajendra Rajamane, said, "It was an eye-opener for the manufacturing industries to adopt automation and robotics in their everyday operations to improve efficiency and enhance the quality of products". He further emphasised that robots can be used to automate complex workspaces and mass produce critical products in extreme conditions of manufacturing. As the price of robots is coming down, more industries are adopting them".

IMTMA has been supporting industries in developing indigenous industrial robots through the world-class Advanced Manufacturing Technology Development Centre set up at IIT Madras in Chennai.

"Indian market strides towards collaborative automation solutions"

…says **Sougandh KM,** Country Manager, India, Universal Robots. In an interview with **Sanjay Jadhav,** he highlights the growth of cobots in various industries and the reasons for their increasing popularity and applications. Excerpts from the interview…

How have you observed the market trends in the adoption of cobots for industrial automation in India?

India is a developing country with significant potential in the manufacturing sector. Cobots are employed to boost the efficiency and productivity of manufacturing processes. The entry of cobots into the Indian market represents a significant stride towards collaborative automation solutions that are poised to transform the manufacturing sector. Cobot applications could be witnessed across various industries including automotive, food and beverage, plastics, cosmetics, ecommerce, logistics metal and machinery. As the market demands are changing at a fast pace, cobots are also being utilised in industrial as well as non-industrial domains. Cobots are highly effective in cost optimisation and productivity enhancement.

How do you perceive the role of cobots in contributing to the growth of India's economy, especially in manufacturing?

Cobots have the potential to significantly contribute to the growth of the Indian economy by handling monotonous tasks. There is a growing interest and higher adoption of cobots in India, particularly in industries such as automotive, electronics and manufacturing. However, the market is still relatively new, and there are challenges related to awareness and adoption, particularly among smaller businesses. To become successful in India, cobot manufacturers will need to continue to educate businesses about the benefits of cobots, provide training and support and develop products and solutions that are tailored to the needs of Indian businesses.

What challenges and risks have you encountered in the adoption of cobots in India? How have you addressed them?

Navigating India's diverse business landscape, from large enterprises to family-run establishments, presents unique challenges and opportunities. Universal Robots, has faced distinct hurdles in promoting cobot adoption. Manufacturers encounter several challenges like identifying the right processes to automate, lack of skilled labour, limited capital and resistance to cobot adoption.

What are the company's future plans to meet evolving customer demands and industry requirements?

Boasting the longest reach and highest payload capacity at an impressive 20 kgs, the UR20 sets a new standard in industrial automation. Its remarkably compact footprint is a game-changer, allowing for automation of tasks requiring heavy lifting over extended distances. This next-generation robot goes beyond sheer strength, offering an array of features for varied uses. With its advancements, the UR20 emerges as the epitome of modern robotics, perfectly poised to meet the ever-evolving demands of industry.

“Real world scenarios are driving AI advancements”

…says **Job Philip,** CEO and Co-Founder, Assert AI. In an interview with **Neha Basudkar Ghate**, he describes emerging AI trends, mentorship insights and strategies for staying ahead in the dynamic AI landscape. Excerpts from the interview….

Can you tell us about the core technology and innovations that drive your solutions and set you apart from competitors?

Today, we stand as one of India’s largest AI-Computer Vision companies, boasting two cutting-edge platforms: Alpha, our CCTV AI platform, and Falcon, our drone AI solutions platform. Our years of investment culminate in maintaining top-tier standards of quality, security and performance. To maximise positive customer impact, we deploy our solutions at the ‘Edge’, thus reducing latency and enabling real-time analysis.

In this rapidly evolving field, what tech trends do you believe will have the greatest impact on the industry in the coming years?

I envision several crucial AI tech trends. AI innovations are transitioning from academic and R&D labs to practical business applications. With critical mass achieved, real-world scenarios are driving AI advancements. The best AI architectures are emerging from solutions to genuine business problems, leading to increased adoption. Rather than touting AI as panacea for all problems, there will be a growing recognition of its limitations.

Could you share a memorable mentor/ individual who has inspired you in your journey in the tech industry?

I have always incorporated the philosophy of Nassim Taleb to tech organisational paradigms. Simply put, it is important to cap the losses and let the upside run uncapped. At Assert AI, we view risk as something to be managed like a brake in a car—the attempt is always for it to limit our downside so that we go faster, so as to create a framework for us to chase opportunities and create optionality. We desire to learn and improve daily, and take many small- and medium-sized risks like revamping our existing tech, expanding in the US and hiring somewhat ahead of time.

Can you share some insights into how Assert AI plans to adapt and stay ahead in the dynamic landscape of AI and ML?

Customer centricity: We obsessively track the improvements after the deployment and do almost everything to create a loop where AI data is actionable, impactful and is being used to derive measurable Return on Investment.
R&D: Investing heavily in R&D has helped us develop a productised offering for various industries like warehouses, inventory management, toll roads etc.
Feedback loop of failures: Our iterative and long-term problem-solving approach has helped our solutions to become robust and be deployment ready for most real-world usecases.

"We are dedicated to being pioneers in the industry"

Q Can you provide an overview of Commtel Networks' business model and how it differentiates itself in the market?

>> Commtel Networks operates as a global leader in the engineering and technology sphere, specialising in high-performance digital communication, surveillance, security, safety and Artificial Intelligence (AI) solutions, predominantly serving clients in critical national infrastructure sectors. What sets our business model apart is our turnkey single-point responsibility approach. This method ensures that we are wholly accountable for every stage of a project, offering our customers peace of mind as we design and oversee all the intricate details from inception to completion.

Our distinct edge in the marketplace is largely attributable to our remarkable team, which represents a blend of dedication, expertise and innovative thinking. We take pride in nurturing a workforce that stands unrivalled, playing a pivotal role in fostering the unique position we hold in the industry today. Moreover, our strategic presence in pivotal markets—India, the UAE and the USA—backed by purpose-built facilities, empowers us to efficiently deliver on complex projects, solidifying our reputation as a trustworthy partner in the sector.

Shriprakash R Pandey, CMD, Commtel Networks. In an interview with **Neha Basudkar Ghate,** he describes how Commtel Networks is focused on aligning their business development strategies with the rapidly evolving trends and challenges.

Q How do you define *Engineering Intelligence*? How are such solutions incorporated in your product lines?

>> In our philosophy at Commtel Networks, 'Engineering Intelligence' represents a harmonisation of technological advancement with deep-seated engineering expertise to forge solutions that stand at the intersection of sustainability, safety and efficiency. This approach is central to our ethos of fostering a symbiotic relationship between digital progression and humanity, a commitment reflected in the meticulous designs and systems we cultivate to address the unique demands of Critical National Infrastructure (CNI) sectors such as energy, power and transportation.

Over a span of 25 years, we have proudly borne the mantle of facilitating this vision, nurturing a landscape where innovation meets reliability, acting as reliable catalysts in steering our customers towards achieving their noble objectives seamlessly. As we forge ahead, our vision remains clear: persisting as a trusted ally in the industry, synonymous with innovative and intelligent engineering solutions. We are propelled by a desire to maintain our stature as a preferred partner in the CNI sector, crafting a future landscape that is not only efficient and intelligent but prioritises safety above all, carving a pathway to a smarter, safer and more sustainable future.

Q Committing oneself to the next era of digital transformation is one of the pillars for business success. How is your company working towards executing this?

>> Indeed, steering towards the next phase of digital transformation remains central to our strategy for success. Our dedication to being pioneers in the industry translates into substantial investments in learning and development initiatives. We facilitate avenues for our team to constantly hone their skills through a wide array of training programs, workshops and industry events.

In 2019, we pioneered the establishment of our AI & Digital Transformation (DT) vertical, a strategic move aimed at guiding our clientele smoothly through their digital transformation journeys. This commitment to

innovative technology further crystallised in 2021 with the introduction of CN-SHIELD, an AI solution engineered to offer 360-degree protective solutions for CNI.

Q Can you elaborate on Commtel Networks' global presence and its strategies for entering and establishing a strong foothold in international markets?

>> Our operational footprint currently spans India, the UAE and North America, a strategic positioning that grants us a significant advantage in handling projects across both domestic and international spheres seamlessly. This global presence not only facilitates smooth project execution but also engenders deep connections with diverse market dynamics, thereby equipping us with the insight to craft solutions that are globally relevant and responsive to distinct regional needs.

Looking forward, we intend to consolidate and augment our foundations in the strategic markets of the Middle East and North America, in tandem with our on-going commitments in India. It is our aspiration to increasingly leverage AI, integrating it judiciously into the solutions we offer, thereby amplifying the value and efficacy we bring to our customers.

Q As a global engineering and technology company, what are Commtel Networks' future plans for business development, and how does it plan to adapt to emerging industry trends and challenges?

>> Moving forward, Commtel Networks is steadfastly focused on aligning our business development strategies with the rapidly evolving trends and the multifaceted challenges emerging in the CNI sectors. As investments in the CNI sectors, including Oil & Gas, Power and Transportation, continue to climb, we find ourselves at the threshold of expansive opportunities. Leveraging our strategic geographical foothold in vital regions such as India, the GCC and North America empowers us to seize these opportunities while maintaining a balanced portfolio that is not tethered to a single locale.

The compass that guides us is an unwavering commitment to nurturing our customers' growth narratives by staying abreast of industry evolutions and tailoring our portfolio to suit their changing needs. Looking ahead, we envision a pathway of growth that is mutually enriching, fostering economic prosperity for our organisation and the communities we serve, while consistently meeting and rising above our customer expectations. ❐

SEMICONDUCTORS reshaping high-tech MANUFACTURING

Rupesh Kharbanda,
Senior Director,
Moglix

In an era marked by the relentless march of technology, semiconductor innovation stands as the unsung hero powering high-tech manufacturing and the automotive industry. This Cover Story explores how semiconductors are shaping the future of these sectors, from IoT to AI, and why staying ahead in the semiconductor race is vital for businesses. Discover the trends and supply chain implications that will define the future of semiconductors.

The automotive and manufacturing sectors are experiencing a remarkable acceleration of innovations, primarily attributed to the advent of Industry 4.0. This fourth industrial revolution is founded on cutting-edge technologies such as the Internet of Things (IoT), Artificial Intelligence (AI) and smart manufacturing practices. Semiconductors are (literally) the heart of this revolution. Hence, be it a fitness watch or a self-driving car, micro-processors are the brain of every intelligent system.

Innovation in semiconductor technology has played an instrumental role in revolutionising high-tech manufacturing in the automotive and industrial manufacturing sectors. The automotive semiconductor market alone is predicted to grow at a steady rate of 7%, and is expected to be worth ~$58,770.1 million in 2023, rising to $115,609.68 million by 2033.

Regarding supply chain management, semiconductor technology has transformed the industry by enabling greater visibility and transparency. Semiconductor sensors have revolutionised logistics and production processes, allowing organisations to track inventory and monitor product quality in real time. The integration of semiconductor technology in supply chain management has led to significant cost savings and increased efficiency in operations, ultimately driving business growth.

With a rising demand for smart devices, companies are scrambling to integrate semiconductors into their products to stay ahead of the competition. The semiconductor industry works on a 'winner takes it all' principle. Companies with leading-edge capabilities capture an outsized portion of industry revenue. This makes it vital for organisations to maintain a commitment to innovation and stay ahead of the curve regarding cutting-edge semiconductor technology.

Understanding semiconductor innovation

As the demand for semiconductors continues to rise, the chip-making industry is facing significant challenges in terms of sustainability and cost-effectiveness. To address these issues, the industry is actively pursuing innovative approaches to chip-making that are both environmentally friendly and financially feasible. Some top global semiconductors trends and innovations are:

- **Internet of things:** As the demands for smaller-sized, diverse connectivity technologies and lower power consumption increase in IoT devices, semiconductor manufacturers focus on sensor and integrated circuit development. For example, IMOSTAR, a Taiwanese start-up, offers multi-band IoT chips. It collects sensor data and previous usage patterns to enable predictive maintenance.

- **AI and algorithmic chips:** **Hardware-based accelerations are being introduced via algorithmic-specific chips to keep up with the rising volume of data that AI systems process. For instance, Rebellions, a South Korean start-up, offers domain-specific AI processors, while Gauss Labs, a US-based start-up, provides AI-based semiconductor manufacturing solutions.**

- **Advanced materials:** **Semiconductor start-ups are focusing on shrinking the structures' size and exploring novel materials like silicon carbide and gallium nitride. Start-ups like EPINOVATECH and QustomDot make GaN chips for transistor devices and create colour-changing nanoparticles for semiconductors, respectively. These offer cost-effective, robust solutions within restricted chip sizes.**

• **RISC-V:** RISC-V is poised to revolutionise the industry and topple established players like CISC and RISC, the most popular ISAs. The implications of RISC-V's success are significant, as it will disrupt the traditional computing landscape and may lead to more open and collaborative development practices.

• **Novel architectures:** In the race for faster processing speeds, chip industry players are turning to non-volatile memory chips, 3D-enabled designs and nanotechnology-enabled processors. Efforts are also being made towards simpler instructions for parallel computing. YSEMI, a Chinese start-up, has created an ARM-based cloud processor for high-performance computing.

• **5G:** Organisations are designing technology-driven solutions for 5G to ensure low latency and reliable indoor and outdoor networks. Falcomm, a US-based start-up, is developing 5G power amplifiers for wireless communication to improve semiconductor manufacturing floor connectivity.

Semiconductor innovation in high-tech manufacturing

The realm of high-tech manufacturing has been profoundly impacted by remarkable advancements in semiconductor technology. These innovations, characterised by continuous improvement and component miniaturisation, have empowered the development of exceptionally powerful and efficient electronic devices. From smartphones to AI and IoT applications, semiconductors have been the driving force behind the rapid growth and transformation of diverse industries. The world of smartphones and mobile devices has witnessed a remarkable transformation, as semiconductors power high-performance processors and memory chips. This has led to faster and more efficient smartphones, capable of handling advanced applications and delivering seamless user experiences.

One area where semiconductors are having a significant impact is in the world of IoT applications. IoT technology devices rely heavily on integrated circuits, sensors and other semiconductor chips to function. This has paved the way for smart homes, wearables and industrial IoT applications. For instance, smart thermostats like Nest, empowered by semiconductor technology, have transformed energy efficiency in homes by intelligently regulating heating and cooling systems.

Another area where semiconductors are becoming increasingly important is in the field of AI. As AI technology becomes more prevalent in fields such as military, retail, healthcare and research, the demand for specialised sensors, memory and fast processors to run and maintain these systems is skyrocketing. In fact, the worldwide AI market is predicted to grow to $390.9 billion by 2025.

Semiconductor chips are also playing an essential role in the medical field. Devices such as Magnetic Resonance Imaging (MRI) machines, pacemakers, blood pressure monitors and patient monitors rely on semiconductors for improved accuracy and functionality. For example, wearable fitness trackers like Fitbit utilise semiconductor technology to monitor vital signs and track health metrics.

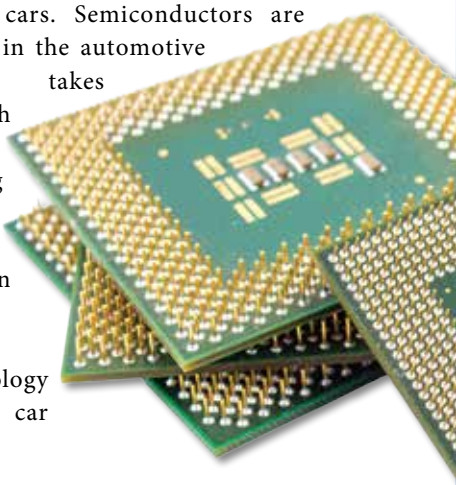
In the renewable energy sector, semiconductors have a crucial role in optimising power conversion, energy storage systems and monitoring equipment. Solar inverters, which convert DC power from solar panels into AC power for use in homes and businesses, rely on semiconductor devices to ensure maximum energy efficiency and reliability.

Semiconductors in the automotive industry

In 2019, sales of automotive semiconductors hit $40 billion. By 2040, sales of automotive semiconductors might reach $200 billion. Automotive semiconductors are one of the fastest-growing markets for the global semiconductor industry. They are crucial to innovating better engines known as ICEs (Internal Computing engines). Moreover, there will be no electric vehicles without semiconductors. Some of the key trends in automotive semiconductor innovation are:

• **Better connectivity:** Users are accustomed to features like route planning and road closure warnings utilising the internet-connected GPS in our cars, red light alerts, parking assistance and many other critical services that you require while operating a vehicle. The semiconductor processes and senses crucial data on the computing systems of the car, enabling precise, dependable and timely operation of the vehicle.

• **Vehicle electrification:** Mechanical systems are currently being replaced by electric ones for some of the features and functions of cars. Semiconductors are essential to accomplish this in the automotive industry. Electrification takes things up a notch with battery management in hybrid vehicles, improving the efficiency of fuel combustion and recovering energy from brakes in electric vehicles.

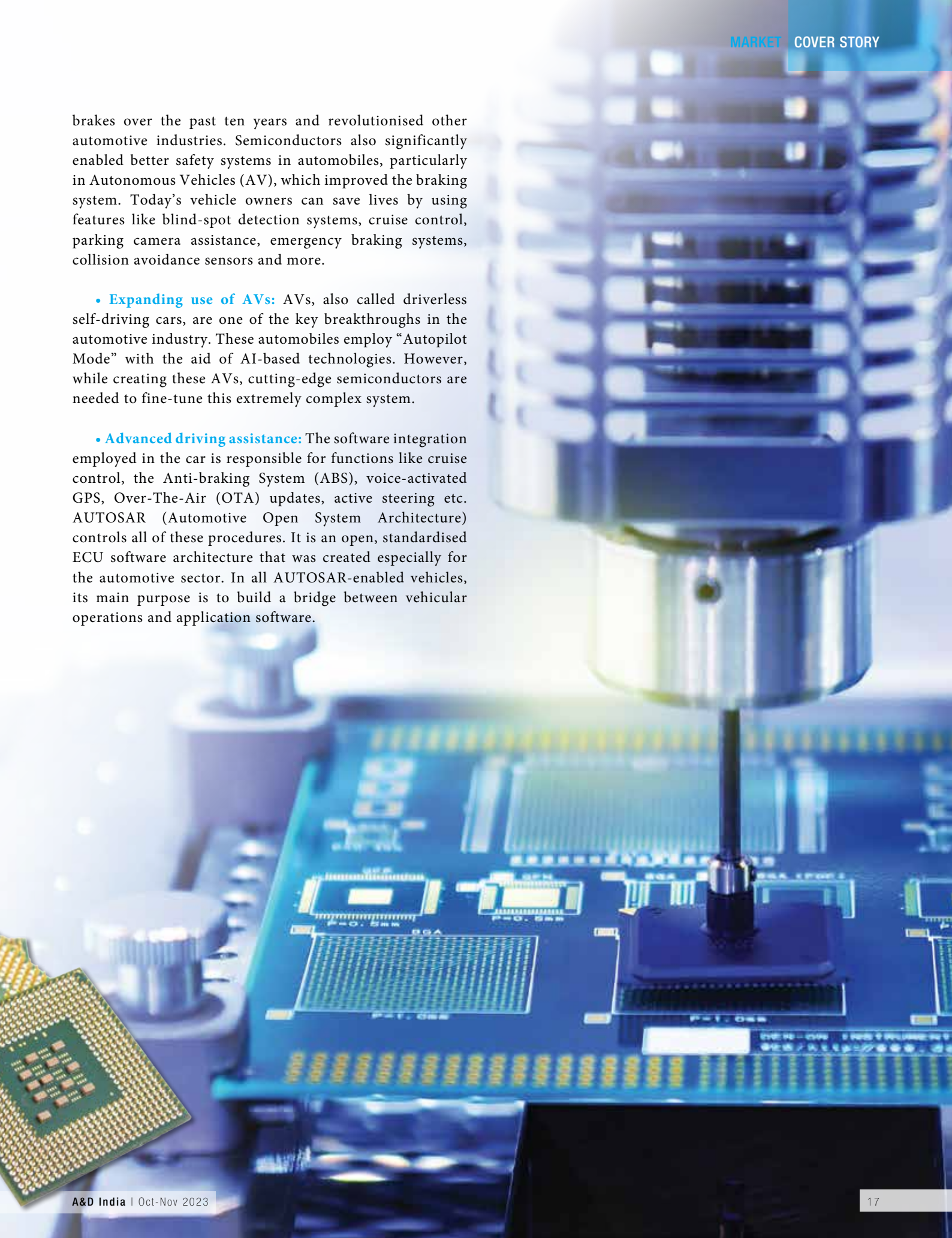


• **Increased safety:** Technology has significantly improved car

brakes over the past ten years and revolutionised other automotive industries. Semiconductors also significantly enabled better safety systems in automobiles, particularly in Autonomous Vehicles (AV), which improved the braking system. Today's vehicle owners can save lives by using features like blind-spot detection systems, cruise control, parking camera assistance, emergency braking systems, collision avoidance sensors and more.

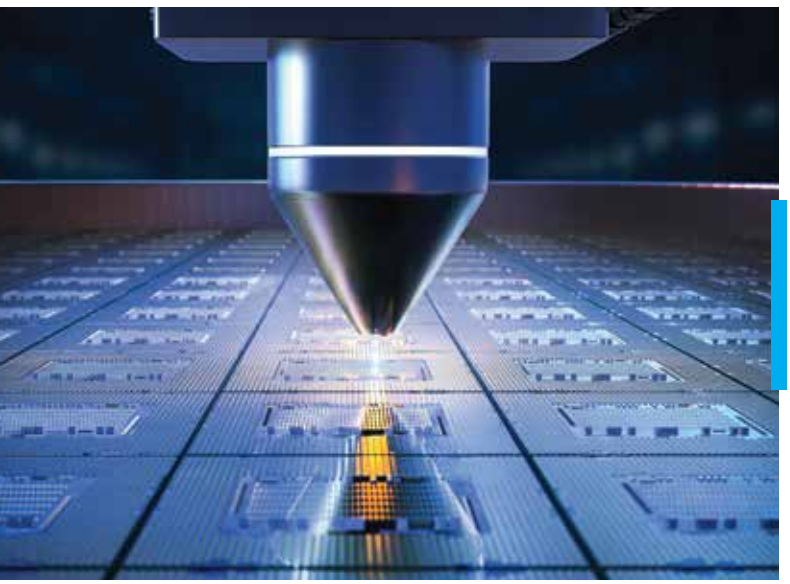
• **Expanding use of AVs:** AVs, also called driverless self-driving cars, are one of the key breakthroughs in the automotive industry. These automobiles employ "Autopilot Mode" with the aid of AI-based technologies. However, while creating these AVs, cutting-edge semiconductors are needed to fine-tune this extremely complex system.

• **Advanced driving assistance:** The software integration employed in the car is responsible for functions like cruise control, the Anti-braking System (ABS), voice-activated GPS, Over-The-Air (OTA) updates, active steering etc. AUTOSAR (Automotive Open System Architecture) controls all of these procedures. It is an open, standardised ECU software architecture that was created especially for the automotive sector. In all AUTOSAR-enabled vehicles, its main purpose is to build a bridge between vehicular operations and application software.



Supply chain implications of semiconductor innovation

Leading semiconductor manufacturers, including Intel in the US and Samsung in South Korea, play a pivotal role in global production. The top five producers comprise China, Japan, Taiwan, South Korea and the USA. The intricate semiconductor supply chain involves various stakeholders in design, manufacturing, testing, packaging and distribution, with intellectual property licensing and recycling also in the mix. Vulnerable to disruptions like the 2020 COVID-19 pandemic, the supply chain necessitates investments in capacity expansion and supplier diversification. Intel's $20 billion investment in Arizona and MICRON's $15 billion expansion in Boise, Idaho, are examples. However, a looming talent shortage requires new workforce strategies to meet growing industry demands by 2030, as cautioned by Deloitte.



Procurement strategies in the era of semiconductor innovation

The semiconductor industry experienced an average growth rate of 7.6% annually from 2015 to 2022. Amid macroeconomic challenges, the industry's revenues are expected to decline by 3%–4% in 2023. With shortages affecting manufacturers in automotive, consumer goods and technology sectors, some COOs are turning to AI-based solutions to boost supply chain resilience. McKinsey reports that 90% of the semiconductor shortage-driven demand is associated with mature technologies used in everyday applications, such as cars, electronics, home appliances and medical devices. Manufacturers must devise strategies to overcome these challenges:

Chip hunting to alleviate short-term bottlenecks

Progressive companies propose a two-pronged approach by combining short-term quick fixes with strategic focuses on medium- and long-term goals. A technical strategy to scour the markets for chip supply is necessary to remedy the issue immediately. This can be achieved through AI, enabling companies to find new supplier sources, even custom-made parts. The long-term strategy includes:

- Identifying vulnerable categories.
- Implementing inventory strategies to mitigate supply risks.
- Forging closer ties with IDMs and fabless players.
- Creating a digital twin of the supply chain.

It is essential to continually review and align supplier and OEM trajectories, while an actively managed technology roadmap can steer purchases towards areas of lower supply risk. To reduce dependence on older technologies, companies must make hard-headed decisions on products with chip availability in mind and limit EOL exposure by revisiting chip portfolios.

Future trends

Despite their diminutive size, semiconductors have become indispensable in managing our connected world. These tiny components have driven technological progress, enabling the digital infrastructure that underpins vital sectors such as healthcare, telecommunications and defence. As time marches on, the demand for top-tier semiconductors is only set to increase, spurred on by the growing capabilities of AI and the rise of IoT. Some of the key future trends could be:

- Optimism regarding revenue growth
- Automotive emerges as the key revenue driver
- Chip shortage to end soon

Final thoughts

As industries embrace digitalisation and automation, the demand for chips will grow significantly. Consequently, semiconductor companies must address the supply shortage promptly to support on-going innovation and drive productivity across various sectors. Despite the challenges, the semiconductor industry remains a driving force behind technological advancements shaping multiple industries' future. To sustain this progress, collaborative efforts, investment in research and development and efficient supply chain management will be essential to meet the growing demand for semiconductor chips and fuel continued growth and progress in the digital era. ☐

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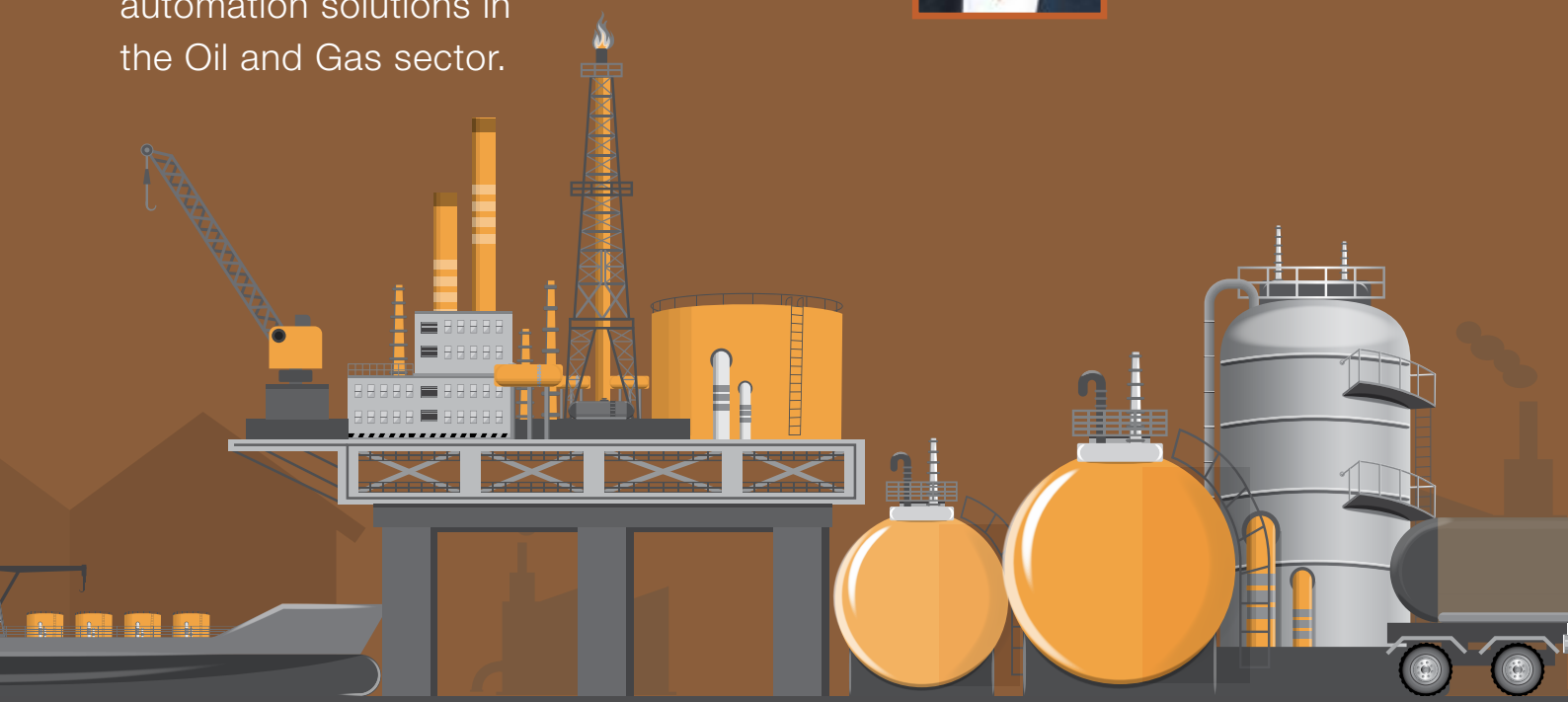
Intelligent energy applications for AI

The historical and current role of automation in the Oil and Gas Industry includes the integration of AI and ML in subsurface mapping, along with other solutions. This article highlights the promising future of automation solutions in the Oil and Gas sector.

Anish Garg,
Director, Oilmax Energy



The Oil and Gas Industry was among the first few to have gone in for large-scale automation. This happened in the 1980s with the establishment of large-scale offshore exploration and production, with remote offshore environments necessitating automation. Over time, automation turned into a key factor in a range of operations from well control to processing and facility management. Tailored automation solutions, such as Programmable Logic Controller (PLC) for equipment handling, entered the fields of oil and gas exploration and production. Today, with the advent of Artificial Intelligence (AI) and Machine Learning (ML), automation offers several more exciting solutions and these are rapidly being adopted by the Oil and Gas Industry for greater efficiency. Discussed below are three of the innumerable applications of automation in Oil and Gas.

Unmanned well platforms and offshore solutions

The shift of operations to greater distances from shore and the challenges of working 1–5 km below the ocean's surface posed new challenges. Working at such offshore locations, at times in harsh and inclement weather, mandated the adoption of unique and creative solutions. Automation turned into a necessity for offshore operations in many different applications. For instance, automatic well control solutions and unmanned platforms are now in use at several locations.

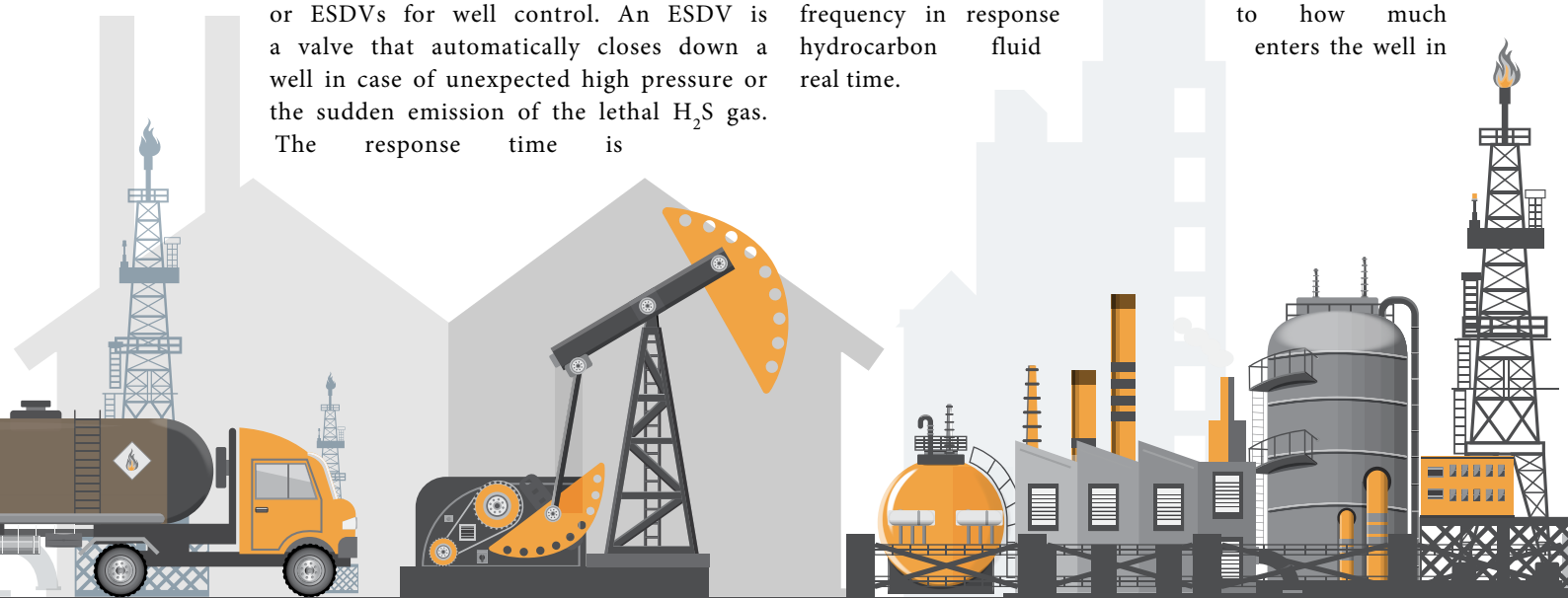
Companies employ highly-skilled personnel to respond to emergencies. These may arise from the sub-surface or during bad weather. Things may also go wrong when hydrocarbons are being taken off the platform. Whatever the cause, the response has to be quick and effective. Automation provides the solution by controlling valves, vessels and wells safely. An example is the use of Self-Actuated Emergency Shut-Down Valves or ESDVs for well control. An ESDV is a valve that automatically closes down a well in case of unexpected high pressure or the sudden emission of the lethal H_2S gas. The response time is significantly quicker than when a human operator shuts down a well manually.

Another interesting example is the early adoption of robotics by the Oil and Gas Industry in the form of Unmanned Undersea Drones or Submarines. Seawater is highly corrosive and the legs and other portions of offshore rigs that are under water require routine inspection, maintenance, repair and painting. For this, divers need to go and inspect the undersea equipment and structures. This is not only expensive but highly unsafe—particularly in places where the ocean floor is extremely deep. At several locations, weather conditions or the extreme pressure below the ocean's surface, do not allow diving activities for humans. This is where unmanned submarines are used for remote inspection and maintenance. Further innovations in robotics will imply greater induction of underwater drones that will phase out human divers for operations extending from diagnostics to undersea welding.

Automated artificial lift solutions

An Artificial Lift Solution is required when there is not sufficient pressure at the bottom of the well to push hydrocarbons to the surface. Many people are likely to be familiar with the ubiquitous image of the Sucker Rod pump. This is an example of an artificial lift. It resembles a huge hand-pump and works much the same way by pumping out oil from a well through its up-and-down motion.

Artificial Lift Solutions have now moved far beyond the basics. Today, there are downhole Electric Submersible Pumps (ESPs), Positive Cavity Pumps (PCPs) and Electric Submersible Rod Pumps (ESRPs) that use various techniques to lift hydrocarbons from wells. Usually, these Lift Solutions are left to operate at a fixed rate or frequency. Advancement in automation now allows automatic throttling and control of the pump rates or frequency in response to how much hydrocarbon fluid enters the well in real time.



Automation in this segment has had several benefits. It has extended the operating lives of Artificial Lift Solutions by optimising the runtime of the pumps by matching it to the liquid entering the well. It has also improved production by constantly lifting fluid at optimal rates. Most crucially, automation has helped to reduce human bandwidth and man hours involved in performance review and optimisation. In fields with hundreds or even thousands of such wells, smart automation of Artificial Lift Solutions can allow significant improvement in production and reduction in manpower costs. Increase in production and lowering of costs are the primary causes that drive any industry towards automation, after all.

ML in subsurface mapping

The detection of hydrocarbon deposits under the Earth's surface involves scientific research. Deposits closer to the Earth's surface and nearer to convenient locations have already been tapped. The search has now extended to harsher terrain and deeper into the Earth's crust. This is cost intensive. Once pockets of oil and gas are located, studies have to be carried out on economic viability. This involves working out the best solution for optimal extraction to ensure profitability. No wonder oil and gas companies spend billions of dollars every year on complex software to model and simulate various attributes, such as size, shape, seismic inversion, porosity, saturation, temperature, pressure and hydrocarbon properties.

These complex workflows were previously entrusted to engineers and geologists who worked solely by hand. Today, the same engineers and geologists are using software specifically developed for oil and gas subsurface characterisation. This has been a giant leap towards improved modelling, accuracy and reduction in manpower bandwidth for the companies involved. This was just the beginning though. There are greater surprises waiting around the corner!

The surprises mentioned involve the integration of such software with ML and AI to further improve predictive performance. Oil and gas exploration is all about managing risk and correctly looking for signs of oil and gas presence below the surface. The use of AI and ML can allow for the removal of human biases and accurately look for traces of hydrocarbons with increased accuracy after analysing huge quantities of data. Such analysis may not be possible for humans adopting physical means.

Does AI do more good than bad?

Whenever automation is discussed and the promise of unique gains due to AI comes up, there is talk of job losses and a threat to workers. This was a trend witnessed even when computers entered the field. In the Oil and Gas sector, automation has always been the key to some vital problems that human capacities could not resolve. AI and automation will enable oil and gas companies to explore further. As new fields become operational, there will be job creation in the areas of drilling and operations. While it is perfectly fine to monitor the integration of AI with a certain amount of caution and skepticism, it certainly holds a lot of promise for the future of the Oil and Gas Industry. ☐

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F&B's automation revolution and its challenges

Automating the F&B sector will result in multiple advantages for the country. As the country develops its technological usage, hyperlocal players of the industry are on the onset of a major automation revolution. Let's address some of the major roadblocks in F&B automation below.

Sai Surya,
Co-Founder, Ruskle

The Food and Beverage (F&B) industry accounts for approximately two-thirds of the retail sector in India, making it one of its largest segments. However, compared to global markets, the Indian F&B industry has been slower in adopting automation and standardisation methods that can improve efficiency and quality. Among other reasons for this are the fragmented and unorganised nature of the market and price sensitivity of the consumers, along with high cost and low availability of automation technology and infrastructure in the country.

The Indian F&B market is dominated by mass-marketed retail goods in metropolitan cities, where consumers are highly sensitive to price variations. India's average per capita income is $2,400 per annum, which makes consumers cautious about their spending. The rising inflation has also increased the costs of production and distribution in this segment.

Automation practices in F&B

Even so, the rest of the country is largely served by the unorganised sector, which comprises very small to small hyperlocal players who offer similar products at lower prices. These players account for a massive share of the industry and provide ease of access to a large section of the population. However, they face several barriers to growth, such as their dependence on unskilled labour and lack of access to automation technology.

Automation technology is expensive and requires a significant capital investment to scale up. A major factor that discourages many F&B players from investing in automation is the high capital expenditure required to reach an automated scale. Therefore, many F&B players find it difficult to justify the return on investment of automation and prefer to stick to their traditional methods.

Challenges to automation technology

- **Unavailability of government grants**

The current government grants, while helpful, have proven inadequate for the automated machines' acquisition cost. Moreover, accessing these grants is challenging and time-consuming.

- **Lack of infrastructure and utilities**

Automation requires larger infrastructure in place, such as real estate, electricity and utilities, which are scarce and costly in many parts of India. This deters the hyperlocal players from expanding their operations and investing in automation.

- **Lack of know-how and compatibility**

Automation involves understanding the requirements and implementing the processes step-by-step. A major challenge faced by multiple hyperlocal players is that the technology bought is not compatible at times.

- **Lack of skilled labour for automated machinery**

Although automation can reduce reliance on unskilled labour, it also requires skilled labour to operate and debug the machines. Training unskilled labourers is extensive; on the contrary, hiring skilled labour is challenging and expensive as the skilled labour in the industry is largely dominated by the top players who offer better incentives and opportunities.

- **Inability to meet SKU demands**

The Indian consumer has developed a taste for a variety of cuisines and expects a diverse range of products. Hyperlocal players of the industry struggle to keep up with the increasing demands of the consumer because they scale up improperly and rely more on unskilled labour. Resultantly, they are unable to meet the quality and quantity standards required by the market. The organised players, however, have access to technology that enables them to resolve these inadequacies.

Addressing these challenges

The roadblocks in F&B automation have solutions that will aid the hyperlocal players' awareness as well as capital and revenue benefit. They are:

- **Accessibility to capital and machinery**

The biggest challenge faced by many F&B players is the lack of capital to invest in automation. In some global markets, governments provide support and incentives for the manufacturing sector, such as subsidies for power and other utilities, grants and loans for plant and machinery and tax breaks. This has resulted in a production boom and access to newer products.

If India can facilitate easier access to capital, either through government schemes or private investment, it can facilitate the impending growth and expansion in the F&B industry. Automated machinery is expensive and a major deterrent for most small players. One way to make machinery more accessible is to offer payment terms in instalments. This can help machine manufacturers sell their inventory faster and help F&B players acquire the machines they needed.

- **Educating the hyperlocal players**

Providing the hyperlocal players with the right tools and information to adopt automation is a necessity. In this regard, educational programmes can incentivise the hyperlocal players to initiate their transition into an automated world. An ease of access to understanding the right equipment and training programs for the unskilled labour can be huge breakthroughs to develop change. For example, a major roadblock for the industry is the turnkey design needed in automation. Access to good industrial design can bring out a positive effect in streamlining these processes and production. Moreover, enabling the players to access technology at the most basic level, such as a basic software that can help them map and layer processes, will also be of huge help.

- **Enabling tech using IoT and mobile applications**

India is one of the largest consumers of mobile phones. Enabling access to tools using mobile applications would be a great way to reach a large number of consumers. The internet infrastructure in India is robust and affordable to the masses, and that the hyperlocal players can exploit this. Vyapar is an indigenous Indian POS software that has a UI/UX interface that is easy to understand and available in several languages. Such applications can be used by hyperlocal players in order to progress. The software is quite exhaustive but remains affordable and user friendly.

- **Building partnerships with the existing players**

A great way to help scale the small industries could be using the existing players to host workshops. A low-level technology and knowledge transfer could help facilitate the educational programmes as well. Medium-to-larger players constantly upgrade and expand their machinery or use existing automated machinery that is no longer fit for purpose. This technology can be made available to the hyperlocal players at an affordable cost.

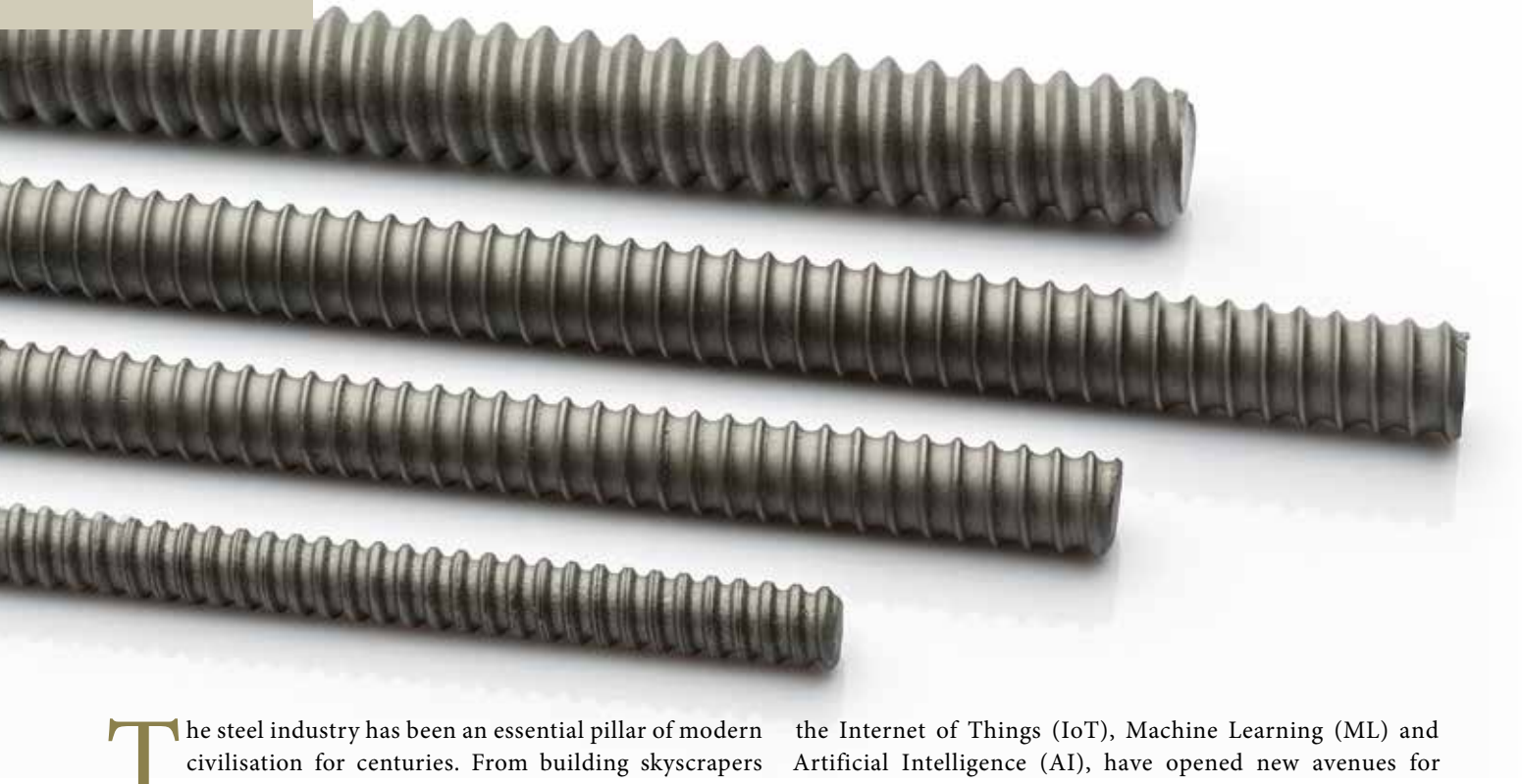
A way forward…

An economy thrives when it is well supported by existing industries. India has a large and competitive market and a burgeoning middle class that has had a substantial increase in spending power. These solutions will help the F&B industry in India disregard all challenges with respect to automation. While the market is still price sensitive, there are several niche segments that are emerging in the F&B industry and challenging the previous price barriers. The increase in consumer demand, while a positive outcome of the new middle class, is also an opportunity vis-a-vis the gap in supply. If India can find solutions to automate its systems and plug this gap, it can become a global leader in the F&B space. ❐

How is automation and digitisation shaping the **steel industry?**

The adoption of automation and digitisation in the steel industry has had a significant impact on the industry, primarily on productivity. This article discusses automation's contribution in increasing production and reducing costs in the steel.

Lalit Beriwala,
Director,
Shyam Steel Industries



The steel industry has been an essential pillar of modern civilisation for centuries. From building skyscrapers and bridges to manufacturing automobiles and appliances, steel is a critical raw material that has shaped our world. The Indian steel industry is a major contributor to the global steel market and is one of the largest steel-producing countries in the world.

The ongoing demand for steel is driven by various sectors in the country, including construction, automobiles and consumer goods. The Indian steel industry has thus impacted the overall economic and infrastructural development of the country to great extent. Moreover, the government's focus on the *Make in India* initiative and the ever-growing infrastructure development have further accelerated the extension of the industry.

Driving the industry forward

In recent years, the industry has undergone significant changes due to automation and digitisation. These advancements have increased efficiency, productivity and safety and are poised to drive the industry forward for years to come. India takes after China to become the largest global producer of steel. To maintain this momentum, the industry must be prepared to compete at an international level and take the sector to an advanced stage of development.

The digital transformation of the global steel industry is well underway, and steel producers are pressed to remain competitive while upgrading and implementing new automation systems in their production units. While automation in terms of steel mills and processing plants (using robotics and other automated machinery) has been cultivating for decades, recent advancements in technology, such as the Internet of Things (IoT), Machine Learning (ML) and Artificial Intelligence (AI), have opened new avenues for the steel industry.

Advanced possibilities for automation

Automation is significant for the steel industry for its improved safety advantages. As steel manufacturing is a hazardous process in which workers are exposed to high temperatures, heavy machinery and dangerous chemicals, automating some of the more dangerous tasks (e.g. furnace operations) reduces the risk of accidents and injuries. One of the most significant advancements in steel production is the use of robots.

Robots are used in steel mills for tasks varying from loading/unloading materials to maintenance and cleaning. They are also used for welding, cutting and shaping steel, which were previously manually completed. Evidently, robotic systems are particularly useful in hazardous environments such as high-temperature furnaces and areas with toxic gases. Additionally, automation can help reduce worker fatigue, improving productivity and reducing errors. As automated systems can operate around the clock without interruption, automation also enables improved efficiency and cost savings as automated systems can operate around the clock without interruption, increasing output and reducing downtime for steel mills.

Additionally, automated systems can also optimise production processes, adjusting parameters such as temperature, pressure and feed rates in real-time to ensure optimal output and quality, thereby ensuring better value for customers. Another area of automation in the steel industry is the use of AI and ML. AI and ML algorithms can analyse

large amounts of data from sources such as sensors and cameras to optimise production processes. They can also predict equipment failures before they occur, allowing for sources such as maintenance and minimising downtime.

Effects of digitisation

Digitisation refers to the process of converting analogue information into digital form. In the steel industry, digitisation involves the use of sensors, cameras and other digital devices to monitor and control the production process. Digitisation allows manufacturers to collect vast amounts of data on production processes, equipment performance and product quality. This data can then be analysed using AI and ML algorithms to optimise production processes further. Leveraging data and analytics can assist in optimising processes, improving efficiency and reducing costs.

Digitisation also validates predictive maintenance, which is significant in the steel industry. Monitoring equipment performance and analysing data in real-time helps identify potential issues before they become major problems, reducing downtime and maintenance costs. Digitisation also helps in reducing the risk of counterfeiting and ensuring compliance with regulatory requirements. Radio-frequency Identification (RFID) and blockchain can help manufacturers track raw materials and finished products throughout the supply chain, ensuring transparency and traceability. Manufacturers can use digital devices to monitor the quality of raw materials, track the progress of production processes and monitor the finished product for defects. This level of tracking and quality control was not possible with analogue systems. Steel companies are increasingly using digital channels to engage with customers, providing them with information about products, prices and delivery times, improving customer satisfaction and helping companies build stronger relationships with their customers.

Possible challenges to workforce

The adoption of automation and digitisation in the steel industry has had a significant impact on the industry. The Indian market has seen progressive changes in production time, material cost and productivity. Another characteristic of automation and digitisation has been the improved, efficient quality of the final product. Digitisation has made it possible to monitor the production process in real-time, identifying and addressing quality issues quickly.

Automation and digitisation have also had an impact on the workforce; although automation has reduced the need for manual labour, it has also given rise to new job opportunities. Companies now require workers and operators skilled in technology and data analysis to manage and maintain the new systems. Overall, automation and digitisation have the potential to transform the steel industry, offering numerous benefits to manufacturers and customers. Automation and digitisation require significant investments in hardware, software as well as training, which can be a barrier for small and medium-sized enterprises (SMEs).

As the demand for workers with specialised skills like robotics and data analytics will increase, a shortage of skilled workers is expected as the younger workforce may be averse to pursuing a career in manufacturing. Despite these challenges, there are significant opportunities for the steel to grab. Automation and digitisation can also help companies meet environmental regulations by reducing waste and emissions.

Effective benefits to steel manufacturers

The steel industry has long been a cornerstone of industrialisation, powering the growth of economies worldwide. India's steel industry is better placed than other countries and should strengthen its fundamentals, driven by increased export opportunities, limited imports and improved domestic demand. India's finished steel consumption is anticipated to increase from 133.596 MT in FY22 to to 230 MT by 2030–2031.

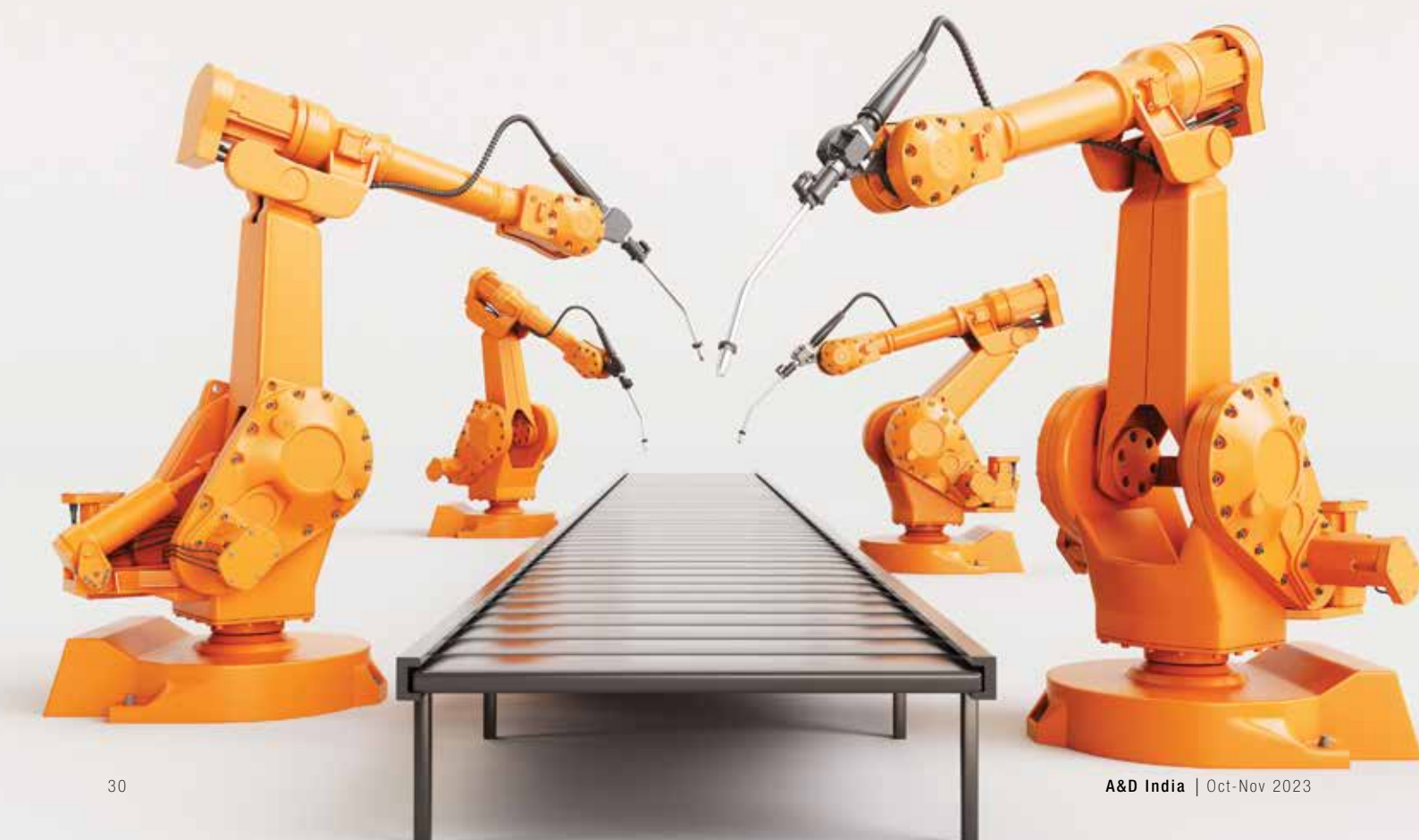
In recent times, automation and digitisation have emerged as critical drivers of change in the industry, offering numerous benefits to steel manufacturers and their customers. Improved safety, efficiency and supply chain visibility will help manufacturers not only reduce costs but also improve quality and increase market value. However, addressing the challenges of cost and workforce development will be critical in ensuring that the benefits of automation and digitisation are accessible to all manufacturers. ☐

Shyam Steel, Durgapur Factory

Robotics and industrial automation: Empowering synergy with Cobots

The integration of Cobots is reshaping India's manufacturing landscape, emphasising safe collaboration between humans and robots and paving the way for a more automated future in the nation's industries. This article gives an abstract on the surge witnessed in industrial robot installations in India, especially in the automotive sector.

Mahesh Wagle,
Co-founder and Director, Cybernetik



In the ever-evolving landscape of industrial automation, India is positioned at a crucial juncture. In its annual report for 2021, the International Federation of Robotics (IFR) revealed that India witnessed a significant surge in the sales of industrial robots. In a new record, 4,945 units were installed, reflecting a remarkable 54% increase compared to the previous year. This surge in installations has propelled India to the tenth position globally for annual robot installations, as per the findings of the IFR's 'World Robotics' report. This statistic highlights the vast potential and untapped opportunities for growth in the realm of robotics and industrial automation. India's automotive sector leads in robot utilisation, with 60% of the country's robots in this industry, according to the IFR. Other sectors adopting robots include pharmaceuticals, healthcare, electronics, metals, electrical, FMCG and plastics. Robots in healthcare are working on rehabilitation, surgery and elderly care, showcasing their versatility.

Automation: A pragmatic choice

For many business owners, automating their manufacturing processes becomes a more viable option than establishing entirely new facilities. Automation eliminates the need for procuring new equipment, hiring additional manpower and investing in extensive training programmes. This shift towards robotics and automation streamlines operations enhances efficiency and alleviates the hassle associated with expansion.

Currently, Indian manufacturers are transitioning from the 'growth stage' to the 'maturity stage'. During this phase, companies seek to optimise their assets. This trend is driven by the increasing demand for quality products, where automation is a natural ally. Manual processes carry a higher degree of risk for the workforce, prompting organisations to opt for automation to ensure error-free and safe operations.

Role of traditional robots

Traditionally, industrial robots have played a pivotal role in India's automation journey. These machines offer precision, speed and consistency, making them invaluable assets in tasks such as welding, assembly and painting. Typically fixed in place and operating within predefined parameters, they have proven to be invaluable assets in many industries. However, their integration often requires careful planning, programming and safety measures to ensure seamless operation alongside human workers and other automated systems. The emergence of collaborative robots (Cobots) is fundamentally reshaping the manufacturing industry's robotic automation landscape.

Rise of Cobots

The emergence of Cobots is proving to be a game-changer in the industry. These machines are designed to work alongside human operators, ushering in a new era of synergy between human labour and automation. According to analytics firm ABI Research, the collaborative robot market is projected to exceed $11.8 billion in value by 2030, a substantial leap from its 2019 valuation of $711 million. Cobots prioritise safety through advanced features like force and proximity sensors, ensuring secure collaboration with humans. Their ease of programming and adaptability make them ideal for a wide range of applications.

In addition to safety, Cobots offer several advantages on the production floor. They are remarkably easy to set up, require minimal programming experience and can be operational in just weeks compared to months for industrial robots. Cobots are highly versatile, capable of handling various tasks with suitable end effectors and can be easily repositioned. Moreover, they empower employees by taking over repetitive manual work, reducing the risk of workplace injuries and allowing workers to focus on more creative tasks.

Challenges and considerations

Addressing challenges and considerations in the realm of cobots and automation is crucial. One significant concern in our increasingly interconnected world revolves around ensuring robust security and safeguarding data privacy. Additionally, the operation and maintenance of these systems demands a cadre of highly skilled technicians, underlining the critical importance of workforce development in this field. Bridging the skills gap necessitates substantial investments in training and education, paving the way for a workforce that can effectively navigate the complexities of modern automation technologies.

Future of manufacturing

The integration of cobots is fundamentally reshaping the manufacturing landscape, prioritising safe collaboration between humans and robots while elevating overall task performance. This shift towards collaborative robotics signifies India's potential for growth and transformation in the field of robotics and industrial automation. Despite the current lower robot density, the nation is on a trajectory towards embracing advanced, efficient and collaborative solutions. As industries increasingly adopt automation to enhance efficiency, safety and quality, they pave the way for a future where technology and innovation drive progress, ultimately reshaping India's manufacturing sector. ☐

Future-proofing the automotive industry **with lightweighting**

The automotive industry has actively been addressing environmental impact concerns through compliance frameworks. This article delves into the automotive industry's efforts to reduce its carbon footprint by implementing compliance frameworks, improving resource efficiency and exploring innovative materials and manufacturing techniques to create more sustainable vehicles.

Doraiswamy Bharath Sunderraj,

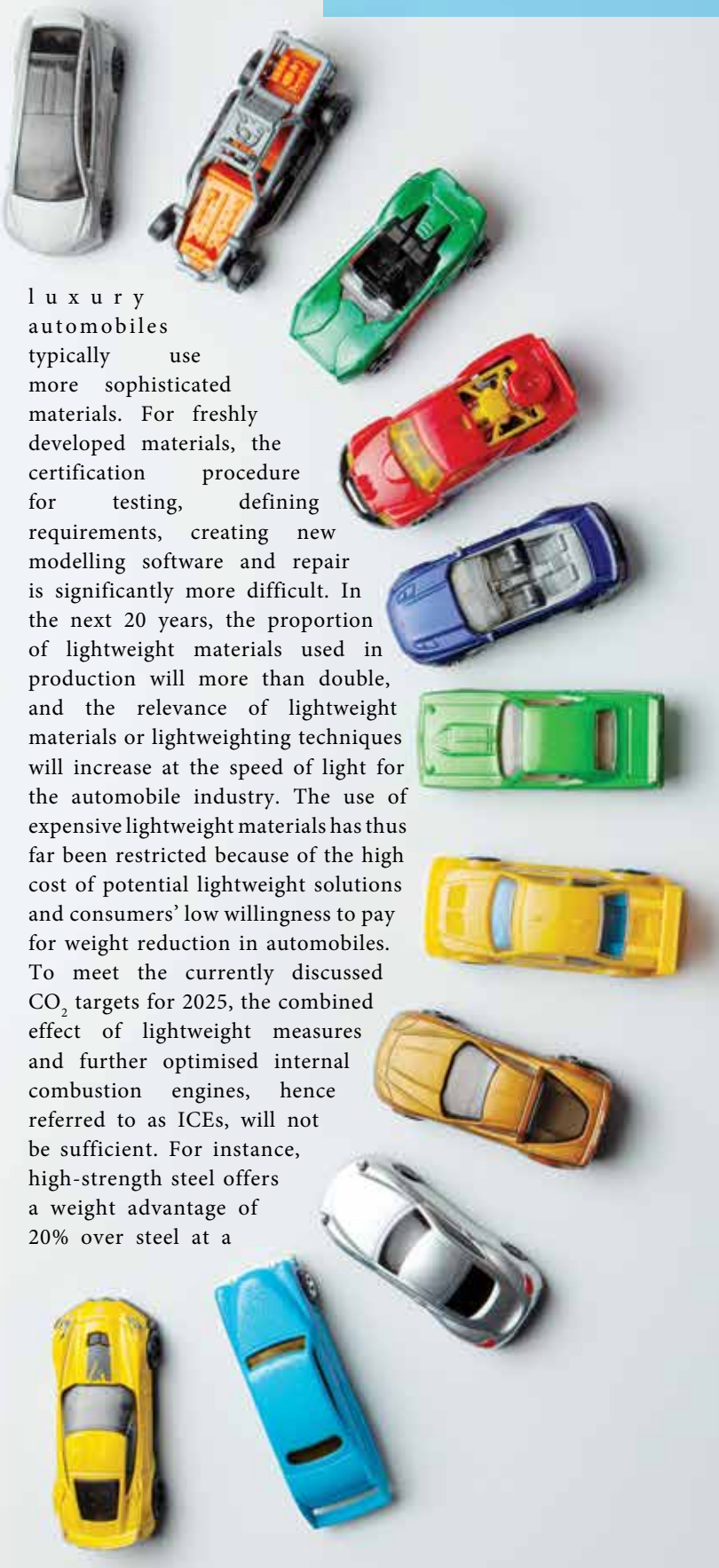
Program Manager, TechVision, Frost & Sullivan

The automotive industry has established a set of compliance frameworks related to environmental impact. The framework tackles exclusive parameters like diversified energy and fuel strategies, emissions performance and efficiency standards in response to strict regulatory frameworks to significantly reduce Greenhouse Gas (GHG) emissions and carbon footprint. Additionally, the industry's globalisation creates site-specific difficulties and growth opportunities for the automotive value chain, which have an immediate impact on the technical requirements and development frameworks necessary for successful, sustainable product lifecycles.

Between 2000–2018, water use per vehicle was reduced by 47.7% and absolute volumes were decreased by 27%, thanks to long-term investments in water-efficient technologies and gradual adjustments to procedures, as reported by the 2019 Automotive Sustainability Report published by the Society of Motor Manufacturers and Traders (SMMT). The industry has reduced relative CO_2 by 53.6% during the last 20 years. The average amount of energy used to make one vehicle has decreased by 43.3% because of significant investments made by automobile manufacturers in lowering energy use at manufacturing facilities and offices since 1999. The automotive industry has been compelled by this to continuously raise production standards while concentrating on total vehicle performance. The automotive industry has been working continuously to embrace innovative manufacturing techniques and materials to reduce the weight of essential parts and components. Due to the high GHG intensity of the production of lightweight materials, vehicle lightweighting lowers fuel-cycle GHG emissions but may raise vehicle cycle (production) GHG emissions.

Except for ultra-lightweight designs that incorporate considerable amounts of carbon fibre, using lightweight materials is a cost-effective way to cut CO_2. However, their abatement potential is limited. High-strength steels and other ferrous materials are still mainly used in the body structures of cars. Generally, the term Advanced High Strength Steel (AHSS) is used for dual-phase steels, complex-phase steels, TRIP steels and martensitic steels (multi-phase steels). Conventional high-strength steels are single-phase ferritic steels. For AHSS, properties such as strength and elasticity can be applied to facilitate a wide range of features, and the use of specific types of steel can be tailored to obtain desired properties and formability. By using HSS and AHSS as a replacement for traditional steel, a weight reduction of up to 50% of car weight can be achieved. There are multiple ways of assembling and forming multi-materials, either by joining metal-metal or metal-polymer materials. Multi-material joining holds the potential to gain improved material properties regarding strength and formability.

Since there is less of a financial incentive to reduce weight, luxury automobiles typically use more sophisticated materials. For freshly developed materials, the certification procedure for testing, defining requirements, creating new modelling software and repair is significantly more difficult. In the next 20 years, the proportion of lightweight materials used in production will more than double, and the relevance of lightweight materials or lightweighting techniques will increase at the speed of light for the automobile industry. The use of expensive lightweight materials has thus far been restricted because of the high cost of potential lightweight solutions and consumers' low willingness to pay for weight reduction in automobiles. To meet the currently discussed CO_2 targets for 2025, the combined effect of lightweight measures and further optimised internal combustion engines, hence referred to as ICEs, will not be sufficient. For instance, high-strength steel offers a weight advantage of 20% over steel at a



cost increase of 15% per item, whereas aluminium is 40% lighter but 30% more expensive.

Additive manufacturing is one of the most important technologies in the automotive industry. Traditional manufacturing processes such as cutting, drilling, welding and grinding are subtractive processes that remove and refine excess material to provide the desired product; on the contrary, additive manufacturing technology is a layered, additive process. Using 3D Printing technologies, the material is created, or rather developed, to aid reduced waste material and post-processing efforts. There is significant growth in the use of additive manufacturing technologies in the automotive sector due largely to the ability of additive manufacturing to simplify the design, prototyping and re-production processes. The industry has a high scope, considering the demand and opportunities for volume prototyping and for customised parts that 3D Printing technology offers. A variety of automotive parts are now 3D Printed (mainly for prototyping), such as engine cylinder heads, intake manifolds, headlamps, door handles, display buttons and brake rotors.

Other main automotive trends include electrification and autonomousity, NVH reduction and green manufacturing techniques to reduce carbon footprint. For instance, Toyota has set a goal to develop artificial photosynthesis technologies from CO_2, water and solar power. The main aim is to complete basic verification tests for the creation of primary CO_2-absorbing material (material or fuel) using the world's most efficient photosynthetic unit. Similarly, the automotive industry also follows a strict supplier audit, which is revised every year under its Dealer Environmental Risk Audit Program (DERAP). Bridgestone can extend the same type of programs for its dealers and suppliers. Global legislation such as The End-of-Life Vehicle (ELV) Directive in the European Union (EU) has put pressure on OEMs to increase the recyclability of the materials used in vehicles.

The use of hybrid materials makes it challenging for recycling as it needs to take into account various recycling requirements of specific materials. This has resulted in the need for developing effective recycling techniques. Achieving lightweight is dependent on the entire vehicle design, component design, material choice and manufacturing processes; failure of either can lead to inferior performance and quality and high costs. There is a need for increasing collaboration of car manufacturers with materials developers to achieve the best performance of the lightweight vehicle, including all aspects such as sustainability, safety and cost-efficiency. ☐

Editorial credit: Nataliya Hora / Shutterstock.com

Ensuring flexibility and quality in **pharma and chemicals**

The pharmaceutical industry is a robust and important market in India. With patients demanding quality healthcare, introducing flexibility as an innovation is important and cannot be ruled out.

Dr Deepak Birewar,
Chairman and MD,
Inventys Research

Until now, the pharma industry has focused on balancing the demands of cost and time. However, with flexibility being an important attribute, a new balance of the flexibility–cost–time triad is discovered. Today, all three factors are important and must be considered to ensure operational efficiency. The pharma industry is highly competitive and time-sensitive, with quality being the top priority. In the wake of rapid digitisation, the adoption of pharma manufacturing technologies is emerging at the forefront, where flexibility is a significant capability being offered. This flexibility can be achieved by introducing recent innovations in the manufacturing facilities.

Need for flexible production systems

Why does pharma need flexibility? The answers are multiple. Maintaining efficient and high-quality production at scale is one major challenge for pharma companies. Along with this, exposure to highly sensitive ingredients, strict regulations and focus on the quality of life-saving products is also a requirement.

With more people becoming affected by rare diseases, the pharma industry is under pressure to address a wider category of illnesses. Consequently, the breadth of medicines to be developed is also diversifying to include peptides,

nucleotides, conjugate modules and many more. The demand for cell and gene therapy, biological molecules and immunotherapy is also increasing significantly. However, manufacturing these on a larger scale is a roadblock for pharma companies because of limited resources and a lack of commercial manufacturing capabilities. Additionally, orphan drugs and biopharmaceuticals are highly potent, expensive and targeted for specific patients. Forecasting their sales volume can, therefore, be a challenge and requires volatility and flexible manufacturing systems.

Furthermore, patients vary across age groups in each demography and require customised dosages. Hence, in pharma, the 'one-size-fits-all' model is not applicable. Thus, flexibility in production systems is needed to cater to modern demands. This is pushing pharma companies to shift their operations away from large-scale, bulk manufacturing and towards more agile and flexible production environments. Hence, they seek to optimally use the available capacity of chemical manufacturers to meet the specialised demands of their customers.

Benefits of flexible manufacturing systems

Traditional manufacturing setups use different equipment for different processes. This model is inefficient, requires financial and physical resources in abundance and does not suffice to meet modern requirements. In such a scenario, chemical manufacturers complete the chemistry, manufacturing and development of processes and further take over the scale-up, process validation, tech transfer and stability testing after regulatory approval is obtained. Hence, by associating with chemical manufacturers, the marketing period for pharma players significantly decreases.

However, this is not the only benefit. Additionally, the need for costly capital expenditures on in-house equipment is eliminated, and the risk of development decreases. This further allows drug developers to focus on creating innovative and transformative products.

Flexibility in the chemical industry

The chemical industry forms the backbone of various sectors, and pharma is one such market. The industry's production of highly complex production is substantial and comprehensive. This puts forth the need for a flexible production system. In the chemical industry, flexibility implies the scalability to develop complex chemicals and, simultaneously, allows manufacturers to reduce their carbon footprints faster and more efficiently.

A major technological advancement that has already begun is the manufacturing of pharma intermediates up to Active Pharmaceutical Ingredients (APIs). This responsibility

is taken over by trusted chemical manufacturing companies that are developing and validating manufacturing processes by leveraging state-of-the-art technologies and their expertise in the sector.

Approaches to flexible manufacturing

It is expected that Industry 4.0 will bring about a wave of revolution in the production processes through which the chemical industry will be able to seamlessly automate production tasks, thereby benefiting various sectors, specifically the pharmaceutical market.

Chemical manufacturers invest in specialised production lines to attract high-value projects. However, once completed, the investment may be wasted or might require additional costs to upgrade for new projects. Hence, they need the flexibility that could help them attract lucrative projects and adapt to new production requirements with minimal time and financial expenses. The different approaches for attaining flexible production systems are as follows:

Cross-over equipment usage

Pharma companies can outpace their competitors with re-investment to enhance production efficiency. Resultantly, they can launch most of their products on the market without any rework. The introduction of flexible production lines is a prominent example of this reinvestment. The idea is to identify cross-over steps in manufacturing when two or more processes share similar steps; hence, the same piece of equipment can be used for both.

For example, for some drugs, the active pharmaceutical ingredient must be mixed with a solvent, after which the

Pharmaceutical and chemical manufacturing system in process

solvent is removed by a separation column. Many drugs require this step. If the conditions required are similar, the separation column can be adapted to work on multiple production lines, thereby creating instant flexible production.

Modular manufacturing

The ballroom concept of this approach encompasses the use of a large manufacturing area with no fixed equipment. Hence, the existing facility is used for different modules like facilitating standardisation, simplifying processes, reusing designs etc. It provides benefits like plug-and-play functionality, low capital costs, smaller footprints and a reduced need for dedicated cleanroom space. Many pharma companies are opting for this model more as it offers accelerated equipment commissioning, faster changeovers, high versatility and improved Overall Equipment Effectiveness (OEE).

Data-driven manufacturing

As an initiative of the International Society for Pharmaceutical Engineering, Pharma 4.0 is helping the industry adapt to Industry 4.0's modernisation efforts, including improved connectivity, automation and real-time analysis of data and operations in the factories to produce highly specialised products.

This approach encompasses leveraging innovations like real-time system design, seamless tech integration and enhanced shop-floor data for real-time production insights and decision support. This further paves the way for efficient, high-quality and compliant production systems. With Big Data and IoT, pharma companies can break organisational silos and enhance collaboration across manufacturing processes. IoT tools significantly help in the analysis of the appropriate equipment for use in flexible production. It also provides the structure to implement other emerging technologies, such as blockchain, IIoT, ML etc. in the production processes.

Smart monitoring systems

Intelligent monitoring systems on production lines can bring flexibility and reduce production downtime while optimising containment integrity. Such equipment solutions deliver real-time information on the use of manufacturing components throughout the production line. This means manufacturers can plan maintenance schedules proactively rather than reactively, helping to keep downtime to a minimum, without affecting the sterility of end products.

Additionally, real-time data usage helps chemical manufacturers precisely track batches and proactively manage validation programmes on their aseptic lines. The latest smart-monitoring tools show real-time data on an online dashboard that can be accessed remotely. Consequently, manufacturers can oversee production lines in different facilities even while they are on the move.

Robotic lab creation

A robotic laboratory is another way that can help accelerate the drug discovery process. While its conception is still in its nascent stages, it is certainly a next-generation evolution in drug discovery. Different processes like design, synthesis, purification, analysis and sample management can also be integrated into a fully automated platform. It is anticipated that robotic cloud platforms will used to allow access to these remote-controlled labs to conduct research and further innovate products.

Addressing industry challenges

The pharma industry is bound to evolve, and flexible production technologies are appropriate solutions to cope with the scenario. Flexible manufacturing systems are, therefore, needed in the pharmaceutical industry to address the challenges of volatility, uncertainty, complexity and ambiguity. Chemical manufacturers need to play on their strengths and ensure that they stand out in the market. Flexibility and agility in manufacturing operations are the differentiating elements that will help them have a competitive edge and support the pharma industry's scalability. ☐

Industrial robotics in the automation age

Industrial robotics has come a long way since its inception, and it continues to evolve at an incredible pace. Today, robots are a vital part of modern manufacturing. They help to provide speed, precision and efficiency in tasks that would otherwise be impossible or impractical for humans to perform.

Vinayak Bhat,
General Manager,
Bastian Solutions

In recent years, industrial robotics has undergone a significant transformation, with technological advancements driving innovation and growth in the manufacturing sector. Early robotics solutions were mostly used in the automotive industry, performing tasks such as welding car chassis together. However, with time, robotics has become more versatile. They are now seen in food processing, electronics and pharmaceutical warehouse.

One of the most significant developments in industrial robotics in recent years has been the emergence of

collaborative robots (Cobots). These robots are designed to work alongside humans, performing tasks that require prominent levels of accuracy and repeatability. Cobots are equipped with sensors that allow them to detect the presence of humans and stop working if they come too close, making them safe to work with.

Another major development in industrial robotics is the use of mobile robots. These robots are designed to move around the factory floor and perform tasks such as material handling and inspection. Mobile robots are equipped with sensors and cameras that allow them to navigate the factory floor and avoid obstacles.

Key trends in industrial robotics

The use of industrial robots is on the rise, and this trend is expected to continue in the coming years. One of the key trends driving the growth of industrial robotics is the need for greater flexibility in manufacturing. With consumers demanding more customised products, manufacturers need to be able to quickly adapt their production processes to meet changing demands. Industrial robots are being designed to be more flexible and adaptable, making it easier for manufacturers to switch from one product to another.

Another trend in industrial robotics is the use of cloud computing and the Internet of Things (IoT). Robots are being equipped with sensors that collect data on their performance and transmit it to the cloud, where it can be analysed in real-time. This data can be used to improve the performance of the robots and optimise the process of manufacturing

The use of Artificial Intelligence (AI) and Machine Learning (ML) is another trend in industrial robotics. AI and ML are being used to develop robots that can learn from their experiences and improve their performance over time. These robots can perform tasks that are too complex for traditional robots to handle, such as recognising objects and making decisions based on visual data.

Flexible and adaptable robots

One of the challenges of industrial robotics has been designing robots that can be quickly reprogrammed to perform different tasks. Traditionally, robots were designed for specific tasks, and reprogramming them to perform different tasks was a complex and time-consuming process. However, with the emergence of collaborative robots and the use of AI and ML, robots are becoming increasingly flexible and adaptable to manufacturing processes.

Collaborative robots are designed to be easy to programme, and they can be reprogrammed quickly to perform different tasks. They are also designed to work alongside humans, making it easier for manufacturers to introduce them into their production processes. AI and ML are also being used to develop robots that can adapt to changing production needs. These robots can learn from their experiences and adjust their performance based on the data they collect. For example, a robot that is designed to pick and place objects can learn to recognise several types of objects and adjust its grip to pick them up more effectively.

AI and ML are effecting a significant impact on industrial robotics like pick-and-place robots, enabling robots to perform tasks that were once thought impossible. With advanced computer vision and ML algorithms, robots can now recognise and sort different types of products with greater accuracy and speed than ever before. This has revolutionised industries such as manufacturing and logistics, where robots are now being used to automate tedious and repetitive tasks, freeing up human workers to focus on more complex and creative tasks.

Use of robots on the factory floor

Evolving landscape of robotics

The use of industrial robots is no longer limited to the automotive industry; robots are now being used in a wide range of industries, from food processing to pharmaceuticals. The flexibility and adaptability of robots are making it easier for manufacturers to meet the changing demands of consumers, and the use of AI and ML is opening new possibilities for robots to perform tasks that were once thought to be impossible. Industrial robotics is undoubtedly an exciting field, and it will be fascinating to see how technology becomes more approachable as it continues to evolve in the future. ☐

Role of die and mould in **toy manufacturing**

Die and mould are responsible for shaping plastic material to the desired design and shape of the toy. They ensure that the toy is manufactured in large quantities with consistency and precision. A read on…

Gaurav Mirchandani,
Founder & CEO,
SM Toys

The die and mould industry plays a crucial role in the manufacturing of toys in India. Die and moulds are specialised tools used in the production of toys, allowing manufacturers to create toys with consistent shapes, sizes and intricate details. Most of the items for sale in toy aisles across the nation are made of plastic, as can be seen by taking a stroll down any one of them. Many of them have probably been produced using techniques for plastic injection moulding. Building blocks, dolls, robots and craft kits are just a few of the toys and games that can be produced using plastic injection moulding to appeal to kids.

Manufacturing processes

Die and mould are used in the injection moulding process, which is one of the most common manufacturing processes in toy production. In this process, the plastic material, usually referred to as thermoplastic, is heated and melted in the injection moulding machine. The melted plastic is then injected into a die that is formed to shape the plastic into the desired design of the toy. After cooling down, the plastic toy is then released from the mould.

Die-casting is a popular method of mass production in metal processing. Molten metal is frequently injected under high pressure into a steel mould cavity, where it solidifies into its final shape. The steel mould is made up of at least two portions that can be separated to release the cast result. In many ways, die-casting is like plastic injection moulding. Due to the steel construction of the injection system and die (mould), the bulk of die-cast items are made of metals with lower melting points, such as zinc, copper, aluminium, magnesium, lead and their alloys.

Going back in time

The creation of die-cast toys began in the early 20th century. The bulk of die-cast toys are constructed of zamak, a zinc alloy with trace quantities of aluminium and copper. When compared to wood, plastic and sheet steel, one appealing characteristic of die-cast toy manufacture is the capacity to make extremely detailed precision models. Die-cast toys are more durable than hollow-structure toys made of steel sheets or plastic, regardless of the level of detail and precision.

Blow moulds are used to produce hollow plastic toys, such as bottles, balls and inflatable toys. In blow moulding, plastic is melted and formed into a hollow tube, which is then inflated inside a mould cavity to take the shape of the mould. The plastic then cools and solidifies, and the toy is ejected from the mould. Blow moulds are typically made of steel or aluminium and are designed with the desired shape and size of the toy.

Rotational moulds, also known as rotomoulds, are used to produce large plastic toys, such as playground equipment, ride-on toys and outdoor furniture. In rotational moulding, the plastic powder is placed inside a mould, which is then heated and rotated in multiple axes to evenly coat the interior of the mould with melted plastic. The plastic then cools and solidifies, and the toy is ejected from the mould. Rotational moulds are typically made of aluminium or steel and are designed with the desired shape and thickness of the toy.

Defining die and mould in toy manufacturing

Here are some key aspects of the role of die and mould in toy manufacturing in India:

- **Toy design and development**
  Die and moulds are used in the design and development stages of toy manufacturing in India. Toy designers and engineers create prototypes and models of toys using specialised die and moulds. These tools help in creating accurate and precise toy parts, ensuring that the final product meets the desired design specifications.

- **Mass production**
  Once the toy design is finalised, die and moulds are used in the mass production stage of toy manufacturing. These tools enable manufacturers to produce toys in large quantities with consistent quality and precision. Die and moulds are used to create various toy components, such as body parts, accessories and small details like eyes, noses and mouths, which are then assembled to create the final toy product.

- **Cost-effective production**
  Die and moulds help toy manufacturers in India achieve cost-effective production. Once the initial investment is made in creating the dies and moulds, they can be used repeatedly to produce a large number of toys. This helps reduce the per-unit production cost and increase overall profitability for toy manufacturers.

- **Customisation and innovation**
  Die and moulds also enable toy manufacturers in India in customising and innovating their toy designs. Customised die and moulds can be created to produce toys with unique shapes, sizes and features, allowing manufacturers to cater to specific customer preferences and market demands. Die and moulds also facilitate innovation in toy design by enabling manufacturers to create new and unique toy concepts.

- **Quality and safety**
  Die and moulds play a crucial role in ensuring the quality and safety of toys. Accurate and precise die and moulds help produce toys with consistent quality and safety features. For example, die and moulds are used to create parts with smooth edges, preventing sharp edges that could potentially harm children. Die and mould production also aid in producing toys that comply with safety regulations and standards set by various national and international agencies.

- **Export and global competitiveness**
  The role of die and moulds in toy manufacturing in India is also crucial for exports and global competitiveness. With high-quality die and moulds, Indian toy manufacturers can produce toys that meet global standards, enabling them to compete in international markets. Die and moulds help Indian toy manufacturers produce toys efficiently and cost-effectively, making them competitive in the global toy market.

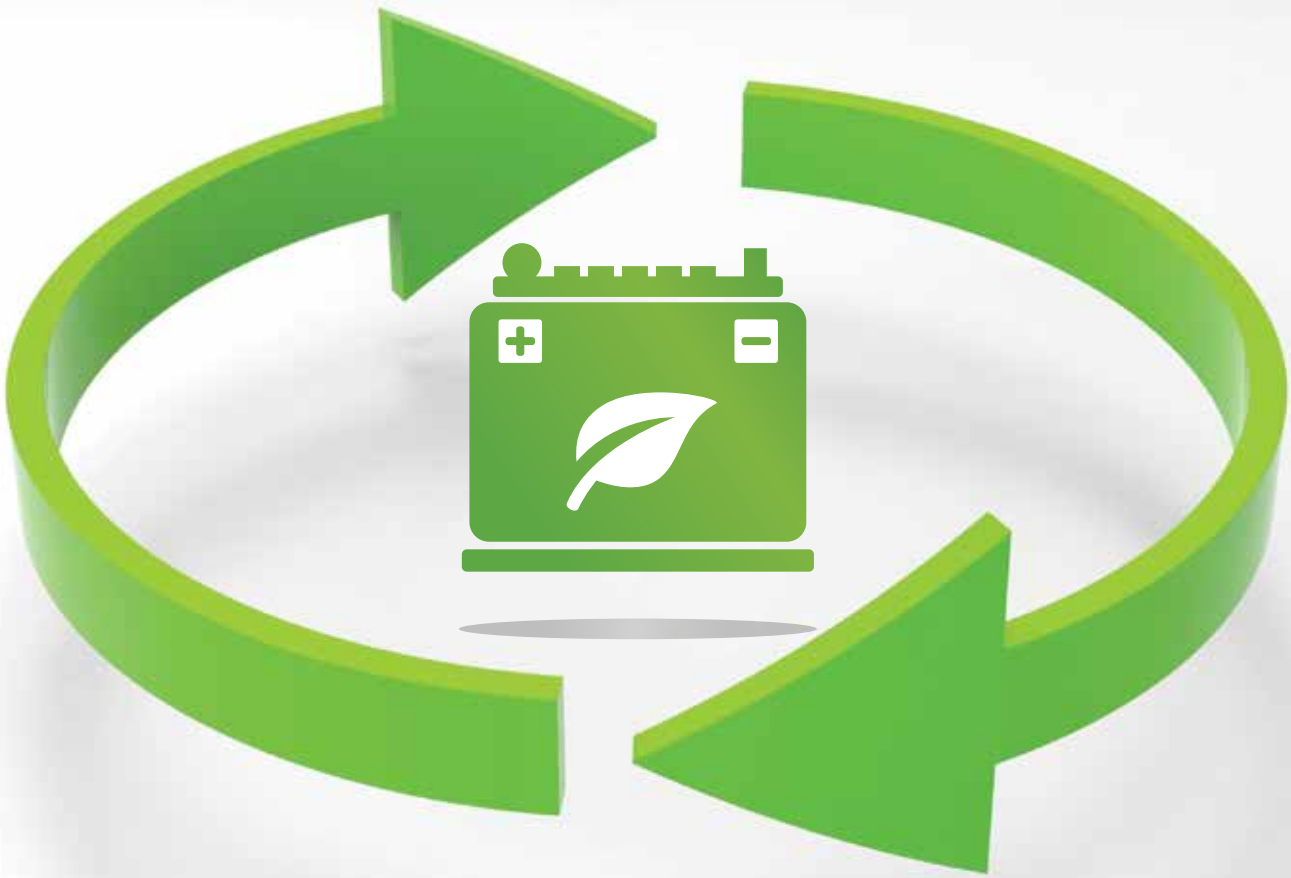
Contributing to the toy manufacturing ecosystem

In conclusion, die and moulds play a vital role in the manufacturing of toys in India. They are used in various stages of toy production, including design, development, mass production, customisation and innovation. Die and moulds enable cost-effective production, ensure quality and safety and help Indian toy manufacturers compete in the global market. The die and mould industry in India is a critical component of the toy manufacturing ecosystem, driving innovation, efficiency and competitiveness in the industry. ☐

Battery swapping solutions bring e-mobile revolution

It has been noted that the global response for e-mobility sales has been tremendous, so much so that more people are opting for EVs than fuel-based vehicles. Here is an insight into preparing India for battery swapping technology, a revolution for e-mobility solutions.

Rohit Vadera,
CEO, Pure EV



The rise in global warming and climate change has become a real threat to our existence on Earth. The effects of carbon emissions on global warming have increased the need for green solutions' adoption. Thus, Electric Vehicles (EVs) are the perfect solution to protect the environment and reduce carbon emissions.

The government of India has launched many endeavours to develop this. However, the limited driving range provided is still a critical challenge that all e-mobility manufacturers are pondering over. Battery swapping technology, a concept where the depleted EV batteries can be replaced with fully charged, runs at the forefront of all available solutions.

Increased efficiency for EVs

Battery swapping technology offers a faster and convenient way to 'refuel' an EV than conventional charging methods. Instead of waiting for hours at charging stations, users can swap their empty batteries for fully charged ones, making it more practical for long-distance travel. It also helps EVs overcome driving range limitations with strategically located swapping stations. Thus, battery swapping is expected to increase e-mobility efficiency exponentially, especially in industries like logistics, where time is a crucial factor

Standardisation and compatibility

Standardisation and interoperability across different EV brands and models is crucial to making battery swapping technology viable. Establishing standard battery pack designs and interface protocols will ensure that multiple vehicles can use the same swapping infrastructure, fostering widespread adoption. It will also reduce the need for specialised charging stations and will make it easier for drivers to swap batteries.

Enhanced battery life

Frequent fast charging of EV batteries can lead to battery degradation in traditional charging methods. Battery swapping, on the contrary, involves using fully charged batteries, potentially reducing the strain on EV batteries and thus extending their lifespan. Swapped batteries are charged slowly with precision, resulting in an increased life span and reduced ownership costs. Battery swapping technology is highly beneficial for fleet owners.

Reduced need for expensive charging stations

Battery swapping technology eliminates the need for expensive, high-capacity charging stations, relying on swapping stations with pre-charged batteries. This approach could reduce infrastructure costs and accelerate the deployment of charging facilities. Moreover, battery swapping stations reduce the grid load, which becomes very high as a vast number of vehicles are charging in a queue. It helps in saving the infrastructural cost of charging stations and saves energy.

Need for sustainable practices

Battery swapping has many benefits, including reduced charging time, cost-effectiveness, saving energy, increased driving and improved battery efficiency. Though battery swapping shows minimal environmental impact, it raises concerns about the recycling options for said batteries. Proper recycling and sustainable battery production practices are essential to mitigate these concerns. Implementing battery-swapping technology requires a well-organised network of swapping stations, regular battery maintenance and battery monitoring to ensure optimal performance and safety. While battery swapping is highly advantageous for EV businesses and consumers, India faces some challenges that we need to overcome sooner. They are:

- **High infrastructural cost:** The most significant challenge is the involvement of high infrastructural costs in building battery swapping stations. The high price involved makes it a difficult business proposition. However, the government's support can help companies invest more in battery swapping

technology. In the budget 2022–2023, the government announced plans to introduce battery swapping policy and interoperability standards. The policy aims to improve the efficiency of the battery-swapping ecosystem to promote the adoption of EVs in India.

- **Need for skilled workforce:** Another critical challenge is technical concerns. Battery swapping requires precise technical skills to swap batteries quickly and without damaging the battery. This requires a skilled workforce with proper training and experience. To overcome this challenge, skill training and practical workshops are needed to train people to perform this technical task correctly and with precision. Many institutes and universities offer internship programmes and hands-on workshops to develop people for the EV ecosystem. Aspirants can join any course according to the area they desire to work in. There are internship programmes where institutes have tied up with reputed EV companies to offer their students hands-on training in different aspects of EV.

- **Interoperability:** One of the most critical challenges among the few mentioned is interoperability. Currently, EV batteries are not standardised; therefore, they are only compatible with some types of vehicles. This makes it inconvenient for EV owners to opt for battery swapping. However, the government of India has laid out a policy for interoperability standards, indicating that standardised production of batteries that are compatible with a wide range of EVs will be manufactured. This effort will help to promote more EV adoption and also will be convenient for EV owners to choose battery swapping instead of simply recharging the batteries.

How the future looks

The future of battery swapping technology is bright despite the hurdles. The efforts by the government of India in promoting battery swapping are all positive signs for EV owners. The efforts of EV companies in generating awareness about the advantages of battery swapping are helping the more open mindset of the consumers. The advent of new technologies like automated battery swapping and standardised designs are being developed to reduce cost and help make it convenient for EV owners. The future of battery-swapping technology is looking better in India. As more consumers adopt EVs, it will further help to develop the EV sector in India.

Battery swapping technology has the potential to scale beyond individual vehicles to other sectors, such as electric bikes, scooters and small electric machinery, further promoting the transition to sustainable electric mobility. It is highly effective for fleet owners and commercial vehicles. The rising rate of EV adoption will raise the charging time of EV batteries and add to the grid load. Battery swapping stations will help reduce the charging time and grid load. The technique will help improve the driving range of EVs and reduce the owner's cost as well. It is an optimal and viable solution which will help increase the adoption of EVs in India. ☐

A reliable, stable solution for automation and production

DFI recently showcased its products, including factory automation, rugged products, motherboards, and systems, at the Automation Expo 2023, held at the Bombay Exhibition Centre, Mumbai, from 23rd to 26th August, 2023.

The company presented four themed areas for the exhibition: factory automation, rugged products, motherboards, and systems. The exhibits included industrial-grade motherboards, embedded system modules, touchscreen tablets, and rugged systems. Among them, the 'SR-IOV virtualisation technology', developed in partnership with Intel, can improve the efficiency of factory transformation. Additionally, the first '3.5-inch high-performance industrial-grade motherboard QRB551', created with Qualcomm to meet industrial automation needs, stood out as a highlight of the exhibition area.

Elaborating on this, Charlie Yang, General Manager, DFI America, mentioned that the SR-IOV virtualisation technology can host four operating systems in one hardware system, saving the hardware for three additional PCs. Yang added, "Our PCs also offer remote management. Thus, the technician doesn't need to go to the actual site. They can conduct remote diagnostics and remotely connect to the factory PC".

According to Yang, the most important advantage that DFI can bring to the market is its quality. Factory automation PCs need more complex solutions. Explaining how DFI is set apart from its competitors, he stated, "In case of issues, you cannot just restart PCs present in a production line, as they would delay the production. Our PCs undergo a strict validation process so that the quality and lifecycle of the PC are up to ten years. Our customers can be very confident in using our PC in their production line".

With the 'Make in India' initiative in place, multiple global companies are set to make their way into the Indian market, and automation-driven giants like DFI stand at the forefront of our digital transformation. Bringing in smart manufacturing solutions, DFI believes that their strong sense of accountability for their customers will help them navigate the Indian market.

DFI | Taiwan

Autonomous robots provide greater efficiency at production sites

OMRON has announced the launch of the MD-650 Autonomous Mobile Robot (AMR), which provides greater efficiency at production sites. With the addition of this medium-payload (650 kg) mobile robot, OMRON has expanded its lineup of autonomous robots to appeal to a wider variety of part and material transport applications.

MD-650 Mobile Robot

OMRON's existing lineup of mobile robots ranges from 60 to 1500 kg, and the MD-650 provides a mid-weight range option (650 kg). Sameer Gandhi, MD, OMRON Automation India, said, "This new addition to our AMR family is to strengthen and enhance the solution for warehousing (pallet transfer to the warehouse), line-side replenishment, as well as aid flexible manufacturing, thus generating value for our customers to make hassle-free and automated material movement. It provides operators relief from manual tasks for transferring material while ensuring the safety of human beings working in the same space. We look forward to collaborating with the right solution partners to co-create and develop advanced industrial solutions based on the human–machine collaborative technology the robot offers".

Product features:

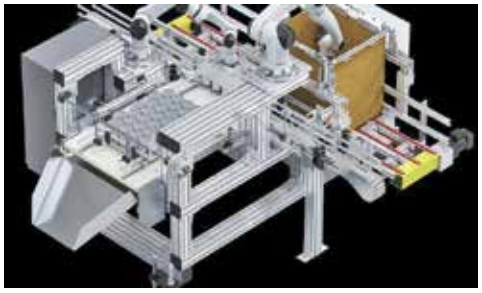
- High speed and safety with top-level transfer speed in the medium payload range and a unique obstacle avoidance algorithm
- Integrated control of all mobile robots using proprietary software technology
- High safety in accordance with international standard ISO3691-4

The unique 'OMRON Fleet Manager' software enables integrated control of up to 100 mobile robots on a single system and automatically selects the optimal mobile robot for each process based on payload and availability. OMRON will continue to expand its existing product lineup to contribute to the creation of safe factory environments and robots to help reduce the burden of material transport processes across various industries.

OMRON Automation | Mumbai

Automation systems for the packaging industry

Proco Machinery has recently announced the launch of a new collaborative robot packer to address the growing labour shortages in the packaging industry. The Proco Collaborative Robot Packer promises a one-year payback to customers. Collaborative Robot Packer is designed to work alongside human operators to increase efficiency and performance. The new robot packer can perform a range of tasks, from testing containers to packing them into cases. The system is modular and on castors, making it easy to use and flexible in operation. With its design, the company believes the system can be easily adapted to different container shapes and sizes, making it an ideal solution for the growing complexity of packaging applications. John McCormick, President, Proco Machinery, said, "This new collaborative robot packer is designed to be flexible, versatile, and easy to use, helping our customers stay competitive in their markets".



New collaborative robot packer

Proco Machinery | Canada

Device bridging the digital divide and providing connectivity to under-connected industries

Rohde & Schwarz and Skylo Technologies recently collaborated to set up a device acceptance scheme for Skylo's Non-Terrestrial Network (NTN). The proven device test framework from Rohde & Schwarz will be used to test NTN chipsets, modules, and devices to validate their compatibility with the Skylo test specification. The NTN device is designed to bridge the digital divide by providing reliable and affordable connectivity to under-connected industries such as agriculture, maritime, and logistics. The network leverages advanced satellite and terrestrial technologies to allow real-time data transmission, thereby transforming industries that have previously been limited by a lack of connectivity. This partnership seeks to enhance NTN's testing capabilities, ensuring seamless integration of NTN NB-IoT protocol in devices with Skylo's network, adhering to 3GPP Release 17 standards. Employing advanced testing methods, they aim to guarantee the highest quality and efficiency for Skylo's connectivity solutions.

Non-Terrestrial Network (NTN)

Skylo Technologies | Bengaluru **Rohde & Schwarz | New Delhi**

Component to increase security for OPC Classic communication

Softing Industrial Automation's dataFEED OPC Suite now has a new component—the dataFEED OPC UA Tunnel. It enables easy and secure access to OPC Classic servers across network boundaries and firewalls. A DCOM configuration is no longer required. The configuration of the two tunnel ends is quick and easy using Export/Import. The security mechanisms of the OPC UA standard, which include authentication of users by means of certificates as well as signing and encryption of data, ensure maximum protection. The suite currently supports up to 50 OPC UA tunnel connections.

OPC UA tunnel increases security for OPC Classic communication

The following are some noteworthy features: Process data storage in Influx DB databases: DataFEED OPC Suite v5.30 stores process data in InfluxDB, a scalable, available, and fast NoSQL database.

All-in-one data integration solution: DataFEED OPC Suite Extended integrates OPC Classic with IoT for Industry 4.0, connecting leading controllers and devices.

Softing Industrial Automation | Germany

Thermal camera for shock and vibrant test ratings

Teledyne FLIR recently presented the latest additions to its thermal camera lineup, the E5 Pro and E6 Pro. These advanced cameras feature a spacious 3.5-inch touchscreen display and seamless integration with FLIR Ignite Cloud while preserving the beloved point-and-shoot, pistol-grip design of the Ex-Series thermal cameras. Designed with professionals in mind, the E5 Pro and E6 Pro are ideal for various applications, including mechanical, building and electrical thermal inspections. The E5 Pro and E6 Pro cameras offer improved 640 x 480 screen resolution, enhance visual detail and feature built-in 5MP digital cameras and LED lamps for low-light conditions. Multi-Spectral Dynamic Imaging (MSX) overlays visible camera details onto thermal images, even in low light. Users can also add on-screen annotations to highlight key findings. These cameras are designed for outdoor and industrial environments, with drop-testing up to two metres, an IP54 rating and 25G-shock and 2G-vibration test ratings.

FLIR E5 Pro and FLIR E6 Pro cameras

Teledyne FLIR | Delhi

Highlights: December–January 2024

» AUTOMOTIVE MANUFACTURING

The automotive manufacturing industry stands at the forefront of automation and digitisation, leveraging cutting-edge technologies to optimise production processes and enhance product quality. From robotics and IoT devices on the factory floor to AI-driven supply chain management, this sector continues to evolve rapidly. In our upcoming issue, we will dive deep into the automotive industry's digital transformation, exploring the latest innovations that are shaping the future of car manufacturing.

» PREDICTIVE MAINTENANCE

Predictive maintenance technology is revolutionising industrial operations by harnessing the power of data analytics to foresee equipment failures and reduce downtime. With the integration of IoT sensors and machine learning algorithms, industries from manufacturing to energy are embracing predictive maintenance as a cost-effective solution. In our upcoming section, we will unravel the intricacies of this technology, showcasing real-world applications and its potential to revolutionise maintenance practices across various sectors.

» SAFETY AND INTEGRATION

Safety and integration technologies play a pivotal role in ensuring the harmonious coexistence of humans and automation in manufacturing environments. From collaborative robots equipped with advanced sensors to sophisticated safety protocols, these technologies are safeguarding workers while optimising productivity. Our forthcoming issue will spotlight the latest advancements in safety and integration, emphasising their significance in creating efficient, secure and adaptive manufacturing ecosystems for the future.

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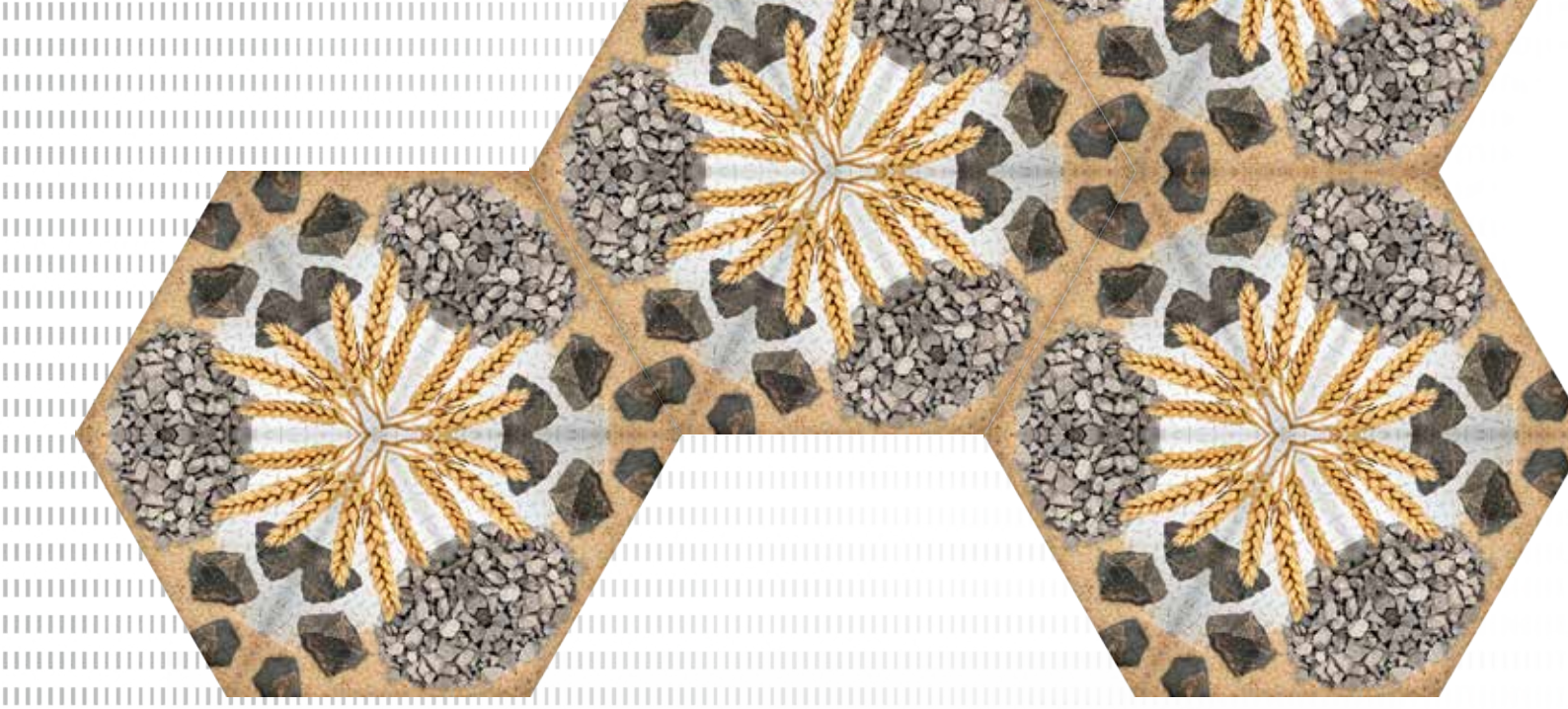

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