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- ▶ Metal Forming..... 20
- ▶ Tool Making..... 30
- ▶ Supply Chain Management..... 34
- ▶ Green Manufacturing 40





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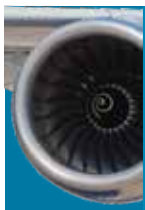
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“Redefining Industry Trajectory”

Neha Basudkar Ghate

Joint Editor, neha.basudkar@pi-india.in

New year, new horizons

As we usher in a new year, the manufacturing landscape is gearing up for a wave of developments and challenges that promise to redefine the industry's trajectory. In the past decade, the Indian automotive sector has been at the forefront of a remarkable evolution, driven by economic shifts, technological advancements and a changing regulatory environment.

The global push to address climate change, stemming from the alarming rise in greenhouse gas emissions, has led to stringent emission norms worldwide. The automotive sector responded with regulations like Euro standards and Bharat Stage standards. Now, the focus has shifted to decarbonisation, with governments and industry collectively working towards cleaner technologies and the adoption of low-carbon and zero-emission vehicles.

Our Cover Story this month explores the potential of Hydrogen Internal Combustion Engines (H2ICE) in achieving green ambitions for the automotive sector. Positioned as a bridging technology, H2ICE offers an immediate and viable powertrain option for medium- and heavy-duty vehicles, supporting cost competitiveness until fuel cell technology is commercialised and fostering hydrogen infrastructure development.

In tandem with the H2ICE spotlight, this edition delves into Metal Forming Technology in our Industry Focus, alongside Technology Focus articles on Supply Chain Management and Tool Making. The Special Feature accentuates Green Manufacturing, emphasizing the industry's commitment to sustainability.

As we navigate the challenges and opportunities of the coming year, the manufacturing sector in India stands at a crossroads, ready to embrace innovation and sustainable practices. Let this edition of our magazine serve as a guide for manufacturers looking to stay ahead in an ever-evolving landscape, where green ambitions and technological advancements converge for a brighter, more sustainable future.



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CONTENTS

MARKET

08 NEWS

10 "Factors such as climate change impacts drive innovation in clean energy"

Interview with Rohit Pandit, Managing Director
and Chairman, Shuzlan Energy

11 "Energy efficiency is at the forefront of every industry"

Interview with Anvar Jay Varadaraj,
Executive Director, Elgi Equipments

MANAGEMENT

12 "Our business is focusing on creating smart, sustainable solutions for customers"

Interview with Nitin Singh, Vice President and Head,
Internal Audit and Corporate Sustainability,
Havells India

COVER STORY

16 Hydrogen ICE fuels green ambitions in automotive sector

The cover story explains why Hydrogen Internal
Combustion Engine is the key zero carbon emission
technology solution for commercial vehicles in India

FOCUS

METAL FORMING

20 Metal Forming 4.0: Embracing digitalisation for enhanced production

Overall scenario presented by Metal Forming 4.0

MARKET

AUTO COMPONENTS MANUFACTURING

24 Practice and preach: How manufacturers can recycle

Importance of recycling in automotive manufacturing

IMTEX PREVIEW

28 IMTEX Forming 2024 to be held at BIEC from January 19 – 23

The upcoming Imtex Forming edition is set to
showcase four dynamic exhibitions: Weldexpo, Moldex
India, Tooltech, and Fastnexus India.

TECHNOLOGY

TOOL MAKING

30 Efficient special tools for timely metalworking

The article discusses ideal tool selection based
on factors like business situation, manufacturing
programme, production type, and personal preferences



34

SUPPLY CHAIN MANAGEMENT

Data-driven logistics:
A boon for the
Indian MSMEs



20

METAL FORMING

Metal Forming 4.0:
Embracing digitalisation
for enhanced production



SUPPLY CHAIN MANAGEMENT

34 Data-driven logistics: A boon for the Indian MSMEs

This feature showcases data-driven decisions transforming MSMEs, fostering economic growth

DATA ANALYTICS

36 Adhering to customer trends with data analytics

Through data analytics, manufacturing businesses adapt products to meet consumer demands efficiently, as outlined in this article

SPECIAL FEATURE

GREEN MANUFACTURING

40 Sustainable manufacturing: A win-win for both business and the environment

Unravel the diverse strategies defining eco-friendly manufacturing in this insightful article

SMART EV MANUFACTURING

44 Smart manufacturing in EVs Challenges and innovations

Here is a look into how smart manufacturing techniques accentuate the utility of EVs

16 COVER STORY

Hydrogen ICE

fuels green ambitions in automotive sector



40

GREEN MANUFACTURING

Sustainable manufacturing:
A win-win for both
business and the
environment



All image courtesy: shutterstock

NEW PRODUCTS

- 46 Smallest and frameless BLDC motor; Heater Controllers for NOx reduction; Push-in technology suitable for the field assembly of connectors; A new add-on for Additive Manufacturing
- 47 Screen printing machines for Autonomous Factory operations; New safety switch with a rotating actuator head; The 3-in-1 solution for fast thread machining; Super-resolution microscopy across all scales and applications

Columns

- 03 Editorial
- 04 Content
- 06 Industry Edge
- 48 Highlights: Next Issue
- 48 Company Index



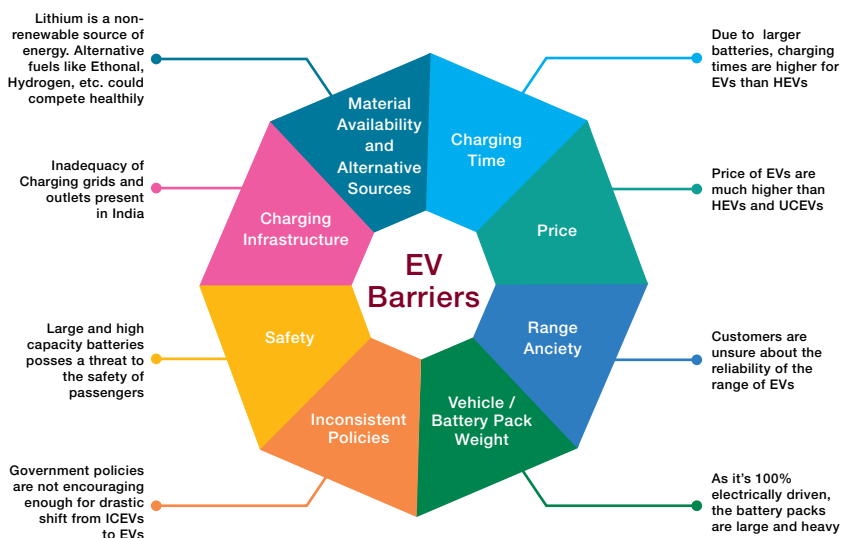
Arun Bhardwaj

Editor, EM and A&D India

Talk

“The complete adoption of EVs is a goal achievable for our country, provided we address the challenges faced on priority”

Challenges for EV adoption in India



While the Indian government has set ambitious targets to use EVs, here are some challenges that we must tackle:

- 1. High upfront cost:** Manufacturing electric cars in India is estimated to be 30% higher than conventional vehicles, primarily due to expensive battery technology.
- 2. Limited charging infrastructure:** As of 2023, India has approximately 5,254 public EV charging stations, with 90% concentrated in major cities like Delhi, Mumbai and Bengaluru.
- 3. Battery range:** Charging an EV using a standard AC charger can take several hours, while fast-charging stations can charge up to 80% of the battery in 30–60 min.
- 4. Limited models:** The lack of variety and choice in EV models in the Indian market disheartens potential buyers who may not find a suitable option within their desired price range.
- 5. Infrastructure investment:** Inadequate power grid infrastructure hinders the deployment of EV charging stations. Public-private partnerships are needed to facilitate the expansion of grid infrastructure in India.
- 6. Battery technology:** India is a significant supplier of battery cell imports from China and South Korea.
- 7. Awareness and education:** In a survey, around 40% of Indian consumers were unaware of EVs. It is essential that the masses are educated and informed, and the country is working towards this gradually.

By addressing these unique challenges and implementing innovative solutions, India can pave the way for a greener and more sustainable way of living.

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Mitsubishi Electric inaugurates new manufacturing plant

Mitsubishi Electric India recently announced the launch of its state-of-the-art smart manufacturing facility for advanced Factory Automation Systems in Talegaon Industrial area in Pune. This manufacturing facility is driven by best industry practices to deliver products with the highest quality and reliability. The overall manufacturing facility measures 40,000 sq. m., initially built up to 15,400 sq. m., backed by a Greenfield Investment of ₹ 2,200. This new manufacturing plant will not only act as a tool for business expansion but will also create

avenues to expand the local manufacturing of its global product range to address ever-evolving customer demands. Enlightening the event, Hisahiro Nishimoto, Group Vice President, Industry and Mobility Area (IMBA), Mitsubishi Electric Corporation, Japan, said, "With this new facility, we are solving social challenges such as decarbonisation and labour shortages, to realise a sustainable society and by providing production sites with energy-saving equipment and solutions that utilise automation technology and to establish Mitsubishi Electric as a Circular Digital Engineering company".

Gogoro launches battery swapping ecosystem in India

Gogoro recently announced the immediate availability of its battery-swapping ecosystem and Smartscooters in India. The company also unveiled its first India-made Smartscooter, the CrossOver GX250. Initially available to B2B customers in Delhi and Goa, the company plans to roll out in Mumbai and Pune in the first half of 2024, with consumer availability in the second quarter of 2024. Horace Luke, Founder and CEO of Gogoro, said, "We are on the cusp of a dramatic change in the global urban transportation landscape, and with its more than 250 million mopeds and motorcycles, India is well positioned to lead the shift to sustainable consumer and B2B transportation. The Gogoro CrossOver series embodies everything our brand has come to stand for, and the new made-in-India CrossOver GX250 is optimised for riders in India with more seating space, greater storage, and better ground clearance". The CrossOver series is built on a redesigned all-terrain frame that enables increased rigidity and comfort while offering a variety of storage, riding and customization capabilities.



BPCL and Tata Electric Mobility collaborate to deploy 7,000 EV charging stations across India

Bharat Petroleum Corporation Limited (BPCL) and Tata Passenger Electric Mobility (TPEM) joined hands to deploy 7,000 EV chargers across the nation. This collaboration taps into BPCL's fuel stations and TPEM's expertise in Tata EVs to drive this initiative forward. With this pivotal agreement, the goal is to revolutionise EV distribution, underscoring a strong commitment to this transformative objective.

Santosh Kumar, Executive Director In-Charge Retail, BPCL, said, "BPCL is set on an endeavour to convert 7,000 conventional retail outlets into energy stations, forming a crucial part of their comprehensive decarbonisation strategy aligned with India's vision for net zero carbon emissions by 2040". Shailesh Chandra, Managing Director, Tata Motors Passenger Vehicles and Tata Passenger Electric Mobility, stated that, "A reliable charging network would catalyse speeding up EV adoption across India. The collaboration between BPCL and TPEM aligns with their shared vision to foster positive change and create an enabling infrastructure for the expanding EV customer base".

Tata International partners with Lagos Free Zone to expand operations in Nigeria

Tata International is set to expand operations in Nigeria through a strategic partnership with the Lagos Free Zone (LFZ). The agreement with LFZ involves the leasing of a state-of-the-art 6000-square-metre facility within LFZ, a move aimed at enhancing Tata International's operational capabilities in the region. Anand Sen, MD, Tata International, said, "This strategic move reflects our commitment to fueling growth in Nigeria and the wider African continent". Dinesh Rathi, CEO and Managing Director at Lagos Free Zone, said, "LFZ is the first and only free zone in Nigeria that is uniquely integrated with the deepest seaport in the region, the Lekki Port, which commenced operations in April 2023. LFZ thus offers a unique location that will provide our valued tenants with seamless and cost-efficient access to domestic, regional, and international markets".



Intel announces collaboration with local manufacturers to make laptops

Intel, has unveiled a strategic partnership with eight prominent Electronics Manufacturing Services (EMS) companies and Original Design Manufacturers (ODMs) to expedite laptop production in India. Leveraging its comprehensive expertise in the IT industry ecosystem, Intel has shared crucial technological insights and operational guidance, aiming to lay a robust foundation for the local laptop manufacturing sector. This initiative underscores Intel's commitment to advancing technology-driven growth, aligning seamlessly with the 'Make in India' initiative. The collaborative effort has brought together Intel and a distinguished roster of Indian manufacturing companies, including Bhagwati Products, Dixon Technologies India, Kaynes Technology India, Optiemus Electronics, Panache Digilife, Smile Electronics, Syrma SGS Technology, and VVDN Technologies. Rajeev Chandrasekhar, Union Minister of State for Electronics and IT, Skill Development, and Entrepreneurship, emphasised the alignment of this endeavour with Prime Minister Narendra Modi's vision to catapult India's Digital Economy to \$1 trillion and to empower the electronics manufacturing sector to contribute \$300 billion by 2025-26.



SAIC Motor and JSW Group establish a strategic partnership to drive growth in Green Mobility



SAIC Motor and JSW Group are teaming up in a big way to change how cars are made and used in India. They want to work together to use their skills and money to make better car technology. They plan to team up and improve things like getting parts locally, making more places to charge electric cars, making more cars, and bringing in more eco-friendly vehicles. SAIC, known for its cutting-edge technology, is committed to supporting the partnership by providing cutting-edge products and technology to deliver innovative mobility solutions tailored to the Indian market. JSW will hold a substantial 35% stake in the joint venture operations in India under the terms of the agreement. Wang

Xiaoqi, President, SAIC Motor, emphasised, "The automotive industry thrives on collaboration and access. SAIC's commitment to 'win-win cooperation' remains steadfast as we join forces to innovate, create greener mobility solutions, and expand our brand influence in India".

EKA Mobility joins forces with Mitsui and VDL Groep to create a leading global OEM in India

EKA Mobility, has entered into a strategic long-term partnership with Mitsui & Co. (Japan) and VDL Groep (Netherlands), marking a significant milestone in the evolution of the Indian automotive industry and propelling India towards becoming a global hub for sustainable transportation. The alliance will establish cutting-edge global Original Equipment Manufacturers (OEMs) in the region. This venture involves shared investments, equity participation, and technological collaboration. Through phased joint investments exceeding \$100 million (~ ₹ 850 crores), this cooperation aims to establish India as the worldwide manufacturing and sourcing hub for electric vehicles. Dr Sudhir Mehta, Founder and Chairman, EKA Mobility, expressed his views, stating, "This partnership with Mitsui and VDL Groep represents a significant step towards making India a global hub for electric vehicle manufacturing".



Škoda Auto expands strategic collaboration in Kazakhstan

Škoda Auto is steadily expanding its previously announced partnership with Allur in Kazakhstan. Beyond sales and production, the companies agree to enhance technical training in Kazakhstan as part of the Memorandum of Understanding (MoU). The commitments include assembling vehicles from Semi Knocked Down (SKD) kits as well as exploring the feasibility of local production from Completely Knocked Down (CKD) kits, potentially starting after 2025. During his visit, Jahn also met with Roman Sklyar, Deputy Prime Minister, Kazakhstan, to discuss strategic plans and the automotive industry in both countries. Klaus Zellmer, Škoda Auto, CEO, said, "Internationalisation is crucial for Škoda Auto, and re-entering the Kazakh market aligns well with our plan, including launching our brand in Vietnam. I am pleased with the rapid progress of our cooperation with our new manufacturing and sales partner in Kazakhstan, Allur. Following the announcement of our cooperation in October, we have now signed additional vital agreements, paving the way for assembling Škoda vehicles in Kazakhstan next year and establishing the framework for our future collaboration".





“Factors such as climate change impacts drive innovation in clean energy”

...says **Rohit Pandit**, Managing Director and Chairman, Shuzlan Energy. In an interview with **Sanjay Jadhav**, he delves into the conceptualising cutting-edge solutions to catalyse EV adoption by incorporating sustainable charging infrastructure. Excerpts...

What drove the conception of Shuzlan Energy?

Shuzlan Energy's conception was likely influenced by various factors, including the urgency of addressing climate change as stipulated in the Paris Agreement. The agreement underscores the global commitment to limit global warming to well below 2 degrees celsius compared to pre-industrial levels significantly driving innovation in clean energy. Shuzlan Energy might have emerged with a vision to align with the global effort of reducing carbon emissions and fostering sustainable transportation solutions through accessible and efficient Electric Vehicle (EV) charging infrastructure.

Could you expand on the solutions aiding EV adoption in the country, particularly the Charging Station Management software?

We provide cutting-edge solutions to catalyse EV adoption. Our Charging Management software is a testament to our commitment. With our software, we empower operators by enabling real-time monitoring of charging stations, facilitating seamless billing management and allowing remote access for unparalleled control. Integration with diverse payment systems enhances accessibility, making EV charging not just efficient but also user-friendly.

What are the key technological features and solutions that set you apart in the industry?

Our smart charging algorithms play a pivotal role in optimising energy usage and ensuring efficient and sustainable operations. Scalability is a cornerstone of our approach, allowing us to seamlessly accommodate the ever-growing demand for charging stations. We prioritise compatibility with various EV models, providing a versatile charging solution. Our commitment to security is evident through robust measures, safeguarding data and ensuring user trust. Furthermore, we prioritise user experience with intuitive interfaces, making the charging process seamless for both operators and EV owners.

In the long run, what goals is the company working towards in the e-mobility sector?

Embracing sustainable practices by integrating renewable energy sources into the charging infrastructure. The company might focus on incorporating solar or wind power into some or all of its charging stations to reduce its carbon footprint and promote eco-friendly charging. This could involve collaborations with EV manufacturers, energy companies or municipal corporations to expand infrastructure and drive EV adoption through joint initiatives. As a Charge Point Operator, Shuzlan Energy likely aims to be at the forefront of providing a comprehensive, reliable and sustainable charging infrastructure. Our long-term vision is centred around contributing significantly to the growth and adoption of EVs by creating an ecosystem that supports the evolving needs of EV users and aligns with the broader goals of a greener transportation landscape.



“Energy efficiency is at the forefront of every industry”

... says **Anvar Jay Varadaraj**, Executive Director, Elgi Equipments. In an interview with **Neha Basudkar Ghate**, he stresses on the increase in demand for compressors that consume less energy. Excerpts from the interview...

When it comes to the current Indian market, what have been the major market drivers for manufacturing air compressors?

The demand for our products tends to follow the manufacturing trends in the market. With a lot of infrastructure development and expansion, our portable air compressor range is witnessing a lot of demand in the country. Being in the compressed air business offers the advantage of accessing diverse markets and segments, as every industry requires an air compressors. On the other hand, energy efficiency is at the forefront of every industry. Hence, there has been an increase in demand for compressors that consume less energy. ELGi prioritizes fuel efficiency in diesel compressors and less electricity consumption in electric compressors. Our R&D team continuously enhances our product's energy efficiency, thereby reducing energy expenses for our customers.

What strategies is ELGi implementing to cater to the increasing demand in the Indian Air Compressor Market?

We are very bullish about the Indian market. However, being a dominant player with a double-digit market share, the ability to grow further becomes challenging compared to the US or Europe, where we have a smaller market share and could grow faster. In India, we look forward to increasing our presence in industrial segments where we are going deep to understand the opportunities better and then either introduce our products based on the needs or develop new products and offer them to the industry.

How has the integration of IoT technology influenced the growth of compressors in various industries?

IoT doesn't increase demand for our products. The data our devices procure is more important for us as manufacturers to track their running efficiency. We generate a lot of data as we run many machines and assembly lines. We capture data and analyze to predict defects, improve productivity, and quality of the machines. On the product quality side, IoT also provides data on how to improve preventative maintenance. Our goal is to offer a standard package to customers without additional charges.

Could you tell us about the sustainable part of ELGi's product portfolio?

Sustainability is central to our business. Our Environmental E objectives focus on moving towards resource-neutral operations and leading a technology-driven transformation via product stewardship. ELGi's environment-friendly, oil-free, and electric compressors are creating new standards as they deliver industry-leading performance backed by reduced energy consumption and maintenance costs. They also support our customers' efforts to achieve their carbon emission reduction goals. **To accomplish this, we are committed to:** Improving customer experience by manufacturing products that deliver best-in-class efficiency – making existing products 5% more energy efficient by 2030. Additionally Reduce climate impact through lower GWP refrigerant options - attain 80% of product range availability of HFO-based dryers by 2030.

“Our business is focusing on creating smart, sustainable **solutions for customers**”

...says **Nitin Singh**, Vice President and Head, Internal Audit and Corporate Sustainability, Havells India. In an interview with **Neha Basudkar Ghatge**, he discusses Havells India's unique approach to sustainability and innovation, emphasising the company's commitment to integrating sustainability into operations and the global need for collective environmental action...



What are the key factors that differentiate Havells in the competitive electrical and power distribution equipment manufacturing industry?

» ESG issues are increasingly vital for companies, and sustainability has long been a priority. Integrating sustainability into business strategies is crucial for long-term success. Havells was a pioneer, publishing its first sustainability report in 2012–2013. Over the years, we've integrated sustainability into manufacturing practices, reflected in processes such as water and energy-efficient machines, automated labour and reduced paper usage.



How do you see the role of technology and innovation changing over the years, when it comes to growth strategies? How does Havells ensure a balance between innovation and staying true to its core business strategy?

» Our focus on innovation is centred on enhancing capabilities to create smart and sustainable solutions for evolving customer needs. With a dedicated CRI centre and over 600 skilled individuals, we continually innovate and develop sustainable products. Our substantial

investments in research and development underscore our commitment to delivering best-in-class products. This commitment extends to our environmental considerations in both products and infrastructure. For instance, our recently established plant in Alwar and the air conditioner plant in Ghiloth have achieved gold-rated green building certification.

Q What are the current manufacturing challenges that you tackle? How have they impacted the company's products or their relationship with the consumers or other businesses?

»» Havells employs an ongoing process of improvement through cross-functional teams. These teams, such as cost-saving and productivity improvement teams, operate across plants and the head office, fostering brainstorming for advancements. We have embraced new technologies like MES at our gallop plant, emphasising minimal manual interfaces for automated processes. The management philosophy focuses on reducing manpower through technology and automation. Each cross-functional team has specific targets for productivity and cost savings.

Over the years, automation has significantly reduced product lead times, ensuring constant market availability. Emphasising our dealer and distributor network, we've implemented technology solutions, enabling an automated ordering interface. This streamlined process, from order placement to billing, minimises instances where customers cannot meet expectations in terms of quality, quantity or stock levels. Our integrated processes closely align with customer expectations.

Q Are there any long-term goals that the company is focusing on right now or has them in their pipeline regarding the same?

»» According to the recent market structure and awareness with the heightened environmental awareness, consumers are making environmentally conscious choices. We believe in creating a win-win situation for society across the entire value chain by promoting ESG and efficient manufacturing practices. In our recent annual report, we outlined targets in three categories: short-term, medium-term and long-term. These targets are integral to cultivating a culture within Havells. Further, they are broken down into smaller groups or CFTs. By 2030, we aim to achieve two times water positivity, and all our plants will operate at complete permissible solar capacity limits by 2025–26. This approach integrates efficiency, cost and sustainability perspectives.

Q How do you think the company has been integrating sustainability actions into its day-to-day functioning?

»» Companies face a dilemma when considering ESG practices. While there is a need for efficient and sustainable manufacturing, investors may not immediately pay a premium for it. Implementing such practices, like installing solar panels, incurs short-term costs. Communicating a cost-benefit analysis to investors is crucial, emphasising long-term gains and efficiencies. Striking this balance is key for companies in determining their future course of action.

At Havells, our sustainability structure has been in place for nearly a decade. Each plant has a sustainability divisional and at the organisational level, we are integrating our risk management structure with the ESG framework, setting targets for each function aligned with our ESG 2.0 framework aiming to guide our actions in this decade. We have extended awareness efforts to our suppliers, assigning ESG scores to drive improvement and align actions with our values throughout the value chain. In the next five to ten years, significant changes in manufacturing, driven by concepts like lean manufacturing and automation, are expected. Adapting to newer manufacturing methods is a crucial challenge that all companies must address.

Q Is there anything else you'd like to add regarding your experience so far with Havells and with the industry?

»» Companies, regardless of industry, must consider the impending scarcity of resources, such as water. Industries like aluminium and steel, highly dependent on natural resources, must incorporate this concern into their processes. The current water crisis in South Africa highlights the urgency. Procurement decisions and processes must undergo a comprehensive overhaul, identifying alternative materials for better climate and sustainability management.

Every decade brings new concepts, and my perspective is that while progress has been made in addressing environmental issues, much more work is needed. The Paris Agreement, focusing on limiting temperature increase to well below 2° C, is crucial. Global warming is occurring at an alarming and unprecedented rate. It is not just about individual companies like Havells taking action; it requires a collective effort from all companies and humanity. Without a united front, our resources, currently seen as a luxury, may be lost. It is a critical battle we must fight together. □



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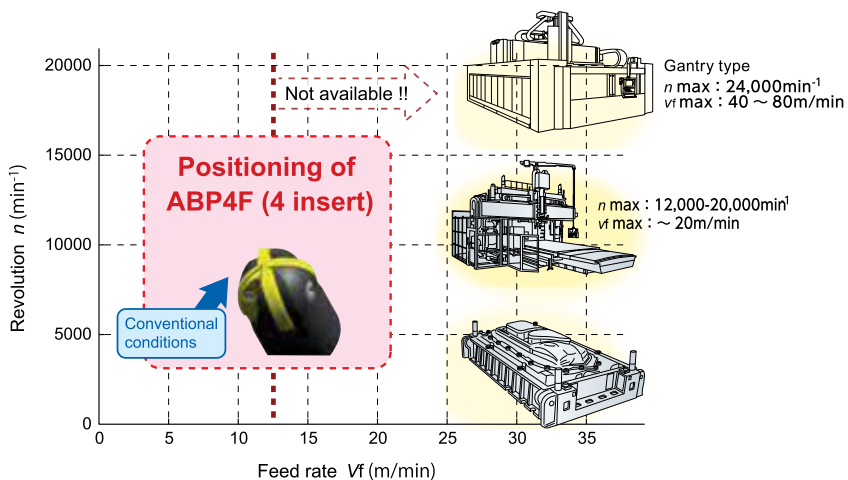
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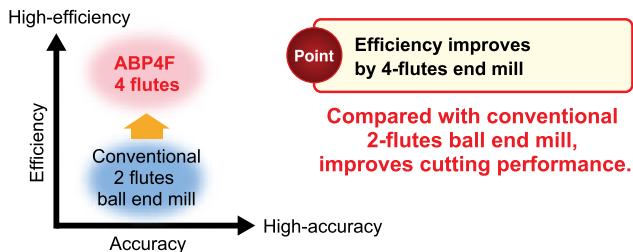
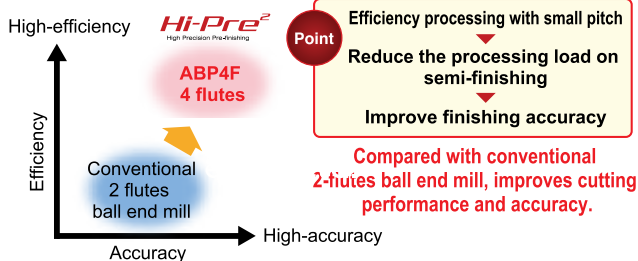


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YOUR GLOBAL CRAFTSMAN STUDIO

Hydrogen ICE

fuels green ambitions in
automotive sector



Navigating a zero-carbon future involves overcoming challenges in infrastructure, technology, and economics. The cover story advocates the Hydrogen Internal Combustion Engine as a pivotal zero-emission solution for Indian Commercial Vehicles (CV), fostering a greener tomorrow.



Nitin Jirafe,

Engine Business Leader,
Cummins India

Over the past decade, the Indian automotive industry has undergone a remarkable evolution, shaped by dynamic economic, technological and regulatory forces. The period witnessed a shift from traditional internal combustion engines to a burgeoning interest in electric and low carbon fuel technologies, driven by environmental concerns and advancements in technology.

Furthermore, the regulatory push on stringent vehicle emission norms from the Government of India not only compelled manufacturers to adopt cleaner technologies but also spurred innovations in fuel efficiency and emission control. In a nutshell, the evolution of the Indian automotive industry in the last decade has been characterised by a transition towards cleaner and smarter mobility solutions, reflecting a global trend towards sustainability and technological innovation.

Climate change is the existential crisis of our times

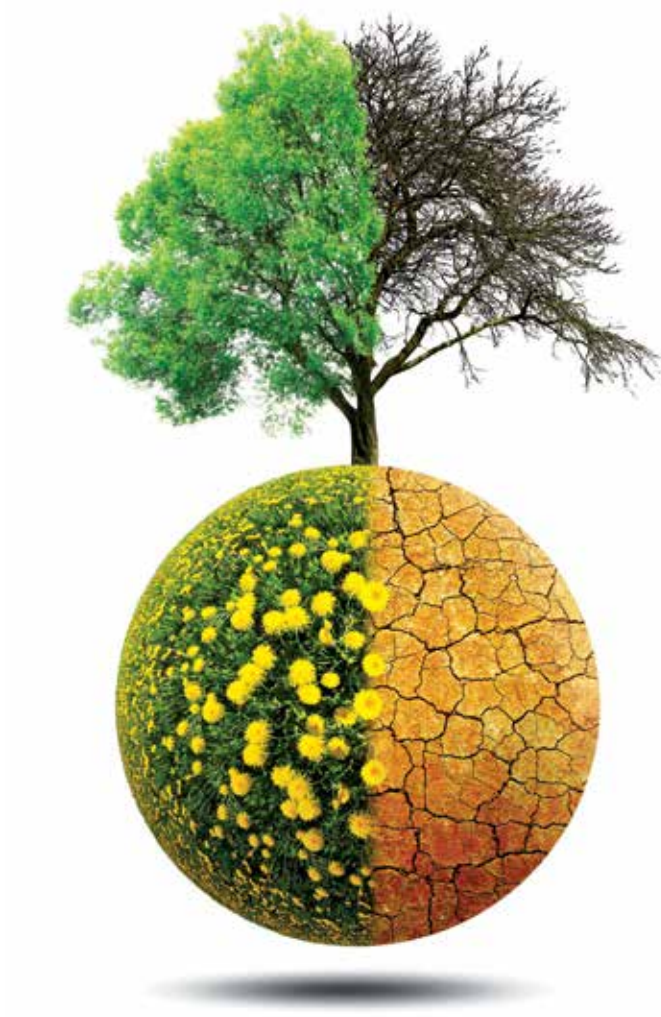
Climate change has emerged as a pivotal force driving the implementation of stringent emission norms worldwide. The alarming rise in greenhouse gas emissions, primarily from the combustion of fossil fuels, has intensified the need for proactive measures. Governments globally recognise the automotive sector's significant contribution to emissions, prompting the establishment of stringent regulations to curb pollutants like NOx, PM, and others. Emission norms, such as Euro standards and Bharat Stage standards, have been pivotal tools in managing these pollutants so far.

However, over the last few years with the focus on climate change and GHG emissions, governments and Industry participants are now focusing on decarbonisation. Governments and Industry are now working towards cleaner technologies and fostering the development and adoption of low carbon and zero emission vehicle technologies, thus steering the automotive industry toward a more sustainable future.

CV industry's contribution to climate change

Needless to say, climate change has had profound effects on India, which is ranked among the top ten countries in the world most affected by climate change. The four major sectors that are the major contributors to the carbon footprint of the country and need to heavily focus on decarbonization are energy (electricity), mobility and transportation, steel, cement and infrastructure industry.

Transport sector is backbone for growth of any economy and with the same accounting for nearly 14% of total Greenhouse gas emissions it provides an opportunity to



the road transport sector in participating and contributing towards the decarbonisation journey.

The need for decarbonisation and the pursuit of alternate fuels and technologies

The automotive industry has been working for decades to reduce the harmful pollutants including carbon footprint. There have been significant technological advancements in base Internal combustion engines as well as after-treatment technologies. The Oxides of Nitrogen (NOx) and Particulate Matter (PM) emissions have gone down by a staggering 90% for current BS6 vehicles launched in year 2020 as compared to BS3 vehicles allowed to sell till year 2017.

Apart from conventional fuels, many alternate fuels are either already being used or planned for future (like CNG, LNG, Ethanol Flex Fuel, Biofuels, Hydrogen etc.) apart from zero emission technologies of BEV and FCEV using electricity from grid and hydrogen.

For these zero emission technologies, it's important to ensure zero carbon emissions for entire well to wheel. This means that government needs to focus on decarbonisation of the electricity grid with renewable energy for supplying electricity to BEVs and encourage production of green hydrogen.

There is no single silver bullet

Cummins believes that transitioning to a zero-carbon future is not a light-switch event, given the challenges on infrastructure, technology maturity and unit economics. With over a century of experience as a global power leader and a six-decade presence in India, we understand, better than anyone else that to address the varied duty cycles, applications, and operating environments, there will not be single solution to reach zero emissions. Therefore, progressing and integrating various technologies today will contribute towards a greener future tomorrow.



Destination Zero™ is Cummins' strategy to go further and faster to reduce its products' Greenhouse Gas (GHG) and air quality impacts and reach net-zero emissions by 2050. The group is pursuing a dual-path approach – acting today to reduce emissions from internal combustion engines while simultaneously investing in new, zero-emissions products. This strategy is part of the framework of Cummins' broader PLANET 2050 environmental sustainability strategy, which also includes a focus on improving the communities the company operates in and using natural resources in the most responsible way.

Multiple paths to decarbonisation

We understand that when it comes to lowering GHG, it's not a matter of which technology is better — but rather which technology is more suitable to a specific set of application and needs. We have to consider range, weight, downtime, performance requirements, customer economics, and related infrastructure to provide the best options for the market. Therefore, we as Cummins are working to develop and improve multiple technologies for myriad applications.

Our multiple paths to decarbonization include:

- Switch to the latest generation Diesel technology- Advanced Diesel (Diesel / Bio-Diesel)
- Immediate shift to Low – Carbon Technology - Natural Gas Internal Combustion Engine (CNG / LNG / Bio-CNG)
- Move to Zero carbon fuel (Innovation in Internal Combustion Engine (ICE) technology - Hydrogen Internal Combustion Engine
- Leap forward to Zero Emission Vehicles – Fuel Cell and Battery Electric and Electrifyer

Achieving zero carbon emission with Hydrogen Internal Combustion Engine

In road transportation sector, while Battery Electric Vehicles (BEVs) and hydrogen fuel cell vehicles are known to be zero emission technology vehicles, there is an emergence of Hydrogen Internal Combustion Engines (H2 ICE) as a viable, near zero carbon emission technology solution for commercial vehicles in India.

At scale, it can help the sector rapidly decarbonise. In fact, vehicles powered by green hydrogen, which is hydrogen produced by using renewable energy have near zero well-to-wheel greenhouse gas emissions.

Battery Electric Vehicle (BEV) is increasingly finding its acceptance in the passenger cars, two / three wheelers, Small commercial vehicles, and City Bus applications in India. However, they are yet to be proven commercially viable for the Medium and Heavy-duty truck/tipper applications, due to reasons like penalty on payload, charging time required, total cost of ownership etc.

Bridging technology for India's commercial vehicle sector

Fuel cell (FCEV) uses hydrogen to produce onboard electricity to power the vehicles. Fuel cell powered bus

deployment has started in India, though in limited numbers. While electrification (BEVs) and fuel cell (FCEV) technologies continue to mature and become affordable, Hydrogen internal combustion engine, built on the fuel agnostic platform is the promising bridging technology for India's commercial vehicle sector. The fuel-agnostic architecture utilises a common base engine with cylinder heads and fuel systems specifically tailored to fuel ranging from diesel, natural gas, renewable natural gas, and hydrogen. The platform offers OEMs common engine architecture across multiple fuel types resulting to a high degree of parts commonality.

The key advantages of H2 ICE are as follows:

- Existing engine hardware can be modified to adapt H2 fuel / combustion system
- Existing vehicle drive lines can be used
- Availability of eco system (existing manufacturing set-up, vendor base, dealer & service network)
- Diesel like performance across power, torque and thermal efficiency
- Cost efficient and Total cost of ownership (TCO) comparable to existing Diesel / CNG variants
- Can use low purity hydrogen
- Quick refilling time compared to Battery charging for BEV's

Towards a better today and a greener tomorrow

If majority of our trucks switch to H2 ICE, it will automatically spur the establishment of a hydrogen infrastructure ecosystem. The infrastructure would include fuel transportation network, fueling stations, and repair shops – very similar to the support system that exists for diesel truck today. To a large extent, development of H2 ICE will also support the development of Fuel cell (and vice versa) as both technologies have many things in common. For example, hydrogen infrastructure (fuel production, transportation & dispensation) and vehicle level hydrogen storage systems are common between these two technologies. Development of the hydrogen ecosystem will need government and policy support. Given the support, hydrogen internal combustion engines will drive decarbonization at a faster rate and will be a key enabler to achieve India's objective of Net Zero GHG by year 2070.

Cummins' mission is to make people's lives better by powering a more prosperous world. A prosperous world requires, necessitates... demands a healthier planet. And that's why Cummins is focused on investing in innovation for a better today and a greener tomorrow and is well poised to power a cleaner and greener India. □

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Metal Forming 4.0:

Embracing digitalisation for enhanced production

This article delves into the challenges and opportunities presented by Metal Forming 4.0, showcasing how embracing Industry 4.0 systems can lead companies into a new era of digital manufacturing excellence.



Yuvraj Shidhaye,
Director, TreadBinary



The metal forming industry is undergoing a digital transformation. With the rise of Industry 4.0, manufacturers are leveraging new technologies to optimise production, reduce costs and create higher-quality products. One area that is seeing particular innovation is metal cutting—the process of shaping metal parts using various machining tools. By embracing digitalisation, metal fabricators can achieve enhanced performance in metal cutting and other forming processes.

Metal cutting optimisation through digital tools

Metal cutting involves techniques like milling, drilling and turning machine parts to the required specifications. It is an essential step in manufacturing final metal components. However, traditional metal cutting has limitations in efficiency and accuracy. With tight tolerances and demand for zero-defect parts, manual machining and older equipment often lead to suboptimal results.

This is where digital technology comes in. Modern Computer-Aided Manufacturing (CAM) software can help automate and optimise cutting. CAM programs allow fabricators to input part designs and have the software determine the fastest, most efficient tool paths for machining.

This prevents over-cutting and minimises cycle times.

CAM software is often paired with Computer-Numerical Control (CNC) machines. CNC technology uses coded instructions from CAM to guide cutting tools. The integration of CAM and CNC machine tools enables precise, automated execution of even the most complex machining tasks. According to Markforged, a leading 3D printer OEM, using CAM software to program CNC machines can improve metal-cutting productivity by up to 50%.

Other software solutions like industrial IoT platforms can collect real-time data from sensors on cutting equipment. This data provides valuable insights into tool wear, cycle time variances and other metrics for continual optimisation. Machine learning algorithms can even analyse data patterns to predict potential failures before they happen.

Together, these digital tools are driving the next generation of smart, connected metal cutting. Companies that leverage them can achieve machining accuracy within microns while maximising uptime.

Rapid growth in India's machine tools market

The demand for advanced machine tools like CNC technology is rapidly rising in India's manufacturing sector. The India machine tools market size is projected to grow by

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\$2.45 billion between 2022–2027, accelerating at a CAGR of 11.31%. A key driver is growing demand from automakers. India's automotive industry is the biggest consumer of machine tools for machining engine components in internal combustion engine vehicles. The continued reliance on ICE technology, as well as growth in hybrid electric cars which also require machined parts, will fuel machine tool consumption. This creates major incentives for Indian manufacturers to integrate the latest digital production innovations like CAM programming and data-driven analytics to maximise their machining productivity.



Digitalisation for efficiency gains in forming

The benefits of digital technology extend beyond cutting to other metal forming techniques. Forming covers processes like forging, stamping and casting that deform or melt metal into finished products. As with cutting, digitalisation enables major efficiency improvements in forming.

For casting, 3D printing technology allows quick iteration of sand moulds and cores without tooling costs. With 3D-printed moulds, foundries can evaluate more design options digitally before casting final products. Rapid prototyping reduces lead time and scrap.

Across forming techniques, automation and robotics are also key digital trends. Robotic arms increase repeatability for safer, higher-volume production. The worldwide industrial robot market, valued at approximately £32.5 billion in 2021, is anticipated to experience a yearly growth rate of about 10%, reaching £52 billion by 2028, indicating the industry is rapidly automating.

The future of digital metal production

Additive Manufacturing (AM) represents perhaps the most revolutionary digital technology for metal forming. AM, also known as 3D printing, builds up parts layer-by-layer rather than machining away material. Complex geometries were impossible through conventional fabrication are now feasible with 3D printing.

The accessibility of AM technology is making digital manufacturing a reality for more companies. Combined with advanced simulation, automation and data analytics, AM completes the digital thread of Industry 4.0 metalworking. Adopters of Metal Forming 4.0 will be able to design, prototype, optimise and produce advanced metal components all through integrated digital systems. Embracing digital is no longer optional, metal forming business should leverage Industry 4.0 systems which shall gain a competitive advantage in capabilities and efficiency to lead into a new era of digital manufacturing excellence.

Overcoming challenges to adoption

Transitioning to Metal Forming 4.0 inevitably involves challenges. Many shop floors still rely on legacy equipment and manual processes. Companies may be hesitant to invest in new advanced technology or lack the expertise to implement it. To overcome these barriers, businesses should take an incremental approach to digitalisation. Key steps like integrating sensors or basic data analytics into existing infrastructure can generate quick returns on investment. This builds internal support for further adoption. Partnerships with digital technology vendors also enable practical digital transformation.

Workforce training is another critical component. Employees will need upskilling to work alongside new automation and digital tools. Lastly, cybersecurity requires focus when adding connectivity to production networks. Proper network segmentation, access controls and other measures are vital to avoid disruptive cyber incidents.

Conclusion

From advanced cutting tools to automated stamping lines and 3D metal printing, digital innovation is revolutionising metal fabrication. By embracing Industry 4.0 systems, metal producers can optimise processes, reduce waste and improve agility. Despite adoption barriers, practical digitalisation strategies focused on delivering real value will pave the way to Metal Forming 4.0. Companies that leverage the latest production software, data analytics and smart equipment will lead the next era of manufacturing excellence. □

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Practice and preach:

How manufacturers can recycle?



Modern production can hardly be imagined without automobile manufacturing as a key element that generates technological development and economic increase across industries. An important part of this industry is automotive component manufacturing, which provides parts used in producing commercial vehicles. This article delves into the importance of recycling practices in the automotive component manufacturing sector, and how you can go about it.



R G Arora,
MD, Mobility Solutions,
A JCBL Group Company

The automotive industry is increasingly put under pressure given the global challenge of environmental problems. In this regard, the issue concerning recycling while manufacturing automotive components cannot be underestimated. Beyond meeting regulatory standards, the adoption of recycling in this sector is an opportunity to reduce the industry's ecological footprint, promote resource efficiency and pave the way for a more environmentally sustainable future.

Environmental impact

New automobile component manufacturing poses significant environmental harm, marked by substantial energy consumption and a lack of conscientiousness in raw material extraction. The industry heavily relies on vast quantities of materials, including steel, aluminium and rare elements for batteries. These materials are not only in short supply but are also challenging to extract sustainably.

Additionally, end-of-life disposal is critical, with current efforts focused on environmentally conscious recycling. Despite efforts, chemicals, including heavy metals, persist in auto part production, emphasising the need for better regulation and sustainable practices across the global automotive supply chain.

Benefits of recycling

Recycling vehicles minimises waste by reusing metals, plastics and fluids, reducing the need for new raw materials and cutting energy consumption. This conservation lessens reliance on resources like gasoline and iron ore, lowering greenhouse gas emissions. Proper recycling ensures safe disposal of hazardous components, protecting the environment. Dismantling end-of-life vehicles to recover materials, such as metals and plastics, is crucial, allowing purified materials to be re-integrated into new automobile production.

Challenges and solutions in recycling

- **Common challenges:** The disassembly of automotive components poses a challenge due to their intricate combinations of metals, plastics and composites, making the process labour-intensive. Moreover, the automotive industry's high-quality standards for safety and performance present a challenge when incorporating recycled materials. Innovative solutions must refine recycling processes to consistently meet or exceed industry standards.
- **Innovative solutions to overcome recycling challenges:** The integration of artificial intelligence-based systems and robotic sorting is pivotal for efficient recycling, enhancing the quality of materials suitable for automotive components. Concurrently, researchers prioritise sustainable design practices that emphasise recyclability, facilitating easy disassemble.
- **Industry-wide collaborations for effective solutions:** Collaborative efforts among trade associations, research institutions and governmental bodies are essential for knowledge exchange and standardised recycling practices. These partnerships facilitate collective problem-solving. Similarly, joint ventures between automotive manufacturers and recyclers establish closed-loop systems, ensuring efficient collection, processing and re-integration of end-of-life components. Such collaborations enhance the sustainability of the entire production cycle.

Emerging trends in recycling of automobile components

In the dynamic landscape of automotive component manufacturing, innovative recycling technologies are reshaping practices to align with sustainability goals. These

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trends respond to the challenges posed by the complex materials used in automotive components and aim to create a more environmentally friendly and resource-efficient manufacturing process.

- **Advanced sorting and separation techniques:**

In response to the intricate composition of automotive components, the industry is witnessing a transformative shift toward advanced sorting and separation techniques. Leveraging artificial intelligence and robotics, these technologies streamline the recycling process by precisely identifying and separating metals, plastics and composites. This automation not only addresses the complexity of disassembling automotive components but also enhances the quality of recovered materials, making them more suitable for reuse in manufacturing.

- **Chemical recycling:** A breakthrough solution for handling the diverse materials found in automotive components is the adoption of chemical recycling. Unlike traditional methods, chemical recycling breaks down polymers into their basic building blocks, enabling the regeneration of high-quality materials. This approach proves particularly valuable for recovering materials from end-of-life automotive components, contributing significantly to the industry's transition toward a more circular economy.

- **Biodegradable and bio-based materials:** Manufacturers in automotive component production are actively exploring alternatives to traditional resources through the integration of biodegradable and bio-based materials. These materials, derived

from renewable sources, align with sustainability goals. The adoption of biodegradable materials not only addresses environmental concerns but also contributes to a more eco-friendly end-of-life cycle for automotive components.

- **Technology integration:** Optimising recycling processes in automotive component manufacturing is facilitated by the integration of advanced technologies. Smart sensors and connected devices monitor and enhance various stages of recycling, from collection to processing. Real-time tracking of end-of-life automotive components ensures efficient logistics and timely recycling, contributing to a more streamlined and responsive manufacturing cycle.

Conclusion

In the realm of automotive component manufacturing, a clear imperative for sustainable practices emerges due to the environmental impact of traditional processes. Challenges like intricate material compositions, stringent quality requirements and high initial capital investment find innovative solutions in advanced sorting technologies, sustainable design practices and financial support.

Industry-wide collaborations, transformative trends like advanced sorting and chemical recycling and technology integration underscore a commitment to environmental stewardship. Embracing sustainable approaches positions the sector at the forefront of a future marked by resource conservation and reduced ecological footprint. Despite challenges, collective efforts pave the way for a more sustainable, environmentally conscious and technologically advanced future in automotive manufacturing. □



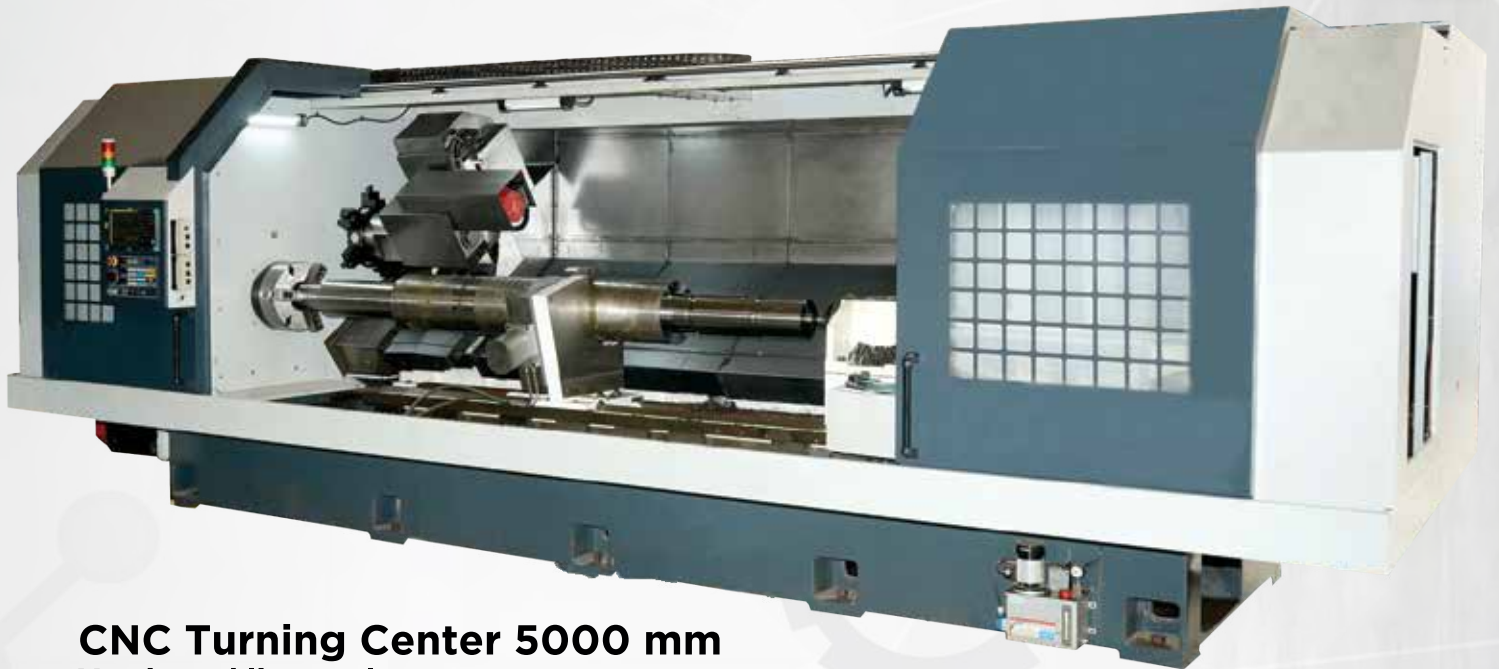
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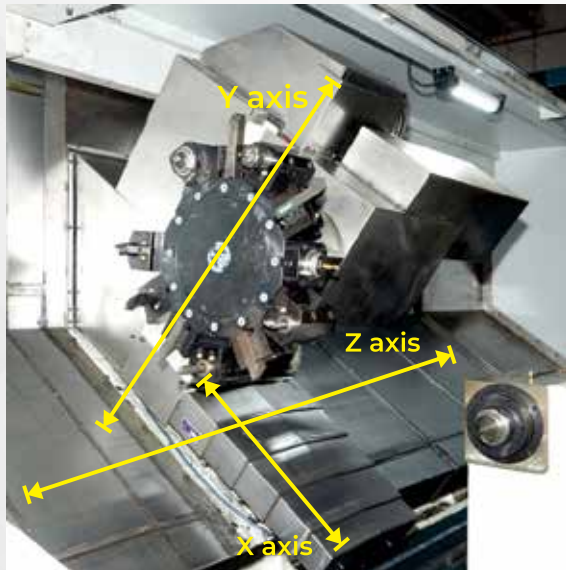


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The upcoming Imtex Forming edition is set to showcase four dynamic exhibitions: Weldexpo, Moldex India, Tooltech, and Fastnex India. This event presents a prime opportunity for manufacturing industries to leverage the thriving business landscape in the nation.



The Indian Machine Tool Manufacturers' Association (IMTMA) will organise the eighth edition of its flagship metal forming machine tool exhibition, IMTEX FORMING 2024 at the Bangalore International Exhibition Centre (BIEC) in Bengaluru from January 19 - 23, 2024.

Tooltech 2024 focusing on machine tool accessories, forming tools, die and mold, metrology, CAD/CAM, Digital Manufacturing featuring the latest innovations in additive manufacturing and Industry 4.0., and Weldexpo, an exhibition for welding, cutting, and joining in association with the Indian Institute of Welding will be held concurrently.

Moldex India and Fastenex India, organised by Messe Stuttgart, focusing on moulding, fasteners, and fixing technologies respectively, will be co-located alongside the exhibition.

This trade fair would feature around 500 exhibitors from 18 countries in an exhibition space of around 45,000 sq. mts. covering five exhibition halls.

Some exhibitors include Fronius India, TRUMPF, Arm Welders, Beckhoff Automation, Ecoclean Machines, S&T Engineers, Statfield Equipments and TURCK India Automation.

Exhibitors will present cutting-edge advancements in metal forming, including innovations in technology related to robotics, automation, welding, wire-forming, drawing, presses, die casting, hydroforming, sheet metal machinery, specialized application presses, die and mold technology, hydraulic and pneumatic systems, testing machines, and more, all showcased at the event.

Expressing his thoughts on the upcoming edition of IMTEX FORMING, Rajendra S. Rajamane, President, IMTMA, said, "IMTEX FORMING 2024 offers great opportunities for manufacturing industries to capitalize on the positive business environment in the country".

Rajamane added, "As most visitors to IMTEX FORMING would comprise key decision makers nurturing an intention to invest, exhibitors can have effective face-to-face business meetings".

Speaking about IMTEX FORMING 2024, Jibak Dasgupta, Director General & CEO, IMTMA, said, "The economic outlook for companies in the metal forming sector looks promising and IMTEX FORMING will play a catalytic role in realizing this promise. This edition of IMTEX FORMING is very comprehensive in terms of offerings of technologies with the inclusion of Weldexpo, Moldex India, and Fastnexus India. It will be a great opportunity for industries across sectors to visit the exhibition and explore the various products, and solutions visitors that are part of day-to-day manufacturing needs".

The last edition of IMTEX FORMING was held in



TOOLTECH

- Beginning from the late 1990s, Tooltech has become synonymous with IMTEX showcasing innovations in machine tool accessories, metrology and CAD / CAM cutting tools and trends from the tooling industry.

DIGITAL MANUFACTURING

- Showcase your wide range of technologies in 3D printing and Industry 4.0 concepts besides robots, cobots and software at the Digital Manufacturing Pavilion and maximize the value of your products and processes by providing end-to-end visibility and control of production processes.

WELDEXPO

- Welding finds acceptance among a wide range of manufacturing applications: pressure vessels, aircraft, ships, medical devices and high-volume products like automotive parts, appliances, food packaging and microelectronics.
- Weldexpo will facilitate in exchange of new technologies, IIW and IMTMA can supplement the growth of each other through Weldexpo.

June 2022 which witnessed a good response from the manufacturing community from across the globe.

The exhibition featured 350 exhibitors from 19 countries and attracted a footfall of 25,656 visitors from 45 countries which included trade delegations and institutional buyers.

Visitors connected with Additive Manufacturing and Industry 4.0 in the concurrent Digital Manufacturing show as well as the indigenous technologies displayed in the AatmaNirbhar pavillion.

Trade delegates from 250 companies across India from sectors like aerospace, defence, railways, power, electronics, medical equipment, textiles, agriculture, turbines etc visited the show. Business orders worth around ₹ 500 crores and enquiries around ₹ 4600 crores were generated, as reported on the last day of the show. □

Efficient special tools for timely metalworking

Choosing the right cutting tool poses challenges—deciding between standard and special tools. The article highlights superior performance in cutting diverse engineering materials. In metalworking, standard tools are fundamental for inventory management..



Fig. 1 - A wide variety of exchangeable heads, shanks, adapters, extensions, and reducers feature MULTI-MASTER as a versatile modular system.

When deciding on the appropriate cutting tool for a particular application, it is difficult to determine whether a standard tool or a special tool is preferable. The ideal tool selection is contingent on various factors, such as the nature of the business situation, the manufacturing program, the production type, and sometimes personal preferences. Standard cutting tools, produced by a specific tool manufacturer, offer high versatility and are appropriate for machining a diverse range of parts that come in different shapes.

Furthermore, the tool exhibits excellent performance capabilities when cutting various engineering materials. To ensure seamless production processes, it is crucial to have the cutting tools delivered in a timely manner. This is why standard tools are the foundation of tool stock management on metalworking production floors.

Special Tool Limitations

A special cutting tool is designed for specific operations on a particular part, made of a specific material, and used on a machine that requires a specific work holding fixture. This custom-engineered tooling solution aims to provide the best possible performance and outcome. However, there is a downside to this solution as it limits the tool's versatility, making it less adaptable to different applications. As a result, special tools are primarily used for high-volume mass production, especially in the automotive industry.

A special tool is not readily available and requires significant engineering effort, including concept design, coordination with the customer, detailed design, and production. The delivery time for special tools is significantly longer than that of standard tools. Metalworking shops often face a dilemma when choosing between standard or special tools, which can impact project timelines. The question remains: which tool will provide the best solution? Should shops rely on readily available standard tools or opt for a highly efficient special tool with a longer delivery time? Naturally, economic factors such as cost per unit and tool costs should be taken into consideration. All things being equal, in an ideal situation where production programs, processes, and inventory are planned, the answer is clear. Therefore, the maximum short lead time is an important factor when choosing a special tool.

Special tools vary in their design complexity. Some are simple modifications of standard tools, such as changes to the corner radius or tool length. These modifications fall under the category of 'semistandard' products, which can be manufactured relatively quickly. The design complexity of a special tool is determined by a pre-design study that assesses the customer's manufacturing limitations, accompanied by cost calculations and production time. The results of

the study determine the limits and cost-effectiveness that correlate to the special tool's delivery time. However, there are additional ways to reduce the delivery time of special tools, such as using solid tools with exchangeable heads, bodies of indexable cutters, or replaceable inserts. The tool manufacturer's delivery times and production abilities play a significant role in the final decision on how to proceed.

Custom-Engineered Special Tools

One alternative to engineered special tools is modular tooling, such as ISCAR's MULTI-MASTER (shown in Fig.1), which features rotating tools with exchangeable solid carbide heads. This tooling system includes a wide range of tool bodies (referred to as 'shanks' in the family nomenclature), adapters, extensions, and reducers that enable the configuration of the required tool for diverse machining operations.



Fig. 2 - The complex-shaped head of NEOSWISS for Swiss-type machines is a modular quick-change head system created by 3D printed technology.

Additive Manufacturing (AM) presents new opportunities for special tool solutions. This technology allows for the quick production of tools with complex profile designs. Although finish cutting and grinding operations are still necessary, the fast manufacturing of pre-shaped products that are very close to a final shape is fascinating (as shown in Fig. 2). Additionally, 3D printing can be used to fabricate carbide inserts without the need for a die-set, which significantly reduces production time and costs. This process is an excellent way to create insert prototypes during the development stages and produce low-batch special inserts. AM of carbide inserts and heads is gaining momentum and is highly capable of ensuring fast delivery of customized tools and their components.

Metalworking shops can quickly manufacture and customize a special tool if an appropriate off-the-shelf product is not available. However, they may not have the means to complete the full cycle of toolmaking. In such cases, tool manufacturers can provide semi-standard tools as standard items, which can be adapted by the customer to their final shape. These semi-finished products can include blank bodies, blank inserts, and blank heads. Some cutting tool manufacturers, such as ISCAR, offer this option and include blanks in their standard product range.

The MULTI-MASTER family offers extra-long shanks with an inner MULTI-MASTER thread on the front face and a center hole on the back face, which can be cut and shaped by the customer. Recently, ISCAR introduced uncoated carbide blank heads with two sections: a disc-form front area with a hexalobular (TORX) recess on the face, and a rear area with an outer

Fig. 3 - A disc-form blank head with MULTI-MASTER adaptation substantially expands the customer's ability to produce tailor-made milling shapes.



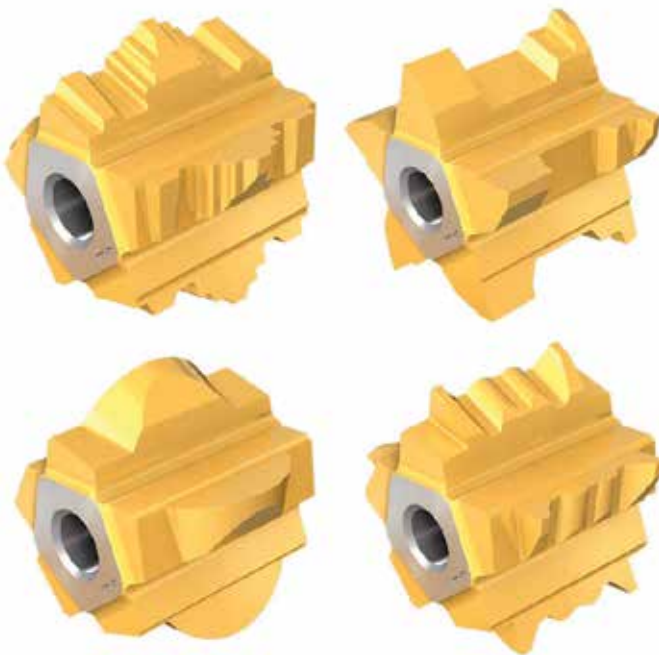
MULTI-MASTER thread (Fig. 3). These heads are intended for producing special items to be mounted on MULTI-MASTER shanks at the customer's machine shops for different machining operations such as milling slots, grooves, threads, splines, gears, and more.

ISCAR's group of unique tool portfolio

ISCAR has also added a group of unique PENTACUT-27 blank inserts with five edges for tailor-made profiles to their product portfolio (Fig. 4). These starlike carbide blanks



Fig. 4 - PENTACUT-27 starlike blank inserts enable fast customized solutions for complex profile grooving.



can be ground by the end-user to form different shapes for shallow profiling and grooving depths when machining pulleys, bearings, and fittings. Customers who produce special tools from blanks are limited compared to ordering specially tailored tools from cutting tool manufacturers. However, when time is of the essence, customers can find the most appropriate solution within given constraints by creating their own specially tailored tools. By providing customers with the ability to create their own tools, new horizons are created to overcome the everyday obstacles of manufacturing. □

Courtesy: **ISCAR India**

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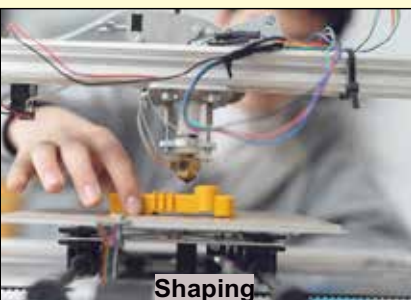
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Data-driven logistics:

A boon for the Indian MSMEs

The transformative impact of data-driven decision-making, highlighting how it not only improves immediate operational aspects but positions MSMEs as key contributors to India's economic growth and development.



Nirav Doshi,
Founder & Managing Director,
NIDO

Data-driven logistics and supply chain management have emerged as a transformative force, particularly for MSMEs in India. The integration of technology into logistics operations provides unprecedented visibility into the movement, quantity and product mix of goods. This newfound visibility empowers MSMEs to make informed

decisions, enhancing overall efficiency and profitability.

Benefits to MSMEs

In the evolving landscape of business operations, technology has become more accessible, making it easier for

management to embrace data-driven logistics. The central advantage lies in the visibility that this approach brings to MSMEs. Previously, information about the location and movement of goods was scattered, hindering effective decision-making. Now, with data-driven logistics, MSMEs have a centralised platform to gain insights into the precise location, quantity and product mix of their goods.

The primary benefit of this enhanced visibility is the ability to make well-informed decisions. MSMEs can now strategically plan their supply chain by understanding where goods are located, how they are moving and the quantity and product mix involved. This level of transparency was previously elusive, making it challenging for MSMEs to optimise their operations fully. Moreover, the widespread availability of technology tools and applications further facilitates the adoption of data-driven logistics. MSMEs can leverage these tools in four distinct ways:

Supply chain optimisation

By analysing past data, both from their own company and parallel players in the industry, MSMEs can make informed decisions about what to procure, how much to procure and where to source their supplies. This strategic approach ensures a streamlined and cost-effective supply chain.

Inventory planning

MSMEs can use data-driven insights to determine optimal inventory levels. This includes deciding where to source inventory, how much to keep and what product mix to maintain. Accurate inventory planning prevents overstocking or stockouts, leading to more efficient operations.

Demand forecasting

Understanding customer demands is critical for MSMEs. Data-driven logistics enables accurate demand forecasting and planning. MSMEs can analyse data to identify customer preferences, regional variations and product trends, allowing for proactive decision-making in response to market demands.

IoT integration

The use of Internet of Things (IoT) devices adds another layer of data-driven decision-making. MSMEs can gather real-time data from various machines, tools and vehicles. For instance, manufacturers can monitor machine performance, track the location of their fleet and analyse employee activities. This data can then be processed to derive valuable insights, leading to informed business decisions.

Conclusion

In the dynamic landscape of Indian business, data-driven logistics has emerged as a game-changer for MSMEs, providing unprecedented visibility and strategic insights into their supply chain operations. In the past, such sophisticated tools were beyond the reach of many small businesses. However, with the increasing ubiquity of technology, MSMEs can now harness the power of data-driven logistics to enhance their operations.

The implications of data-driven logistics for MSMEs extend beyond immediate operational improvements. It positions them to be more adaptable to market changes, responsive to customer needs and resilient in the face of uncertainties. As the backbone of the Indian economy, the success and growth of MSMEs have a cascading effect on job creation, innovation and economic development. As they make strategic decisions based on real-time data, MSMEs not only enhance their own profitability but also contribute significantly to the economic progress of India. □



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Adhering to customer trends with data analytics



This article explains how, with the help of data analytics, several manufacturing businesses can produce and alter their products in response to consumer demands.



Priyam G Aggarwal,
Country Head -
India, Hama

Despite abundance of quantitative data, the science of data has evolved into a highly subjective field. Data analytics has grown both as a field and as an industry as a result. In many industries with access to all relevant data, it is standard practice to employ data analysts from all over the world. They give analysts access to this data and solicit their help in interpreting it. To find market trends and practical sales-boosting strategies, the analysts analyse data and consult their clients. The manufacturing sector is one such industry .

Meeting customer expectations

Using data analytics, a lot of manufacturing businesses have been able to produce and alter their products in response to consumer demand. Producers can now

investigate and correct any product flaws right away because manufacturing development is being guided quickly. The development of Artificial Intelligence (AI) has helped many industries streamline processes, including data analysis.

AI has made it possible for analysts and manufacturers to analyse consumer trends and preferences and improve their current products without having to manually sort through census data and make a judgement call. Data analysis helps not only in finding flaws but also in evaluating results and effectiveness of the corrective actions. Manufacturers can compare process changes, maintenance of the machines, and employee training.

When the results are apparent, the former can judge whether quality of the products has improved, and this also enables them to decide which changes to scrap and which

changes to make permanent, thereby, improving the quality.

Enabling efficient manufacturing process

Process optimisation, or ensuring a productive and efficient manufacturing process, is another benefit of data analysis. One way this is done is by analysing production rates. For this, information on a product's production volume, resource consumption, and time-to-production are gathered. Manufacturers can locate production-process bottlenecks and opportunities for efficiency improvements by analysing data. This analysis also helps optimise a manufacturer's energy consumption. Performance of the manufacturer's machine, amount of energy consumed, and the local environmental conditions are just a few variables that analysts identify and gather information on.

One other advantage of data analysis is that it helps determine the right intervals for maintenance checks of the equipment involved. Data can be used to forecast when machines and other pieces of equipment might break down, giving proper window for maintenance. A manufacturer can get feedback on other factors besides immediate health, such as how long the tools and machines in question will still be useful.

For example, if the data shows that vibration levels of a particular machine are increasing over time, this could indicate that the machine is wearing out and it needs to be maintained or replaced. They can take all these factors into consideration when deciding which equipment stays and gets continued maintenance, while the others get scrapped or recycled for other purposes. As a result, the manufacturing facility's downtime is decreased and equipment reliability is increased.

Optimisation of services

Data analysis aids in the optimisation of short-term inventory and ensures its effective and efficient use, in addition to long-term assets. Analysts look at sales pattern of the manufacturer, giving insights on which products are fast-selling and which take longer to get taken off the shelf, along with an insight into consumer demands. Inventory can be moved quickly after creating a well-planned production-to-retail-to-delivery routine and timing.

For example, if data shows that a particular product is selling quickly, this could indicate that the manufacturer needs to increase inventory levels for that product to avoid running out of stock. Thus, there will be minimal

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excess of inventory as well as quick revenues. An effective sales forecast is also possible via data analysis. Inventory turnovers, production rates, as well as prime sale hours can all be found, and schedules can be set accordingly.

Internally, data analysis aids in reconfiguration of the company into its most efficient and productive configuration. Every industry and company is only as strong as the manpower it hires.

Utilising information on working hours, output, and mistakes made, data analysis considers employee attendance and productivity. This helps manufacturers determine if there are problems in the workflow and what course of action to take. It also helps in evaluating how effective employee training programmes are and how they can be improved. In addition to all of the above, data analysis helps employers determine how to improve benefits and employee satisfaction.



For example, if the data shows that productivity of a particular shift is consistently lower than other shifts, this could indicate that workforce on that shift may need additional training or support. An analyst can examine employee absences, feedback, and turnover rates and then make recommendations about how to boost job satisfaction and keep workers.

Developing effective marketing strategies

Gaining insights into customer needs and preferences is critical for any business, and especially important for manufacturers. Data analysis plays a critical role in gaining customer insights by providing manufacturers with information they need to understand their customers better and develop more effective marketing strategies. One

way data analysis can be used to gain customer insights is by analysing sales patterns. This involves collecting data on things like sales volumes, customer demographics, purchase histories, and then analysing this data to identify patterns or trends that may indicate a customer's needs and preferences.

Data analysis can also be used to analyse customer feedback by collecting data on things like customer complaints, comments, and reviews, then analysing this data to identify patterns or trends that may indicate a customer's needs and preferences. For example, if the data shows that customers are consistently complaining about packaging of a particular product, this could indicate that the manufacturer should consider changing the packaging to improve customer satisfaction.

Data analysis can also be used to analyse social media activity. This involves collecting data on things like customer interactions, mentions, and sentiment, and then analysing this data to identify patterns or trends that may indicate a customer's needs and preferences.

Data analysis can identify patterns in the past, present, and future. The consumer electronics sector will greatly benefit from and value this. Electronics have developed into one of the most important industries today, and they will continue to be so in the future. With aid of data analysis, it is possible to make an educated guess regarding what the intangible characteristics of market consumers are. Because it places such a strong emphasis on selling its products directly to consumers, this industry can create and construct enticing products and promotions.

Increasing ROI

Manufacturers may structure and create their company and manufacturing process more effectively with the use of data analysis, which also helps them make products that appeal to consumers. Internal redundancies may be understood by manufacturers, which would lower associated costs. The manufacturer's Returns On Investment (ROI) would significantly rise, helping to produce higher profit margins as a result. While income might increase, the costs incurred would also go down.

The study of contemporary manufacturing structures and trajectories requires data analysis. AI and automation are also included, which drastically streamline and speed up the process. Additionally, there is no shortage of data to be studied. Every minute, more data is generated. Even though it might seem unpredictable, analysis helps identify quick fixes for the changes and also offers suggestions for how to move forward. The consumer electronics business will continue to expand enormously, along with data analysis, which is here to stay. □



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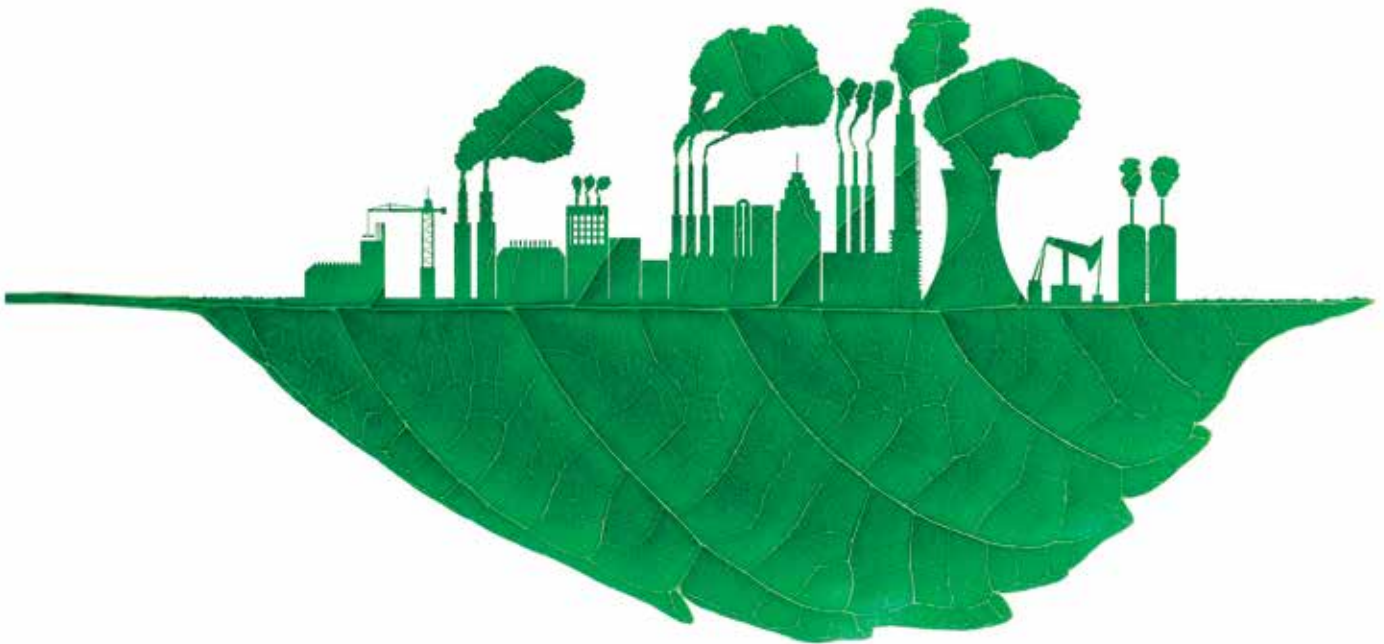
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Navigating sustainable manufacturing practices for business success



Green manufacturing, a pivotal solution in the face of escalating environmental concerns. This article explores the multifaceted strategies that defines green manufacturing with a focus on resource efficiency, policy frameworks, technological investments, skill development, circular economy promotion and the significance of public-private collaboration in driving the green manufacturing revolution.



Rajesh Khosla,
CEO, AGI Greenpac

Green manufacturing has emerged as a solution in the industrial landscape in an era of escalating environmental concerns and the urgent need for sustainable practices. Anchored in environmental stewardship principles, this approach aims to reduce the negative environmental impact of manufacturing processes across the entire product lifecycle, from raw material extraction to product end-of-life disposal.

Green manufacturing, in contrast to traditional manufacturing practices, embraces a holistic approach to sustainable production. This comprehensive approach includes prioritising resource efficiency, conducting life-cycle analysis, embracing green technologies and implementing effective green manufacturing strategies.

Resource efficiency and life cycle analysis

Resource efficiency is the cornerstone of green manufacturing, encompassing material selection, waste reduction and energy-efficient processes, all of which are critical steps towards reducing the environmental footprint of manufacturing operations.

Material selection must be optimised for green manufacturing. Choosing materials that are renewable, recyclable or have a lower environmental impact significantly reduces the overall resource consumption. The reduction of waste generation through process optimisation and robust recycling programmes not only avoids landfills but also preserves valuable resources.

Life cycle analysis is a useful tool for assessing the environmental impact of products and processes throughout their entire lifecycle, from raw material extraction to disposal. Manufacturers can reduce their environmental impact and make informed decisions to improve the sustainability of their products and processes by conducting life cycle analysis. Also, it enables the comparison of various manufacturing options, facilitating the selection of the processes with the least environmental impact.

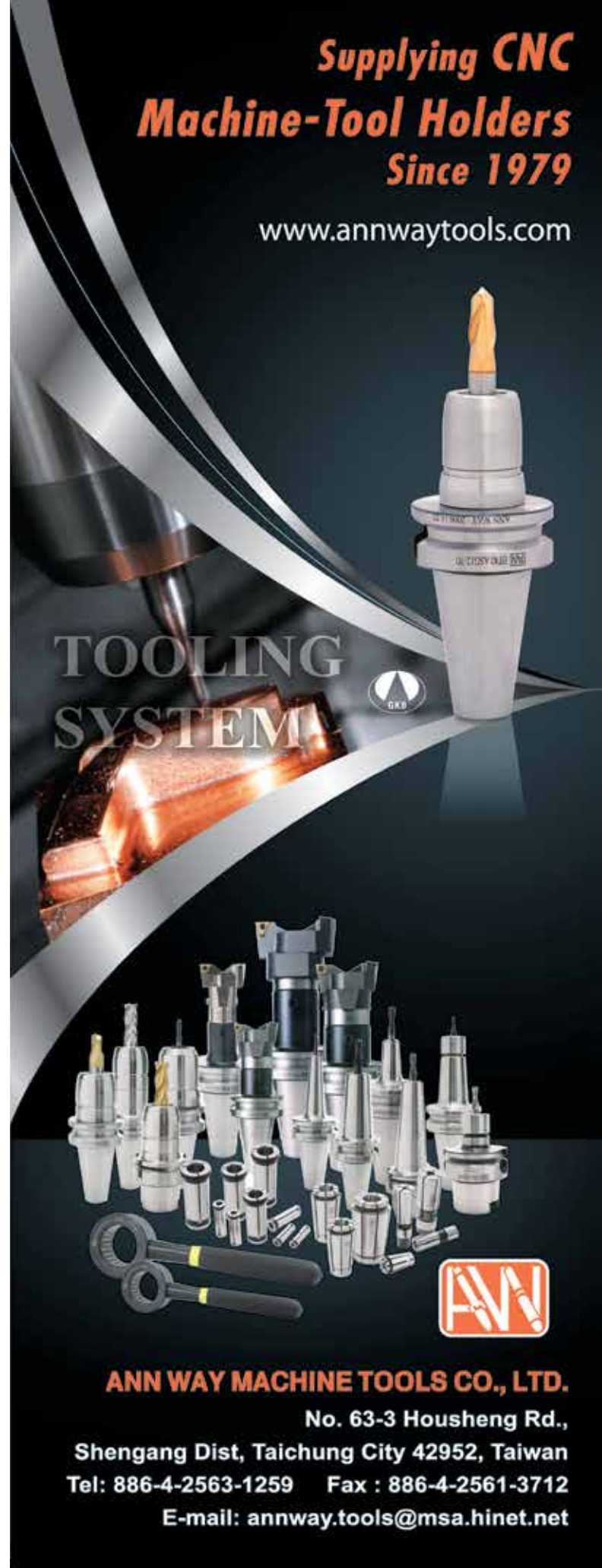
Green manufacturing technologies

The first step towards implementing green manufacturing practices is to incorporate green principles into corporate policies and procedures. Setting clear sustainability goals and targets for environmental performance and incorporating green manufacturing principles into the company culture is important.

Product design and environmentally friendly packaging help to reduce the environmental impact of manufactured goods. Strategies, such as designing products with fewer components, using recyclable materials and optimising packaging can significantly curtail resource consumption

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and minimise waste generation. Employee education and training in green manufacturing practices are critical for successful implementation.

Monitoring and measuring progress towards sustainability goals is critical to the success of green manufacturing initiatives. It entails tracking Key Environmental Performance Indicators (KPIs) and evaluating the impact of green practices regularly. Metrics, such as greenhouse gas emissions, water consumption, waste generation and energy consumption must all be included in KPIs.

By employing these monitoring and measuring initiatives, organisations can systematically evaluate their progress in adopting green manufacturing practices and identify areas for ongoing improvement.

Green manufacturing in the Indian context

The imperative of adopting sustainable practices looms large as India continues its journey towards industrial growth and development.

- **Resource efficiency:** Promoting the use of environmentally friendly materials and incorporating innovative manufacturing techniques can significantly reduce resource depletion.
- **Policy framework:** Initiatives by the Indian government, such as the National Action Plan on Climate Change and the Make in India campaign, highlight the importance of sustainability in industrial growth promoting eco-friendly practices that can help to accelerate the adoption of green manufacturing processes across sectors.
- **Investment in technology and innovation:** Investment in cutting-edge technologies and innovation

is critical for India's successful transition to green manufacturing. Partnerships and collaborations between the public and private sectors can help to accelerate technological advancements in green manufacturing.

Skill development and education

A skilled workforce knowledgeable about green manufacturing practices is required for successful implementation. Efforts should be focused on providing comprehensive training and education to workers to equip them with the knowledge needed to adopt and implement eco-friendly methodologies. Investing in vocational training programmes and educational initiatives geared towards sustainable manufacturing practices will aid in the development of a skilled workforce familiar with green technologies.

Promotion of a circular economy

Adopting circular economy principles, in which resources are used, reused and recycled in a closed-loop system, holds enormous promise for India. Circularity in manufacturing processes, product design and waste management can significantly reduce resource depletion and the environmental impact of the industry.

Public-private collaboration

Collaboration among the government, industries, academia and civil society is critical in driving green manufacturing initiatives. Partnerships can promote knowledge sharing, technology transfer and the development of innovative solutions to environmental challenges while also promoting economic growth.

Green manufacturing emerges as a critical framework for reducing the environmental impact of industrial operations while promoting economic advancement. The adoption of green manufacturing technologies is critical for implementing sustainable manufacturing practices. Renewable energy sources, such as solar and wind power, can reduce the reliance on fossil fuels and associated greenhouse gas emissions significantly. Water conservation and recycling techniques can protect water resources. Pollution control and waste treatment methods capture and treat pollutants, preventing their release into the environment. □





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Smart manufacturing in EVs

Challenges and innovations

In the not-so-distant past, the automotive industry was all about engines, exhaust pipes and gasoline. Now, EVs have surged into the mainstream, promising a greener future and disrupting traditional paradigms. Here is a look into how smart manufacturing techniques accentuate the utility of EVs.



Arun Krishnamurthi,
CEO and MD,
AxisCades Technologies



Smart manufacturing has emerged as the linchpin of Industry 4.0, transforming factories into interconnected hubs of innovation. At the heart of smart manufacturing lie advanced data analytics, automation and seamless human-machine interaction. The result is a production process that is not just efficient but also adaptable and sustainable. In the context of EVs, smart manufacturing practices offer a unique set of solutions. By promoting self-reliance and reducing operational costs, they position EV manufacturers on the cutting edge of the automotive industry.

Financial dynamics: A billion-dollar shift

In the past decade, the automotive industry has witnessed a seismic shift. The EV market, once a niche, is now a billion-dollar behemoth. The global EV sales in 2020 increased by 39% year-on-year to 3.1 million units, where the total passenger car market declined 14%. Research firm Canals forecasts the number to climb in the coming years with 30 million EVs to be sold in 2028. This growth is not just a fluke; it is a testament to the industry's unwavering commitment to innovation.

Smart manufacturing unleashed

Smart Manufacturing, the catalyst behind this automotive renaissance, is more than a buzzword. It is predicted that the market size for global smart manufacturing will reach \$576.3 billion by 2029, rising at a market growth of 12.2% CAGR during the forecast period. The driving force for this is its ability to optimise manufacturing processes, reduce costs and enhance production performance.

Innovations that pay off

Amid these challenges, innovations in smart manufacturing are propelling the EV industry forward. Digital twins, for instance, have become invaluable tools. They allow automotive companies to create virtual replicas of production processes, facilitating efficient validation of processes and equipment. Real-world data, collected from the connected factory floor, is another game-changer. It empowers manufacturers to make data-driven decisions, optimising production and supply chain execution in real time. Imagine having all the critical information at your fingertips, helping you fine-tune operations for maximum efficiency.

Conclusion

In an era where every step towards sustainability matters, smart manufacturing practices play a pivotal role in achieving a greener future, that is constantly evolving, embracing smart manufacturing and digital transformation demonstrating that is not an option but a necessity. The road ahead may be paved with challenges, but the destination is a future where EVs are not just the norm but also a testament to human ingenuity and technological prowess. Smart Manufacturing plays a lead role, conducting efficiency, innovation and sustainability to the tune of billions of dollars. The future of mobility is electric, and it's underpinned by Smart Manufacturing—a financial powerhouse that is reshaping the world one EV at a time. □



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Smallest and frameless BLDC motor

Delta Line is expanding two of its product lines with the introduction of its 38BLF07 frameless BLDC motor and its Leo B2000 servomotor controller. The 38BLF07 motor has a length of just 14 mm, a rated torque of 0.1Nm at a rated speed of 8,000 rpm, and can produce a peak torque of 0.3 Nm. With only 57 g of weight, this motor has been designed to minimise inertia,



Delta Line's 38BLF07 frameless BLDC motor the Leo B2000 EtherCAT variation and Leo B2000 Modbus CANopen variation

making it a suitable solution for dynamic movements with high acceleration and deceleration rates. The Leo B2000 drive has high-performance closed-loop servo drive controller, suitable for servo and BLDC motors. Designed with efficiency in mind and incorporates optimised control algorithms to provide the perfect trade-off between efficiency and performance.

The Leo B2000 drive is the latest generation of servo drives, offering best-in-class performance in a compact housing, delivering up to 2000 W and including all the latest technologies required by the market.

Delta Line | Switzerland

Push-in technology suitable for the field assembly of connectors

Harting has expanded its portfolio with the first monoblock variant for the Han®-Compact housing. Thanks to the use of push-in technology, the new Han® Q 8/0 insert enables up to 30% faster field assembly of connectors. This makes it particularly suitable for environments where space for installation



Han® Q Monoblock

work is at a premium. Push-in technology is a further development of the cage clamp. As it makes the connection as simple as possible, these inserts are particularly suitable for field assembly, for example, in power engineering systems or in the assembly of machine modules or production lines. The

handling of components, for example, during maintenance work, is also facilitated. What's more, a special tool is available for quick disassembly. If wires with wire-end ferrules have been opted for, connections via push-in technology are entirely tool-free.

Harting | Chennai

Heater Controllers for NOx reduction

Eaton recently introduced the 48-volt programmable aftertreatment heater controller for electrically heated catalysts to a global commercial vehicle manufacturer. Rapidly warming up the diesel exhaust after-treatment catalyst and keeping it warm during low engine load operation is essential for optimal performance to reduce harmful Nitrogen Oxide (NOx) exhaust



48-volt programmable aftertreatment heater

emissions. The air-cooled electric catalyst heater controller is part of Eaton's broader 48-volt electrical system portfolio, which contains several technologies that allow manufacturers to integrate 48-volt architectures in next-generation vehicles.

Eaton's family of electric heater power electronics controllers is being developed for solutions between 2 kW and 15 kW of power and operates with up to 99% peak efficiency. The controller is designed to receive power commands from the after-treatment system and provide soft-start and stop capabilities for assisting in maintaining system voltage control and diagnostic feedback on the heater element.

Eaton | PUNE

A new add-on for Additive Manufacturing

Mastercam, has recently announced a new Add-On product, Mastercam APlus® by CAMufacturing Solutions, which was designed for additive manufacturing. APlus can be used with Mastercam Mill, Lathe, or Router licences. Using the same interface Mastercam users are familiar with, APlus customers can program, backplot, and simulate their 3D printing



Mastercam APlus®

scenarios just like they would with traditional toolpaths in Mastercam. APlus uses Direct Energy Deposition (DED) and has toolpaths developed specifically to handle any geometry in Additive Manufacturing (AM), as well as features and utilities designed to remove uncertainty from the process and improve efficiency. Hybrid manufacturing provides users with the versatility to build

parts from scratch, add features to an existing part, or repair a worn or damaged part. APlus integrates seamlessly with Mastercam to allow users to generate Additive Manufacturing toolpaths, as well as visualise the additive and machining outcomes.

Mastercam | Pune

Screen printing machines for Autonomous Factory operations

Panasonic Smart Factory Solutions India recently announced the launch of new cutting-edge NPM-G Series Surface Mount Technology (SMT) machines, NPM-GH and NPM-GP, for Indian manufacturers. The new NPM-GH modular mounter and the NPM-GP screen printing machines mark a



NPM-G Series Surface Mount Technology (SMT) machines

significant step towards realising the concept of 'Autonomous Factory' operations, ushering in a new era of efficiency and precision in assembling state-of-the-art Printer Circuit Boards (PCB). The NPM G Series SMT machines are designed to respond in real-time to customer supply and demand changes through continuous, autonomous updates. Overall, the mounting system offers flexibility and customisable options to address the production needs of PCBAs and extend automation in manufacturing.

Notably, this machine also boasts an accuracy level of $\pm 15 \mu\text{m}$. Each type of head delivers greater component compatibility, from micro-sized chips to large BGAs & large-size connectors.

Panasonic Smart Factory Solutions India | Uttar Pradesh

New safety switch with a rotating actuator head

Schmersal is set to launch four new electromechanical safety switches with separate actuator: the AZ215/AZ216 and AZ315/AZ316 switches handle safety guard position monitoring of sideways or rotating guard doors. Their standout feature is the rotating actuator head made from die-cast zinc, which can be easily rotated in 90° increments before installation.



AZ215/AZ216 and AZ315/AZ316 switches

This allows the head to be approached from the side in four different directions, as well as from above. With this versatile approach position and the possibility of combination with different actuators, the AZ series offers maximum flexibility in installation as well as a range of

universal usage options for the user. The designer can use the AZ switch both for right-hand and left-hand designs on rotating and sliding guard doors. The plastic or metal switch housing is consistent in design and size with the PS 215/216 and PS 315/316 series position switches, giving the AZ switches an equally compact design and easy integration into the surrounding construction.

Schmersal | Pune

The 3-in-1 solution for fast thread machining

Walter recently launched innovative thread milling tools with the name 'Thrill-tec™', designed to combine the machining steps of core-hole drilling and threading in a single tool and operation. This is also true of the TC645 Supreme circular drill/thread mill, which is additionally able to produce a chamfer at the thread entry. Combining work steps improves productivity



Thrill-tec™

and makes this 3-in-1 thread milling cutter ideal for mass production and small series alike. Mass producers benefit from long tool life and short machining time – also because the ability to multitask results in fewer machine shutdowns for tool changes. The TC645 Supreme pays off for small-scale manufacturers because they only have to use one tool, therefore reducing tool changes as well as machine slots.

The left-hand cutting thread milling cutter is excellent at multitasking, mostly thanks to the milling geometry on its face, and the internal coolant supply. The universal thread milling cutter excels in all ISO materials P, M, K, N and S up to 48 HRC, due in large part to Walter's own coating in the WB10TJ grade.

Walter | Pune

Super-resolution microscopy across all scales and applications

ZEISS recently launched two new products, namely ZEISS Lattice SIM 3 and ZEISS Lattice SIM 5, to help researchers unlock the full potential of Structured Illumination Microscopy (SIM). These two new systems have joined the established super-resolution microscope ZEISS Elyra 7 to



ZEISS Lattice SIM 3 and ZEISS Lattice SIM 5

create a new Lattice SIM product family. These two new products use structured illumination to overcome the physical resolution limits of light microscopy. Each system has implemented this technology to address specific fields of application. The

product family enhances accessibility to super-resolution imaging, serving diverse applications such as optical sectioning of tissues, high-speed imaging of living cells, and molecular-level resolution. Unlike conventional structured illumination techniques, the ZEISS implementation of SIM uses a lattice spot pattern instead of grid lines. This leads to a dramatic increase in imaging speed, higher contrast, and half as much light exposure, making Lattice SIM a preferred live cell imaging technique.

ZEISS | Pune

Highlights: February 2024



» Auto Components Manufacturing

This vital sector serves as the backbone of the automotive ecosystem, driving advancements and enabling vehicles to embody cutting-edge technology, safety, and performance. This section will revolve around how Auto Components Manufacturing encompasses a diverse array of processes, technologies, and materials, meticulously crafted to meet the stringent demands of modern automotive design and performance. From intricate engine components to advanced electronics, the sector spans a broad spectrum of products, each contributing to the functionality and reliability of vehicles.



» Design Software and Digital Twins

In the ever-evolving landscape of industrial innovation, the convergence of design software and digital twins stands as a transformative force. The article will throw light on how Design software has progressed from traditional 2D drafting to sophisticated 3D modelling and simulation platforms.

» Upcoming EV Technologies

As the world steadily pivots towards sustainability, the automotive industry finds itself at the forefront of innovation with the rapid evolution of Electric Vehicle (EV) technologies. This section, focuses on how the landscape of EV technologies is poised for a significant shift.



» Data Analytics in Manufacturing

In the dynamic landscape of modern industry, the utilisation of data analytics has emerged as a pivotal force reshaping the manufacturing sector. The integration of advanced technologies and the proliferation of interconnected devices have ushered in an era where data has become the lifeblood of operational excellence and strategic decision-making within manufacturing environments. This Special Feature encompasses the systematic extraction, interpretation, and application of insights derived from vast and diverse datasets generated throughout the production lifecycle.

COMPANY INDEX

Name	Page
A JCBL Group Company	24
AGI Greenpac	40
Allur	09
Ann Way Machine Tools Co.	41
Arm Welders	29
Autogrip Machinery Co.	37
Axiscades Technologies	44
Beckhoff Automation	29
Bhagwati Products	09
Bharat Petroleum Corporation Limited	08
Blaser Swisslube Solutions	07
Chang Lian Fa Machinery Co.	35
Changhua Chen Ying Oil Machine Co.	21
Cummins India	16
Dees Hydraulic Industrial Co.	39
Delta Line	46
Dixon Technologies India	09
Eaton	46
Ecoclean Machines	29
EKA Mobility	09
Elgi Equipments	11
Fronius India	29
Gogoro	08
HAMA	36

Name	Page
Harting	46
Havells India	12
ifm electronic India	02
IMTMA	29, Back Inside Cover Page
Intel	09
Iscar India	Front Inside Cover Page
ISCAR India	30
Jarng Yeong Enterprise Co.	19
JSW Group	09
Jyoti CNC Automation	01
Kaynes Technology India	09
Kim Union Industrial Co.	25
Lagos Free Zone	08
Li Xiang Mach. & Elec. Co.	45
Lien Chieh Machinery Co.	43
Mastercam	46
Mitsubishi Electric India	08
Mitsui & Co	09
MMC Hardmetal India	14, 15
NIDO	34
Optimus Electronics	09
Panache Digilife	09
Panasonic Smart Factory Solutions India	47

Name	Page
PMT Machines	27
S&T Engineers	29
SAIC Motor	09
Schmersal	47
Shuzlan Energy	10
Škoda Auto	09
Smile Electronics	09
Statfield Equipments	29
Syrma SGS Technology	09
Tagma India	33
Tata International	08
Tata Passenger Electric Mobility	08
The Indian Machine Tool Manufacturers' Association	29
TreadBinary	20
TRUMPF India	23, 29
TURCK India Automation	29
VDL Groep	09
VVDN Technologies	09
Walter Tools India	47, Back Cover
ZEISS	47



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