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A JOURNEY OF OPTIMISM



Rajamane

RAJENDRA S RAJAMANE
PRESIDENT
IMTMA

India's consistent growth, as reflected in the manufacturing PMI of 58.5 in June 2024, depicts a story of optimism and promise. Consumerism in India is being boosted by the Union Government's efforts in infrastructure development, manufacturing, and economy. The rise in middle to high-income bracket households depicts our acceleration toward becoming a consumer-driven economy.

The Indian Machine Tool industry has done well in FY 2023-2024, ranking 9th in production and 6th in consumption as per Gardner Intelligence's 'World Machine Tool Survey, 2023'.

While cementing our relations with the traditional sectors such as Automobile, Auto Components, General Engineering, etc., that we have been catering to, our continuous efforts are getting translated into the Machine Tool industry offering products and services to traditional and emerging sectors. These include Electrical and Electronics, Woodworking, Renewable Energy, Semiconductors, Toys, Medical Equipment, Aerospace, Defence, and Railways.

IMTMA's outreach to improve innovation in manufacturing continues with its next event, the 'Symposium on Automation & Robotics' scheduled for September 24 - 25, 2024 in Pune. Smart manufacturing techniques, industrial automation and robotics, appropriate automation, and similar topics will be discussed at the symposium.

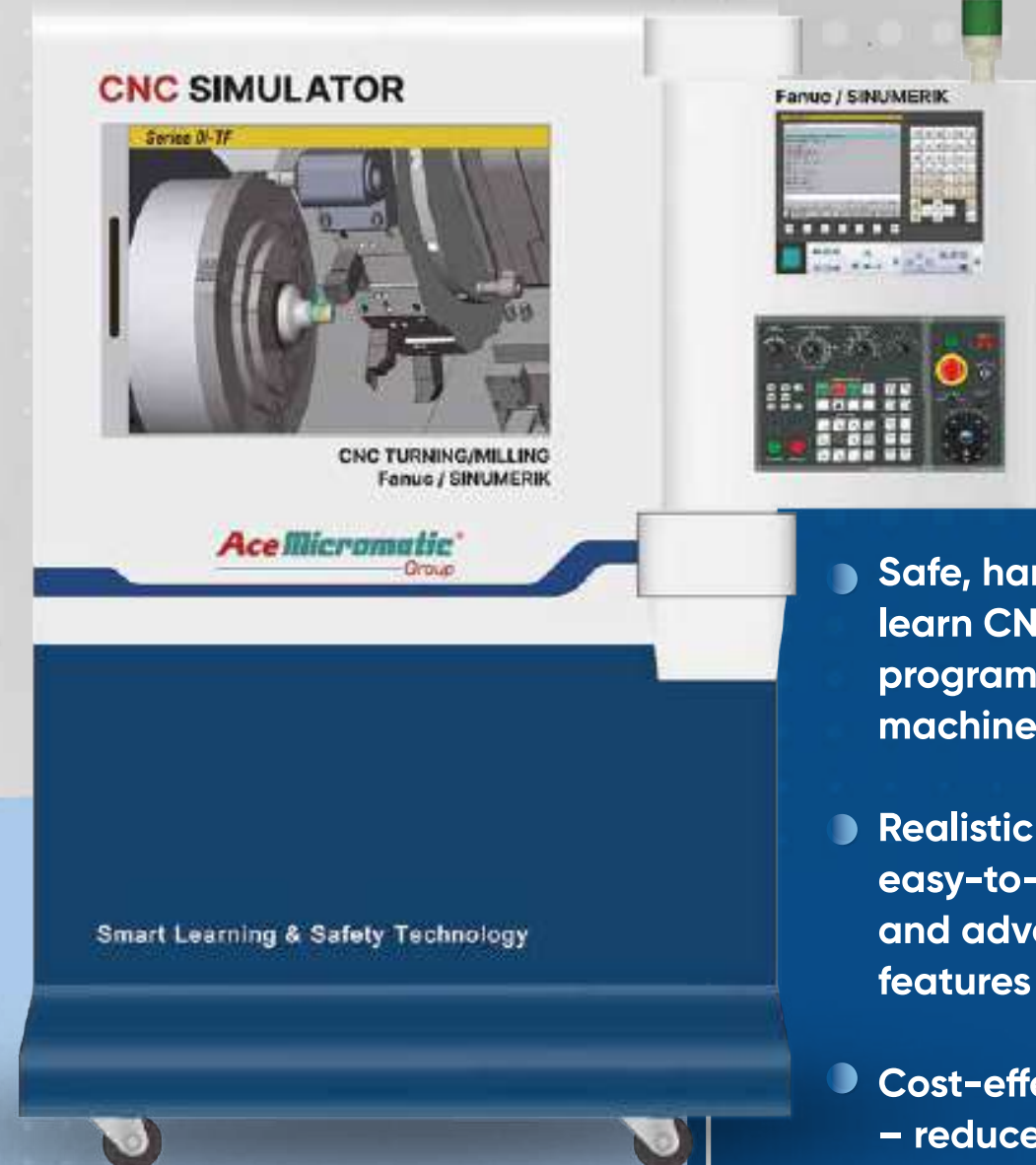
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Wishing you a joyful reading experience of this edition of Modern Manufacturing India (MMI).

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Dear Readers,

As the world's largest democracy and a liberalized economy, India has been faring well in terms of economic growth. Reforms initiated by the Government, a positive business climate, and an overall enthusiasm to excel are key factors driving this growth, with an estimated 8 percent GDP growth earmarked for the year 2024-25.

It is important to realize that in this journey towards a Viksit Bharat by 2047, the role of Indian manufacturing will be paramount in pushing the economy forward. It will be essential for the Manufacturing industry to adopt the latest technologies, innovations, and management techniques to remain competitive in domestic and international markets.

It is important to realize that in this journey towards a Viksit Bharat by 2047, the role of Indian manufacturing will be paramount in pushing the economy forward. It will be essential for the Manufacturing industry to adopt the latest technologies, innovations, and management techniques to remain competitive in domestic and international markets.

Doing so would also enhance productivity and help gain customer confidence in products and services. Collaborating effectively with stakeholders across the value chain and accessing new market opportunities as they arise will yield rich dividends.

The July-August edition of Modern Manufacturing India (MMI) focuses on medical machining and industrial metrology. An article by the Indian Machine Tool Manufacturers' Association (IMTMA) will offer insights into the use of robotics in manufacturing.

IMTMA's primary aim in publishing the MMI magazine is to give readers first-hand information to help analyze contemporary happenings in manufacturing and their

impact on the economy. As you are aware, the success of MMI largely depends on the generous support of its readers, we would like to hear from you on how to improve further in our endeavor as we strive to achieve excellence.

Wishing you a joyful reading of this edition of MMI.



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Soumi Mitra

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ONLY THE FITTEST SURVIVE - LET'S KEEP INNOVATING

The recently released 2023-2024 Economic Survey reflects a strong growth curve of an innovation-driven industrial ecosystem. The DPIIT-recognized startups in India crossed 1.25 lakh in March 2024 from a mere 300 in 2016. As per the report, Indian startups have filed more than 12,000 patents from 2016 to March 2024.

The growing number of patents and startups in India is paving the way for knowledge and innovation-backed economic growth in the country. Interestingly, over 13,000 of these startups are engaged in Artificial Intelligence (AI), the Internet of Things (IoT), Robotics, and Nanotechnology.

According to the survey, India's consistent improvement in the Global Innovation Index validates that the country has been making strides in industrial research and development. Presently, India holds the top rank globally in the domestic market scale indicator of the index.

To facilitate the growing industrial innovation, the Anusandhan National Research Foundation (ANRF), with an estimated cost of ₹50,000 crore during 2023-28, is slated to serve as an apex body to provide high-level strategic direction for scientific research in Indian industry.

*Innovation is the central issue
in economic prosperity.*
- Michael Porter

To foster a conducive innovation environment in the country, the industry and academia have started collaborating on projects. Towards this endeavor, MMI brings out exclusive research projects by the academia, which will contribute largely to the engineering and manufacturing landscape.

As a practice, this edition of MMI also presents curated content, featuring the views of industry experts on contemporary topics. On this note, we solicit your feedback on this issue, and thank you, our readers for helping us remain the best manufacturing publication over time.

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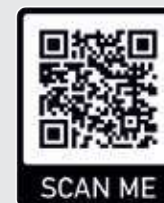
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SUSTAINING GROWTH MOMENTUM

India's economic trajectory remains promising, supported by prudent fiscal policies, accommodative monetary measures, and strong domestic demand. As global economic conditions evolve, India's ability to navigate challenges while leveraging its strengths in diverse sectors will be pivotal in achieving long-term economic stability.

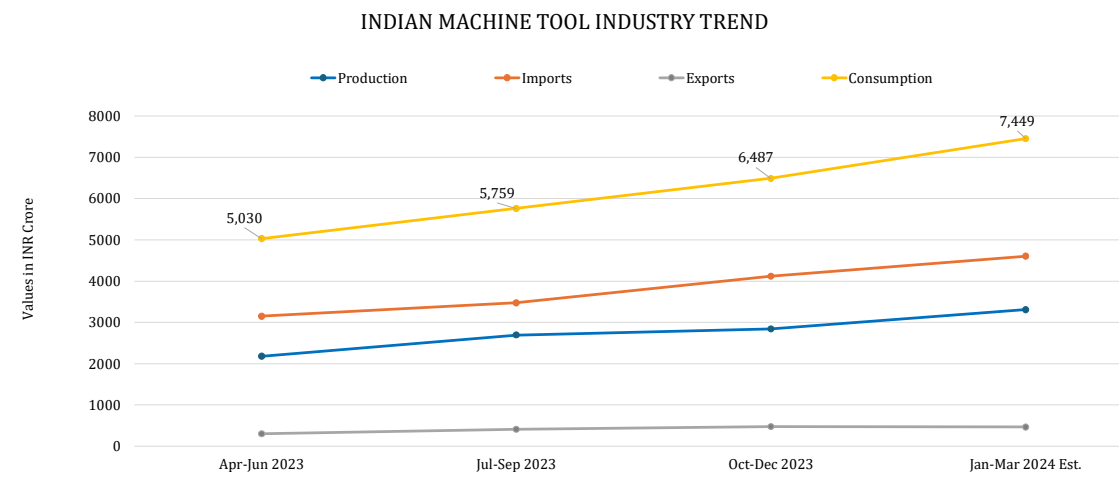


Table 1. Indian Machine Tool Industry Trend

According to the latest World Machine Tool Survey by Gardner Intelligence, India ranked 9th globally in production and 6th in consumption in 2023. For the second successive year, the Indian Machine Tool industry has achieved a double-digit growth.

The fiscal year 2023-24 concluded with a robust real GDP growth of 8.2 percent, marking a significant acceleration from the previous year's 7 percent. The fourth quarter alone saw a growth rate of 7.8 percent, underscoring sustained economic momentum driven by strong domestic demand and industrial activity. However, indicators such as the Index of Industrial Production (IIP) showed a slight moderation, with growth easing to 5.0 percent in April 2024, reflecting challenges in manufacturing output expansion. Both the Manufacturing and Services Purchasing Managers' Indices (PMI) remained in expansionary territory, albeit at slower rates, with readings of 57.5 and 60.2, respectively, in May 2024.

On the fiscal front, the Government of India achieved significant milestones in fiscal management. Gross tax revenues grew by 13.5 percent in FY24, driven by strong performances in both direct and indirect taxes. Fiscal deficit as a

percentage of GDP improved to 5.6 percent, demonstrating disciplined fiscal consolidation efforts. Externally, India's trade dynamics showed strength amidst global uncertainties. Merchandise exports grew by 9.1 percent in May 2024, outpacing import growth, which eased to 7.7 percent. This contributed to a positive current account balance for the first time in 10 quarters, with the annual deficit narrowing to 0.7 percent of GDP in FY24 from 2.0 percent in FY23.

Toward a bright future

Indian Machine Tool industry production in FY24 is estimated to have increased by around 10 percent year-on-year, reaching about INR 13,571 crore (US\$ 1.6 B). The industry's imports in FY24 saw a rise of 12 percent year-on-year, amounting to INR 15,352 crore (US\$ 1.8 B). Machine tool exports during FY24 from India reported a 13 percent growth, amounting to INR 1,659 crore (US\$ 200 M) and consumption is

estimated to have increased by about 11 percent to reach INR 27,265 crore (US\$ 3.3 B) in FY24. In FY24, China (29%), Japan (21%), and Germany (10%) emerged as the top countries for imports to India, contributing to 60 percent of the total machine tools imports. Presses (14%), Vertical Machining Centers (VMCs) (12%), and Turning Centers (11%) were the top machinery types imported, valued at INR 5,700 crore (US\$ 688 M), constituting approximately 37 percent of total machine tool imports during the period.

In exports, Russia (28%), the USA (9%), and China (8%) emerged as the major destinations, collectively representing 45 percent of total machine tool exports in FY24, amounting to a total export value of INR 1,659 crore (US\$ 200 M). Among the machinery types, Turning Centers (17%), VMCs (15%), and Presses (11%) stood out as the top three machinery types exported, with a combined value of INR 705 crore (US\$ 85 M).



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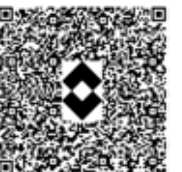
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THE RISE OF ROBOTS IN MANUFACTURING

Industrial robots have come a long way in global manufacturing from performing traditional simpler tasks of handling and lifting to more complex such as assembling and packing. IMTMA's upcoming 7th edition of the 'Symposium on Automation & Robotics' will provide deeper insights into these technological advancements that are revolutionizing the manufacturing game.



Source: Magic Wand Media

In the manufacturing ecosystem, industrial robots are increasingly making their presence felt on shop floors across the globe. Robots, traditionally used for tasks such as material handling, picking, and placing, have widened in scope to cater to various skilled and critical applications like welding, painting, sealing, assembly, and packing. Robots were initially deployed with human safety in mind, especially in hazardous environments with radiation and toxic elements, for handling heavy

loads, and in spaces unsafe for human beings. With improved technology, robots now work alongside humans as collaborative robots, also termed as cobots, enhancing productivity, efficiency, and safety in the manufacturing domain. With industrial automation picking up, robots and cobots are becoming a part of the sub-system of Industry 4.0. Robotization needs human resources skilled in the operation and programming of robots and system integration. Robots can work round-the-clock with no

margins for errors, increasing productivity and quality. Also, sensorized and programmable robots can be customized for different applications and environments, simultaneously capturing and providing data, and enabling future decision-making for enhanced productivity.

Global trends and statistics
The global robot-to-human ratio in manufacturing space has been going up for the last five years at a rapid pace. According to the World Robotics 2023 Report by the International Feder-

Source: IMTMA



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Indian Machine Tool Manufacturers' Association (IMTMA) is organizing the 7th edition of the Symposium on Automation & Robotics on September 24 - 25, 2024, at Hotel Tip Top International in Pune. It will focus on assembly automation, industrial automation and robotics, laser cutting and sheet bending automation, smart manufacturing techniques, appropriate automation, welding automation, and more.

ation of Robotics, the adoption of robotics in factories around the world has been impressive with Asia being ahead of Europe and America. A record 5,53,052 industrial robots were installed in factories around the world with a growth rate of 5 percent year-on-year, as per the report. By region, 73 percent of all newly deployed robots were installed in Asia, 15 percent in Europe, and 10 percent in America. China was the leader with 2,90,258 units, followed by Japan in second place with 50,413 units and the United States in third position with 39,576 units. European nations also performed well with Germany having 25,636 units, Italy 11,475 units, and France 7,380 units in 2022. In the United Kingdom, post-Brexit industrial robot installations were up by 3 percent to 2,534 units in 2022. Sales of industrial robots in India saw a massive 54 percent increase in 2022, reaching 4,945 units installed as against 3,215 units in 2020. However, automation and deployment of robotics can at times be disruptive in terms of employability and the overall economy. For example, robotization is perceived as a threat in Bangladesh's textile industry as it could replace a substantial percentage of the current labor force in the industry. Although the disappearance of some jobs with industrialization has happened in the past, history has revealed that alongside automation, innovation and new jobs have emerged. Workers' skill sets have been upgraded with new work titles.

India's initiatives and challenges

India has been taking concrete steps to widen the scope of artificial intelligence (AI). The Government of India's 'India AI' is an umbrella program that har-



Source: Magic Wand Media

monizes existing AI initiatives, from building language models (Digital India Bhashini) for increasing digital accessibility for citizens to skilling programs (YUVAi) demystifying AI for school students, to achieve the common goal of 'making AI in India and making AI work for India'. The National Strategy on Robotics has identified four priority sectors with the maximum potential to create large-scale socio-economic impact through robotics adoption and to position India as a global leader in robotics across these sectors by 2030. These include Manufacturing, Healthcare, Agriculture, and National Security. The Union Government is ardently advocating the adoption of robots with the Capital Goods Scheme and through institutions such as the Indian Institute of Technology (IIT) and the Indian Institute of Science (IISc). High import dependence, costly hardware components, and lack of funds for research and development remain primary challenges among Indian manufacturing companies in adopting automation and robotics. It is encouraging to see that some large companies like FANUC, ABB, KUKA, and YASKAWA have initiated projects for made-in-India robots. As more companies embrace this trend, the traditional way of manufacturing will see an overhaul and will set India on

the way to becoming an alternative factory of the world.

'Symposium on Automation & Robotics'

Industries in India need to move from conventional manufacturing techniques to smarter ways of manufacturing involving automation and robotics. To encourage the deployment of robotics in the manufacturing space and disseminate knowledge on the latest developments, Indian Machine Tool Manufacturers' Association (IMTMA) is organizing the 7th edition of the Symposium on Automation & Robotics on September 24 - 25, 2024, at Hotel Tip Top International in Pune. Assembly automation, industrial automation and robotics, laser cutting and sheet bending automation, smart manufacturing techniques, appropriate automation, welding automation, and more will be the topics in focus. Experts from a cross-section of manufacturing industries will make presentations through case studies and technology-related presentations. At the symposium, IMTMA also recognizes and rewards companies that have excelled in achieving superior performance by implementing automation and robotics in the manufacturing realm. Participating in the event will help augment Indian automation and robotics evolution. 

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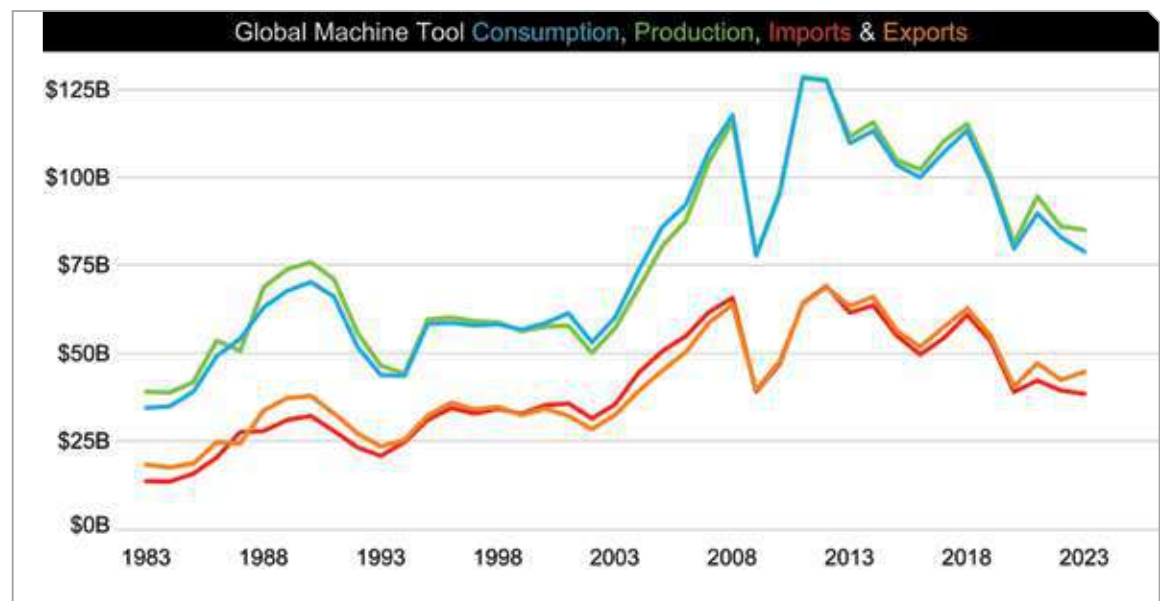


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WMTS: MINOR MARKET FLUCTUATIONS, US SEES GROWTH

According to the annual World Machine Tool Survey (WMTS) conducted by Gardner Business Media (publisher of Modern Machine Shop), global machine tool activity in 2023 was rather unremarkable with the US seeing growth across all metrics tracked by the survey.



This chart shows the global production, consumption, imports, and exports of the Machine Tool industry over the past 40 years, adjusted for inflation.

Global machine tool production was fairly stable while consumption fell some 5 percent across the top 50 industrialized countries in 2023. Specifically, overall machine tool consumption decreased from US\$ 83.0 billion (B) in 2022 to US\$ 79.0 B in 2023 while production decreased a little, from US\$ 86.2 B in 2022 to US\$ 85.3 B in 2023. Of the top-10 machine-tool-producing countries, Germany, the United States, Italy, and Spain posted year-over-year gains in real dollars (adjusted for currency exchange rates and inflation) over their 2022 levels, Spain to the tune of +22 percent. On the other hand, China,

Japan, and Taiwan posted declines in production, with Taiwan declining the sharpest, to the tune of -20 percent. The US is the only top-10 machine tool producing country that is also a top-10 machine tool consuming country and experienced a 5 percent or more increase in consumption. Spain and Switzerland join the US in being up at least 5 percent in consumption, looking at the top-10 machine tool producing countries that are also among the top-20 machine tool consuming countries. Mexico and Turkey enter the top-10 consuming countries, driven primarily by increases in imports.

Of the 2023 top-10 machine tool consuming countries, half of them post year-over-year declines in consumption. Taiwan declined the most (-28%) followed by South Korea (-16%).

The World Machine Tool Survey

These data come from the annual World Machine Tool Survey (WMTS) conducted by Gardner Business Media (publisher of Modern Machine Shop). Each year, the survey ranks the world's top countries in machine tool production, consumption, imports and exports. For the ranking, Gardner's Intelligence team takes

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China (US\$ 27.4 B) is far and away the number-one producer, producing nearly 2.5 times as much as Germany (US\$ 11.4 B). They were followed by Japan (US\$ 9.8 B), the US (US\$ 8.1 B), Italy (US\$ 7.5 B), South Korea (US\$ 5.0 B), Taiwan (US\$ 3.2 B), Switzerland (US\$ 2.7 B), India and Spain, each at \$1.5 B.

reported or estimated machine tool economic data and adjusts for exchange rates and inflation to enable year-to-year comparisons in real dollars. The top-10 producing countries were almost the same in 2023 as 2022, the only exceptions being Germany and Japan swapping positions, the former taking over the latter for the number-two producer spot in 2023. China (US\$ 27.4 B) is far and away the number-one producer, producing nearly 2.5 times as much as Germany (US\$ 11.4 B). They were followed by Japan (US\$ 9.8 B), the US (US\$ 8.1 B), Italy (US\$ 7.5 B), South Korea (US\$ 5.0 B), Taiwan (US\$ 3.2 B), Switzerland (US\$ 2.7 B), India and Spain, each at \$1.5 B. Germany held its position as top exporter, followed by China, which overtook Japan's 2022 runner-up slot. Japan, Italy, and South Korea follow in third, fourth and fifth, with South Korea taking Taiwan's former position. China was also the world's top machine tool consumer by a wide margin at two times the US, US\$ 25.7 B versus US\$ 12.8 B, respectively. Another big gap

in consumption followed behind them, in order, with Germany (US\$ 5.9 B), Italy (US\$ 5.2 B), Japan (US\$ 4.0 B), India (US\$ 3.1 B), South Korea (US\$ 3.0 B), Mexico (US\$ 2.4 B), Turkey (US\$ 1.9 B), and Taiwan (US\$ 1.3 B). China fell as top importer in 2023, overtaken by the US and followed by Germany, Mexico, and Italy.

Analyzing the data

The US is alone among the top-six machine tool producers in showing growth across all four areas tracked by the WMTS: consumption, production, imports, and exports. During the 2022-2023 period, the US dollar experienced less inflation than many comparable economies, which may have contributed to the increase in imports and consumption. Conversely, China and Japan declined across multiple metrics, with both nations seeing declines across three different metrics, including production and consumption. However, China reported strong growth in exports, providing some good news for Chinese OEMs. The US, China, Germany, Italy, and South Korea all experi-

enced growth in exports over 5 percent, with China's and Italy's exports growing by 20 percent or more. Unusually, this growth in exports did not lead to an increase in imports for most of the countries included in our data. In fact, imports fell worldwide, with the numbers diverging sharply from exports. This may indicate that countries that typically go unaccounted for in the WMTS dataset may have increased their machine tool imports. If so, a possible explanation for this change is that countries that have historically had smaller machine tool industries may be shoring up their manufacturing base.

Methodology

This is the 56th edition of an independent, annual survey that collects statistics from countries that produce and consume machine tools, comparing their production and consumption in real US dollars. It is conducted by Gardner Intelligence, the research department of Gardner Business Media Inc. Criteria for inclusion in the report are: 1) the country has imported at least US\$ 100 million of machine tools over at least

2023	CONSUMPTION		PRODUCTION		IMPORTS		EXPORTS	
COUNTRY	USD	Rank	USD	Rank	USD	Rank	USD	Rank
China	\$25.7 B	1	\$27.4 B	1	\$6.1 B	2	\$7.8 B	2
USA	\$12.8 B	2	\$8.1 B	4	\$6.5 B	1	\$1.7 B	8
Germany	\$5.9 B	3	\$11.4 B	2	\$2.8 B	3	\$8.2 B	1
Italy	\$5.2 B	4	\$7.5 B	5	\$1.9 B	5	\$4.2 B	4
Japan	\$4.0 B	5	\$9.8 B	3	\$0.8 B	13	\$6.6 B	3
India	\$3.1 B	6	\$1.5 B	9	\$1.7 B	7	\$0.2 B	21
South Korea	\$3.0 B	7	\$5.0 B	6	\$0.9 B	10	\$2.9 B	5

% negative change USD vs. 2022	<10% decrease	10-20% decrease	+20% decrease
% positive change USD vs. 2022	<10% increase	10-20% increase	+20% increase
No Change			

Source: MMS

Very few countries in the top-seven machine tool consumers experienced a steep growth or decline in any particular area, but the US notably experienced growth across all four metrics.



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Servo Type Drilling / Tapping
Spindle Head Unit



Built-in Motor Facing Head Unit - Flange Type



Boring/Milling Head Unit with ATC



Built-in Motor Spindle Unit



Built-in Spindle



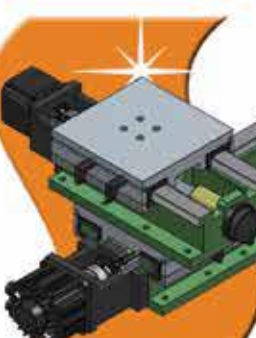
Belt Driven Spindle



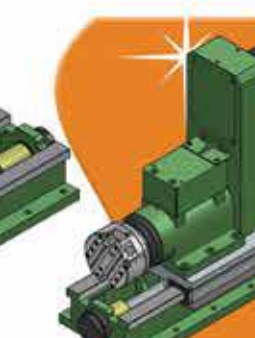
Belt Driven Spindle Coolant



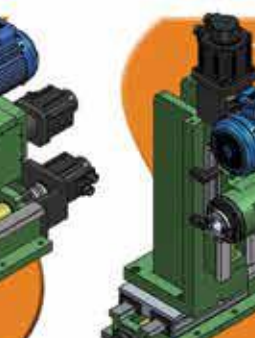
Direct Drive Spindle



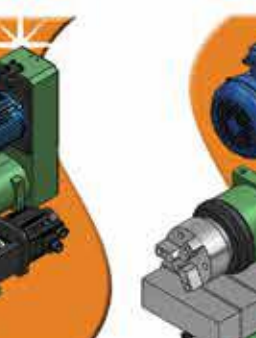
XY Servo Hardness Slide Unit



Servo Facing Head +
Servo Ball Screw Slide Unit



XYZ Servo Slide Table + Milling Head



3-Jaw Chuck Spindle + Slide Unit



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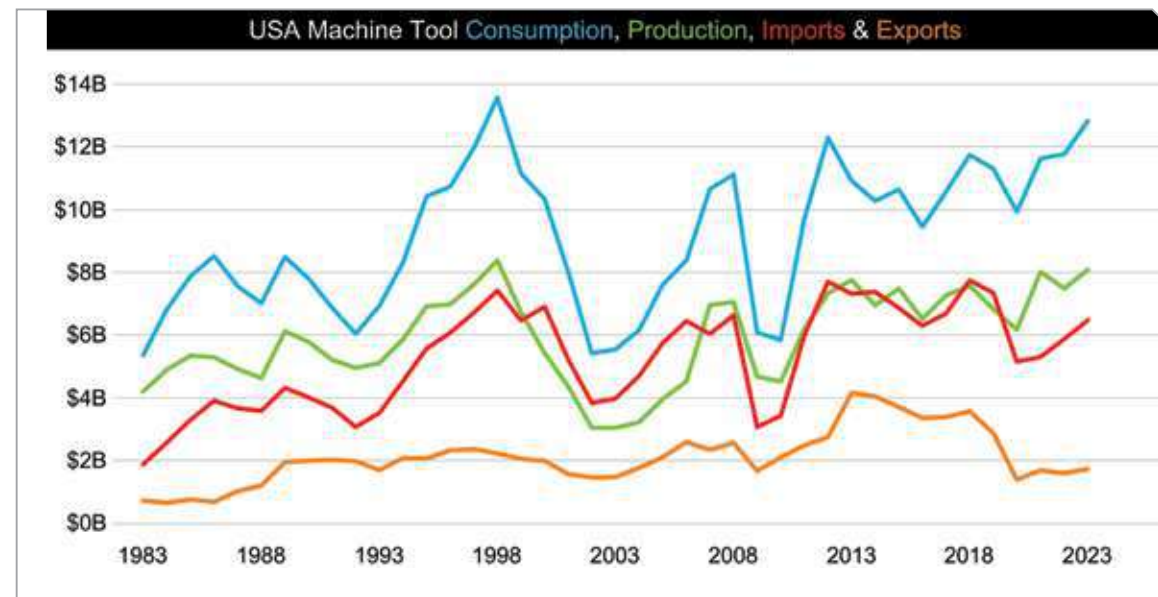


The US is alone among the top-six machine tool producers in showing growth across all four areas tracked by the WMTS: consumption, production, imports, and exports.

one year since 2001; and 2) the country's data are provided or reasonable estimates can be calculated. Data are reported for 51 countries in the 2023 report. Total import, export, and production data are provided by or estimated for, each country. Consumption is calculated by adding imports and production, then subtracting exports. The data typically are reported in local currencies, then converted to US dollars. Historic data are adjusted for inflation using the U.S. Bureau of Labor Statis-

tics' Producer Price Index for capital equipment. This adjustment promotes more accurate comparisons over time. For countries that do not report total imports and exports, data from the International Trade Centre (ITC) are used. ITC data are also used to report imports and exports at the machine tool category level for all countries. Estimates are calculated for production when data are not provided. Imports and exports at the machine tool category level typically sum to numbers

less than or equal to the corresponding totals reported. Differences are driven by reporting the top five rather than all eight machine tool categories. In rare instances, imports and exports at the machine tool category level sum to numbers higher than the corresponding totals reported, likely a function of the machine tool category level data including parts and components that are not included in totals. This discrepancy can also be an artifact of using different data sources. 



The US experienced growth in all areas measured by the WMTS in 2023, as shown in this graph. Both production and consumption were near the all-time high reached in 1998.

Source: MMS

16 17 18 19

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EVOLUTION OF SMART MANUFACTURING

This article explores the evolution of smart manufacturing from basic automation to advanced interconnected systems, highlighting the pivotal role of digital transformation and its future implications. It underscores the fact that although challenges exist, embracing smart manufacturing is crucial for competitiveness.



Source: Magic Wand Media

The industrial landscape is undergoing a seismic shift with the advent of smart manufacturing. Digital transformation, driven by the integration of the Internet of Things (IoT), Artificial Intelligence (AI), and Machine Learning, is revolutionizing how manufacturers operate. These advanced technologies enable real-time monitoring, predictive maintenance, and seamless production processes, drastically reducing downtime and operational costs.

Dawn of digital transformation

Digital transformation in manufacturing refers to the adop-

tion of digital technologies to enhance productivity, efficiency, and flexibility in production processes. This journey began with the automation of individual tasks and has evolved into a comprehensive approach that integrates various technologies across the entire manufacturing value chain.

In the early stages, automation technologies such as Computer Numerical Control (CNC) machines and Programmable Logic Controllers (PLCs) were game changers. They replaced manual processes, improving precision and consistency. However, these technologies operated in silos, limiting their overall impact on the production ecosystem.

Predictive maintenance: A game changer

Predictive maintenance is a cornerstone of smart manufacturing, transforming how maintenance activities are planned and executed. Traditionally, maintenance was either reactive, occurring after a breakdown, or preventive, based on scheduled intervals. Both approaches have significant drawbacks. Reactive maintenance leads to unexpected downtime and high repair costs, while preventive maintenance can result in unnecessary servicing and parts replacement. With predictive maintenance, manufacturers can use data analytics to forecast when a machine is likely to fail and schedule

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Organizers

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Tokyo Big Sight Inc.

Date

Nov.5 (Tue.) - Nov.10 (Sun.), 2024 (6 days)

Venue

Tokyo Big Sight (Tokyo International Exhibition Center)

Indoor Exhibition Space

118,540m²

Exhibits

Machine tools (Metal cutting, Metal forming) /
Machine tool accessories / Tools for machines (Cutting tool & wear-resistant tool) / Diamond, CBN tools /
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Oil hydraulic, water hydraulic and pneumatic machinery /
Precision measuring machines and instruments /
Optical measuring instruments / Testing machinery /
Controller and related software (CAD/CAM etc.) /
Other associated machinery and equipment, raw materials, technologies and publications



Source: Magic Wand Media

maintenance accordingly. AI algorithms analyze historical and real-time data to identify patterns that precede equipment failures. This proactive approach minimizes unplanned downtime, extends the lifespan of machinery, and reduces maintenance costs.

Role of newer technologies in manufacturing

The Manufacturing sector in India is poised to drive significant economic growth, bolstered by strategic industries such as Automotive, Engineering, Chemicals, Pharmaceuticals, and Consumer Durables. Pre-pandemic, manufacturing accounted for about 16 percent of India's GDP and is projected to be one of the fastest-growing sectors. India aims to become a major global manufacturing hub, targeting goods exports worth US\$1 trillion by 2030.

AI and machine learning are the driving forces behind the intelligence in smart manufacturing. These technologies enable advanced data analysis, automation of complex tasks, and the creation of self-optimizing systems. Machine learning algorithms can analyze vast amounts of data to uncover insights that would be impossible for humans to detect.

One application of AI in manufacturing is quality control. Traditionally, quality inspections are performed manually or with basic automated systems that can only detect obvious defects. AI-powered vision systems, however, can analyze products in real time, identifying even the slightest deviations from quality standards. These systems learn from historical data to continuously improve their accuracy, ensuring that only the highest quality products leave the production line.

Moreover, AI is key to optimizing supply chain operations. By analyzing data from various sources, including suppliers, production schedules, and market demand, AI algorithms can forecast demand more accurately and optimize inventory levels. This reduces the risk of stockouts and overproduction, leading to cost savings and improved customer satisfaction.

Challenges and future directions

While the benefits of smart manufacturing are clear, the transition is not without challenges. Integrating new technologies into existing systems can be complex and costly. There is also a need for skilled personnel who can man-

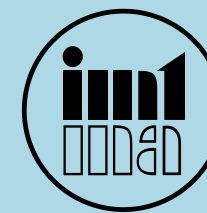
age and interpret the data generated by these technologies.

Cybersecurity is another critical concern. With increased connectivity comes the risk of cyber attacks. Manufacturers must invest in robust security measures to protect their data and systems from potential threats.

Looking ahead, the future of smart manufacturing promises even greater advancements. The convergence of 5G technology, augmented reality (AR), and blockchain will further enhance connectivity, traceability, and transparency in manufacturing processes. 5G will provide the high-speed, low-latency communication needed for real-time data processing, while AR can assist in training and maintenance activities. Blockchain will ensure secure and transparent supply chain transactions.

As technology continues to advance, smart manufacturing will become even more intelligent and interconnected, paving the way for a future where factories are not just automated, but truly autonomous and self-optimizing. Embracing these technologies is essential for manufacturers to remain competitive and meet the ever-evolving demands of the global market. 

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THE GROWING IMPORTANCE OF ESG IN MANUFACTURING

The integration of ESG into the Manufacturing sector is not just a trend; it is a fundamental shift towards a more sustainable and responsible future. Companies that view ESG as a strategic asset rather than a regulatory burden will likely lead the way in this new era of corporate governance.



Source: Magic Wand Media

REJI VARGHESE
MD
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The Manufacturing industry has long been a significant contributor to global economic growth and development. However, its impact on the environment and society has also been a subject of concern. The concept of Environmental, Social, and Governance (ESG) has emerged as a vital framework for manufacturers to assess and improve their sustainability and social responsibility practices.

In addition to environmental concerns, the Manufacturing industry also faces social challenges, such as labor standards and human rights. Companies must ensure that their supply chains are free from labor exploitations and that their workers are treated fairly. Governance is also critical in the Manufacturing industry, as companies must be transparent and accountable to their stakeholders, including shareholders, employees, and the community.



“Companies that view ESG as a strategic asset rather than a regulatory burden will likely lead the way in this new era of corporate governance. And as we look to the future, the integration of advanced technologies with ESG principles holds the promise of not only solving today’s challenges but also creating a more transparent and sustainable tomorrow.”

Peter Jacob
Co-Founder
Genverte

According to the report ‘Global Sustainable Investment Review 2022’ by the Global Sustainable Investment Alliance (GSIA), sustainable investments globally have surged from US\$ 22 trillion in 2016 to over US\$ 30 trillion in 2022, illustrating the growing importance and acceptance of ESG. The International Energy Agency (IEA) in its roadmap to Net Zero by 2050 forecasts that global investments in clean energy technologies will need US\$ 90 billion for projects before 2030 to meet climate goals, underscoring the critical role of ESG in driving the future of engineering and machine tools.

Navigating the ESG maze

Peter Jacob, formerly with Bharat FIH, a Foxconn Technology Group company, and now embarking on an ESG technology solutions company Genverte, says “Numerous frameworks exist to help companies align their practices with ESG principles. Prominent ones include the Global Reporting Initiative (GRI), the Sustainability Accounting Standards Board (SASB), and the Task Force on Climate-related Financial Disclosures (TCFD).”

Business Responsibility and Sustainability Reporting (BRSR)

In India, SEBI has introduced the BRSR framework, which requires the top 1,000 listed companies to disclose their ESG-related information as a mandatory process. These frameworks provide comprehensive guidelines on how to measure, manage, and report ESG performance. Additionally, ISO standards like ISO 14001 for environmental management and ISO 26000 for social responsibility offer structured approaches to integrating ESG into business operations. The integration of ESG into the Engineering sector is not just a fad; it is a fundamental shift to-

wards a more sustainable and responsible future. Jacob says, “Companies that view ESG as a strategic asset rather than a regulatory burden will likely lead the way in this new era of corporate governance. And as we look to the future, the integration of advanced technologies with ESG principles holds the promise of not only solving today’s challenges but also creating a more transparent and sustainable tomorrow.”

Environmental considerations

The manufacturing process has a significant impact on the environment, from resource extraction to waste management. Raghunadh Vaddadi, CEO, RapidQube, a company specializing in digital transformation solutions across manufacturing industries, says, “Companies must adopt sustainable practices to reduce their carbon footprint, minimize waste, and optimize resource use. Some key environmental considerations are renewable energy sources, water conservation, waste reduction and recycling, and supply chain sustainability.”

Social responsibility

Manufacturers must prioritize social responsibility by ensuring fair labor practices, safe working conditions, and community engagement. Vaddadi says, “Some key social considerations companies should consider are diversity, equity, and inclusion, labor rights and fair wages, health and safety, and community development.”

Governance and ethics

It is imperative for companies to implement effective governance and ensure ethical practices at all levels. Manufacturers need to be compliant with regulations and operate with transparency and accountability. Vaddadi says, “Some of the

In India, SEBI has introduced the BRSR framework, which requires the top 1,000 listed companies to disclose their ESG-related information as a mandatory process. These frameworks provide comprehensive guidelines on how to measure, manage, and report ESG performance.

The integration of ESG principles into manufacturing operations offers numerous benefits, including: improved brand reputation; increased operational efficiency; reduced costs and risks; access to capital and investment; and enhanced stakeholder trust.

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Raghunadh Vaddadi
CEO
RapidQube



factors important in governance are diversity and independence of the board, executive compensation, audit and risk management, and ethical sourcing.”

Benefits of ESG in manufacturing

The integration of ESG principles into manufacturing operations offers numerous benefits, including: Improved brand reputation; Increased operational efficiency; Reduced costs and risks; Access to capital and investment; and Enhanced stakeholder trust.

Several manufacturers have successfully integrated ESG principles into their operations, achieving significant benefits.

Siemens: Siemens is one of the largest industrial manufacturing companies in Europe and has long been a proponent of clean energy. In 2015, it was the first global industrial company to commit to achieving carbon neutrality by 2030. More recently, Siemens has taken its ESG commitment to the next level with its new DEGREE framework which stands for decarbonization, ethics, governance, resource efficiency, equity, and employability. Siemens also appointed Judith Weise, one of the top Chief Sustainability Officers in Europe, as its Chief People and Sustainability Officer. The DEGREE framework constitutes a 360-degree approach for all stakeholders – customers, suppliers, investors, people, the societies served, and the planet.

General Motors: General Motors launched a new DEI framework, strategy, and operational model in 2024, focused on leadership, talent equity, inclusive employee experience and culture and community, and social impact. The company was recognized in the Human Rights Campaign Foundation’s Corporate Equality Index and was awarded the Equality 100, the highest possible score in this category.

Moving towards circular economy principles

‘Circular economy’ is a system where materials never become waste and nature is regenerated. In a circular economy, products and materials are kept in circulation through processes like maintenance, reuse, refurbishment, remanufacture, recycling, and composting.

Jacob says, “ESG has made a tremendous impact on how manufacturing companies are thinking about the lifespan of their products and materials, with many companies moving toward a circular economy model. This means extending the life of products through refurbishing, remanufacturing, and recycling, which reduces waste and lessens reliance on finite resources. A circular economy helps companies increase their resilience, boost brand affinity, increase innovation, and drive new revenue streams—all while contributing to the net zero agenda.”

Sustainability and smart manufacturing

With the shift toward digital transformation, more and more companies are investing in new technologies like cloud computing, AI, VR, AR, etc., to improve efficiencies, bring down costs, and stay more competitive.

Mohanraj PB, the architect behind the innovative Genverte solution, says, “An unexpected effect of digitization has been the opening up of new possibilities for increasing sustainability. By integrating these new technologies, companies have been able to enhance their business operations and they can simultaneously hit ESG targets without much additional effort or resources.”

Addressing labor shortages

Amid persistent skilled labor shortages in the Manufacturing sector, ESG principles

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Mohanraj PB
CTO
Genverte



have been a guiding light for attracting talent and reducing turnover of employees. By focusing on the ‘S’ of ESG, companies have transformed their approach to worker safety, health, and satisfaction.

Vaddadi says, “ESG principles include ensuring safety and well-being for workers, facilitating a good work-life balance, providing growth and enrichment opportunities for workers, promoting a culture of diversity and inclusion, and demonstrating corporate social responsibility. By implementing various changes to abide by these principles, manufacturing companies can safeguard themselves against labor shortages, while also ensuring their employees are motivated to perform optimally.”

Ethical sourcing

With increasing scrutiny from stakeholders and the public on a company’s supply chain, it is essential that companies ensure ethical sourcing of raw materials, fair labor practices, and compliance with environmental regulations across their global supply chains. This development is intricately tied with ESG.

Jacob says, “Supply chains can have a substantial environmental impact, from raw material extraction to manufacturing processes and transportation. By increasing supply chain transparency, companies can identify their negative impacts and find ways to implement more sustainable practices. Both supply chain transparency and

ethical sourcing are also critical for ensuring social responsibility, fair labor conditions, and worker safety.”

ESG and innovation

The evolution of ESG in manufacturing has ushered in an age of innovation for the industry. The Manufacturing industry has been traditionally considered to be slow and resistant to change but ESG initiatives have been one of the main driving forces behind its recent transformation. Manufacturers are now leveraging advanced technologies such as IoT, AI, blockchain, and advanced analytics to optimize resource usage, reduce their carbon footprint, and drive operational efficiencies.

Jacob says, “Companies are transforming their product design for sustainability—using fewer components, incorporating recyclables into packaging, and using modular design principles to facilitate repair and upgradeability. All these innovations are helping manufacturing companies stay competitive and resilient in the face of potential future disruptions and turbulent markets while also supporting ESG goals.”

The integration of ESG into the Manufacturing sector is not just a trend; it is a fundamental shift towards a more sustainable and responsible future. Companies that view ESG as a strategic asset rather than a regulatory burden will likely lead the way in this new era of corporate governance. 

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Tech Talks is a column by industry veteran and journalist Reji Varghese that talks about the latest advancements in Machine Tools, provides snippets from history, interesting facts, etc. about the Machine Tool industry.

TO MEASURE IS TO KNOW

As the market potential for industrial metrology is growing strong, industry experts highlight advanced trends that they believe will be prevalent in the near future. They also share their two cents on integrating Industry 4.0 technologies and optical metrology in the product offerings.



Source: Magic Wand Media

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The industrial metrology market is projected to grow from US\$ 14.9 billion in 2024 to US\$ 20 billion by 2029, with an expected CAGR of 6.7 percent during this period. This growth is largely driven by the increasing demand for industrial metrology across sectors such as Automot-

ive, Defence, Aerospace, Electronics, and Manufacturing. In today's rapidly evolving industries, product quality is paramount. High-precision measurement tools are vital for maintaining accuracy and consistency, helping manufacturers meet stringent quality standards and customer demands. These

solutions are particularly crucial in the above-mentioned fields, where components must conform to tight tolerances. From aligning aircraft parts to controlling dimensions in car production or ensuring microelectronic precision, these measurement technologies are essential for product integrity and reliability.

APM Technologies 3D Pvt Ltd



ANIL GUPTA
Managing Director
APM Technologies 3D
Pvt Ltd



Trends that herald more intelligent metrology solutions

The industrial metrology market is witnessing significant advancements, with two

key trends expected to become more prevalent:

Adoption of Automated Optical Inspection (AOI) Systems: AOI systems are becoming increasingly popular in industrial metrology due to their ability to provide fast, accurate, and non-contact inspection of parts and assemblies. These systems leverage advanced imaging technologies and machine learning algorithms to detect defects and ensure quality control in real time. The integration of AOI systems enhances productivity and reduces the likelihood of human error, making them a crucial component in modern manufacturing environments.

Adoption of Portable Metrology Solutions: Portable metrology solutions are on the rise, allowing for on-site measurements and inspections. These solutions offer flexibility and reduce the need for transporting parts to centralized inspection facilities, thereby saving time and costs while maintaining high accuracy.

These trends highlight the move towards more intelligent and flexible metrology solutions in the industry.

Integration of Industry 4.0 technologies and optical metrology

The integration of Industry 4.0 technologies and optical metrology in product offerings is transforming the landscape of manufacturing and quality control. This integration is perceived as Enhanced real-time quality control, Smart manufacturing and zero-defect production, Improved data-driven decision-making, and Addressing industry challenges. Based on recent analyses and market trends, several new industry sectors are expected to experience significant demand growth in the coming years. The most promising sectors include Automotive, EV, Healthcare, Renewable Energy, and Education Technology (EdTech).

APM offers solutions in the field of Scanning and Deformation measurements. Our ATOS Scanning system and TRITOP Photogrammetry systems offer scanning solutions for a wide variety of components, while the cutting-edge ARAMIS, ARGUS, and PONTOS address different deformation needs. In addition to Scanning, we offer services for Surface Modeling, Class A Surfacing, Solid Modeling, Scan-based inspection, and Quality Control to offer a completely reverse-engineered part and help customers with their product development process.



Carl Zeiss India (Bangalore) Pvt Ltd



AVEEN PADMAPRABHA
Divisional Head -
Industrial Quality
Solutions
Carl Zeiss India
(Bangalore) Pvt Ltd



Automation for quality and efficiency

The use of automation in metrology will enable

faster and more accurate measurements, reducing the time and effort required for quality control. This will be particularly useful in high-volume manufacturing environments, where speed and efficiency are essential. Industry 4.0 will facilitate the integration of metrology data into the production process, allowing for real-time feedback and adjustments to improve quality and efficiency. This will enable manufacturers to optimize their production processes and improve product quality, leading to increased customer satisfaction and loyalty.

Enabling real-time control of production processes

The integration of Industry 4.0 technologies and optical metrology in product offerings will provide numerous benefits. Optical metrology can provide accurate and reliable measurement of 3D data that can be integrated with other data sources to optimize production processes and improve product quality. This integration will enable real-time control of production processes, ensuring consistent quality and reducing the likelihood of defects. The integration of Industry 4.0 technologies will also enable the automation of production processes and the use of predictive analytics to anticipate issues before they occur. This will help manufacturers to reduce downtime and improve overall efficiency, leading to increased profitability and competitiveness.

Meeting customers' specific needs

Automotive, Electric and Hybrid vehicles, Aerospace, Electronics, and Medical manufacturing industries are currently key sectors for Carl Zeiss India. However, we are constantly developing new solutions based on customer feedback. This indicates that we are committed to staying ahead of industry trends and providing customers with the solutions they need to succeed. While it is difficult to predict which new industry sectors will see more demand in the coming years, it is clear that Carl Zeiss India will be ready to support these sectors with innovative solutions that meet their specific needs. By focusing on customer feedback and staying ahead of industry trends, we are well-positioned to continue growing and expanding our metrology portfolio in India and beyond.



Mahr Metrology India Pvt Ltd



DEEPAYAN DAS
Managing Director
Mahr Metrology India
Pvt Ltd



Shopfloor measurement one of the trends

The domain of industrial metrology is changing fast. As manufacturing

becomes smarter, metrology needs to evolve to maintain pace with the changed modern manufacturing. While several trends are visible in the field of metrology, two of the dominating trends are measurement on the shopfloor and faster measurement. The former means the parts do not need to travel to the Standards Room but can be measured with the same (or better) accuracy on the shopfloor. The latter means that more and more measuring stations will become automated. We will see a lot of cobot-assisted measuring solutions emerging to ensure faster speed of measurement, reduced cycle time, and minimum operator intervention. Together these trends will go a long way in shaping the metrology of the future. Mahr has been working with our customers in developing products and technologies in both these areas. In the recently concluded Innovation Days organized in Mahr HQ in Gottingen, Germany, we showcased a host of products and solutions targeted towards these trends.

SMAHRT Metrology

Industry 4.0 has been at the forefront of Mahr's product designs. In a connected manufacturing environment, we believe that measuring instruments have to be smarter. This has led to SMAHRT Metrology which means intelligent and networked measurement technology. The SMAHRT Metrology has two parts SMAHRT Products, which are automatic, fast, user-friendly, intelligent, and networked, and SMAHRT Solutions, which are individual, networked, and semi- and fully-automated customer solutions. From our simple Callipers to Integrated Measuring stations, we keep the SMAHRT concept in mind in all our products. Mahr, through its 160 years of history in designing and manufacturing world-class metrology solutions, realizes the importance of optical technology in today's metrology solutions. Many interesting and innovative solutions like the Mahr 4D PLQ 4200 and the range of Mahr solutions in Optical 3D Surface Metrology bear testimony to this fact. Sunrise sectors, including Aerospace, Defence, Medical, EV Manufacturing, and Renewable Energy, are to be major drivers of demand for metrology solutions in the coming years.

Marposs India Pvt Ltd



LUCA MATTEUCCI
Managing Director
Marposs India Pvt Ltd



Optimizing processes and arresting unforeseen breakdowns

The IoT capabilities of Marposs measurement and inspection devices allow them to connect to factory networks and collect re-

al-time data from different production stages. This connectivity enables seamless integration with other smart devices and systems in the manufacturing environment.

Advanced data analysis techniques are used to examine the vast amounts of data collected by Marposs equipment. By identifying patterns, trends and anomalies in the manufacturing process, this study provides insightful information for process optimization. Marposs devices track variables such as temperature and vibration to continuously monitor the health of production equipment. By examining these parameters, the system can predict when maintenance is required before a breakdown occurs. The system alerts maintenance staff when it detects potential equipment failure, allowing them to schedule maintenance during planned downtime rather than in response to unforeseen breakdowns.

MAINDO and C-THRU4.0

The advancement in sensor technology and its integration with the Internet of Things (IoT) includes: IoT Connectivity, Predictive Maintenance and Enhanced Data Analytics.

MAINDO acts as an enabler for Industrial IoT by integrating these advanced sensor technologies and IoT connectivity, providing a comprehensive solution that enhances data-driven decision-making and operational efficiency, granting high security standards. MAINDO is a platform that integrates, shares, and leverages data produced by Marposs and third-party systems focused on quality assurance, manufacturing procedures, and environmental factors. This aligns with Industry 4.0 concepts by providing - Centralized Data Access, Root Cause Analysis, Web-based Accessibility, and Cyber Security.

The second trend is the need of database management systems for tool, process and machine monitoring. With our C-THRU4.0, each individual machining step can be viewed in detail and comprehensively. The software also provides information on process quality.

To be at the forefront of the Automotive industry, Marposs focuses on these developments and keeps upgrading its range of technologies. The company will be able to handle new challenges and seize new opportunities in the evolving automotive landscape with new industries like E-Mobility, Biomedical, Aerospace, HVAC, Electronic, and Semiconductor. Also, thanks to our commitment to research and development, we look forward to strategic partnerships and customer-centric solutions.

PolyWorks India



UDAY DIXIT
General Manager
PolyWorks India



3D metrology and portable scanning devices

Adoption of 3D Metrology and portable scanning technologies - With 2D drawings slowly phasing

out of practice, 3D metrology is expanding rapidly. This is mainly driven by the greater efficiency in terms of quick understanding of the inspection requirements and measurement data. This is coupled with the trend of using portable scanning devices, which facilitates quick in-field measurements and inspections. This increases flexibility and reduces the need for transporting objects to metrology labs.

Integration of data management system - A highly secured data management system that can handle large volumes of measurement data and provide quick access to customized analysis is in great demand. Such systems can provide deeper insight improving decision making.

Optical metrology with Industry 4.0 technologies have advantages

The fusion of advanced optical metrology with Industry 4.0 technologies enhances quality control processes by improving accuracy, efficiency, and connectivity within manufacturing processes. Here's how this integration is perceived and its potential impacts:

Real-time data collection - Since the Optical Inspection system can continuously collect measurement data, it can provide instant feedback enabling quick adjustments and corrections to maintain product quality.

Automated inspection - When integrated with an automated system such as robots, high-speed continuous inspection is possible which reduces human error with a high level of throughput.

Adaptive manufacturing - A large volume of inspection data is generated by an optical inspection system if directed to an efficient data management system. An informed decision can be made regarding process improvement and quality management.

In the coming years, several new industry sectors in India are poised to see rising demand due to technological advancements, policy support, and evolving consumer preferences. These sectors include Renewable Energy, Electric Vehicles (EVs), Information Technology and Digital Services, and Advanced Manufacturing and Industry 4.0.



Around 70-80% decision makers of B2B Manufacturing Sector still prefer Print over Digital.

- Harvard Business Review

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SEEING IS BELIEVING: 3D VISION SYSTEM ENABLES BIN-PICKING ROBOT

With the help of a 3D vision system and robotic arms from FANUC, MetalQuest was able to automate a physically challenging bin-picking task.



MetalQuest is a precision manufacturer and internal FANUC integrator that recently added its first cell with a 3D vision system. The cell machines castings, which arrive at the cell in boxes from the foundry.

“Bin picking is basically the Holy Grail of robotic automation,” says Scott Harms, President, MetalQuest Unlimited Inc. For a human, bin-picking is often non-ergonomic, especially when parts are heavy, leading to carpal tunnel and other repetitive-use injuries. It also tends to be dull work. “People that are doing it can get burned out relatively rapidly,” he adds. However, this task has proved challenging to automate because it requires 3D vision. And according to Harms, “Vision

is the ultimate complexity when it comes to robotics.” Harms’ company, MetalQuest, is not only a manufacturer of precision machined components with locations in Nebraska and Idaho, it’s an authorized internal FANUC integrator. The shop recently tackled the challenge of automating bin picking head-on by implementing its first 3D vision system from FANUC. According to Harms, integrating an automation cell with 3D vision is ‘more than twice as

complex’ as a 2D vision system, but automating this task has been beneficial to the company’s culture.

Casting call

The part the new cell makes starts with a casting. “These parts are literally dumped into a box at the foundry,” Harms explains. When they arrive, they are all at different angles in the box, slanted in different ways. Traditionally, getting these castings into an automation cell

would require an operator to move the eight-pound casting from the box and place it onto a tray or conveyor so a robot can pick it up and load it into a machine tool. These castings are not symmetrical, leading to further complexity – they typically need to be oriented in a certain way for a robot to pick them up and load them into the machine. A 3D vision system enables a robot to pick up castings directly from this box. Now, the operator pushes a box of castings to each of the cell’s two stations. A 3D vision system mounted on a gantry scans one of the boxes and gives a nearby robot positional information on where the castings are located and how they are oriented. If the vision system cannot identify any castings that are oriented in a way the robot can grab, it tells the robot to run what’s called a ‘stir routine’, where the robot moves the parts around in the box until some of them are reoriented in a way it can grab. The system works through one box at a time, at which point an air cylinder slides the vision system

over to the other box and works through that. When both boxes are empty, an alarm sounds, notifying operators to bring over more boxes of castings. After the robot has picked up a casting, the 3D vision system verifies the part and gives the robot more information on the casting’s orientation and how it was picked up. The top and bottom of the casting are not symmetrical, and it needs to be oriented correctly when it goes into the machine tool, so the robot sets the casting in a regrip station with a 2D vision system. This system tells the robot which side of the casting is on top and reorients it if necessary. Then the robot sets the castings into a load station, where the second and third robots can pick it up and perform foreign object detection on the casting. These castings are made using cores, so there’s a risk of material such as excess cast iron or deburring media getting trapped inside. “We have got these very expensive tools that go into these ports and it’s really important that those holes be

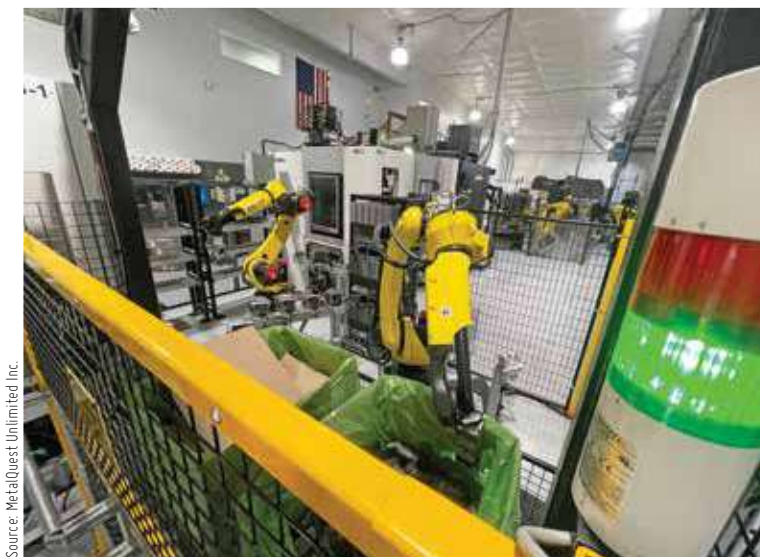
there,” Harms explains. “When they are not, very bad things happen.” The robots have fingers that go inside the casting and confirm it’s clear. If the robot does find debris in the casting, it sets the casting off to the side and moves on to the next one, though Harms notes that this doesn’t happen often. The second and third robots load the castings into one of three Okuma HMCs, and unload them when the machining cycle is finished, placing them onto a rack where operators prepare the finished parts for shipping.

Adding another dimension

According to Harms, implementing the 3D vision system was significantly more challenging than implementing a 2D vision system, which MetalQuest has extensive experience with (in fact, it was a component of the first cell the company implemented in 2011). To prepare for this new technology, the company sent several employees to FANUC headquarters for training on implementing 3D vision systems. Employees also learned a lot on their own. “There was a lot of trial and error involved,” Harms notes.

The robot’s movement as a result of the extra dimension of vision makes this application very complex. Harms points out that when a robot picks parts off a tray or conveyor, the Z-height the robot travels is fixed. When picking parts out of a box, the Z-height changes as the box empties. Furthermore, the robot has to figure out how to work around other parts in the box, and reach all four corners. “It has to recognize the surfaces that it is programmed to pick off of,” he explains, “and then it has to articulate in a way to make its end effector parallel to the surfaces it needs to pick off of.”

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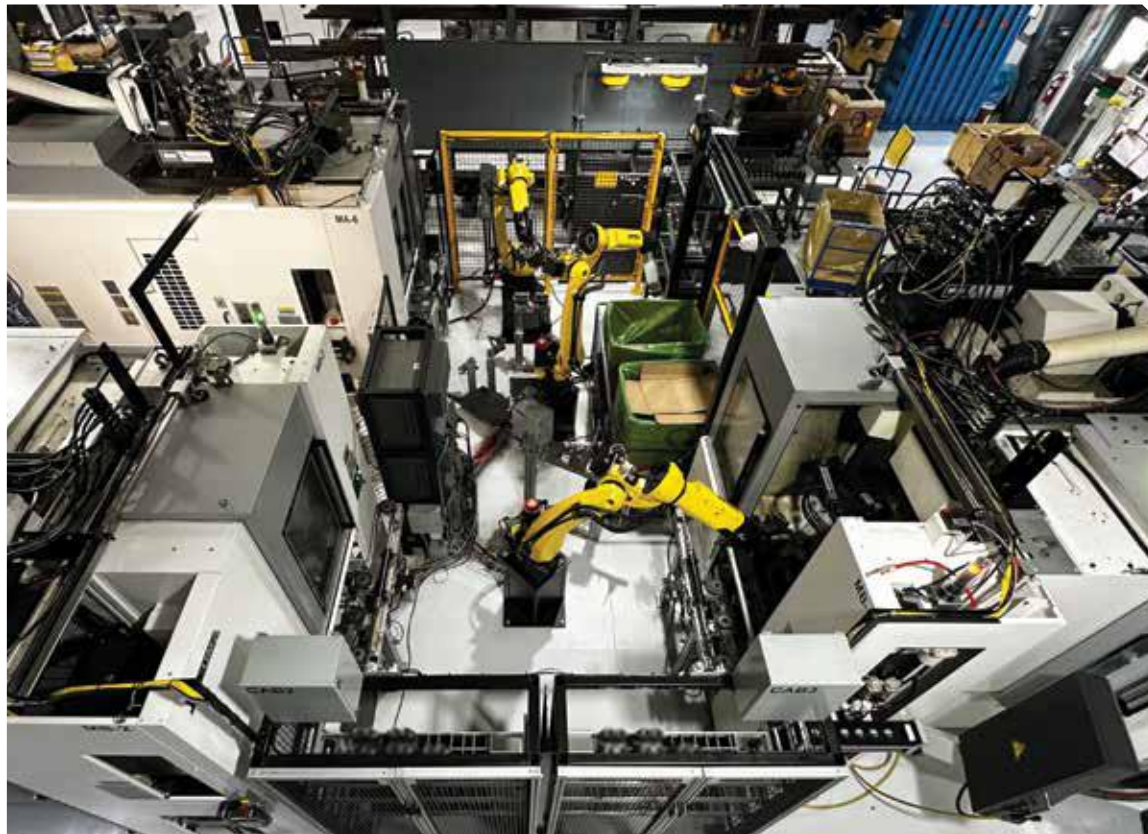


The vision system is mounted on a gantry above the boxes, and provides the robotic arms with data that enables the robot to pick up castings regardless of where they are in the box and how they’re oriented. Humans no longer need to remove each eight-pound casting from the box and place them on a tray or conveyor.

JULIA HIDER
Robots and Autonomy
Correspondent
Gardner Business
Media



Because this cell deals with castings that might have foreign objects inside that could potentially damage a cutting tool or a machine, it's vital for the shop to detect abnormalities in cutting tool forces and stop the machine if it detects something unusual.



The robot then verifies the casting, reorients it if necessary, in a regrip station, and sets it into a load station. Another robot picks up the casting, performs foreign object testing, then loads it into an Okuma HMC for machining.

Source: MetalQuest Unlimited Inc.

End effectors also have different considerations in 3D vision applications versus ones with 2D vision. Harms says that end effectors for 2D vision systems are typically basic and straightforward, while 3D vision systems need end effectors that are more streamlined and can maneuver around other objects (in this case, the other castings in the box). The robot with the 3D vision system uses a magnetic end effector from Magswitch.

Running lights out, but not actually

According to Harms, this cell can run for hours unattended. "We designed this thing to run a full shift without user intervention," Harms says. The cell even runs lights-out, though not in the literal sense of the term. "You literally leave the lights on," he explains. MetalQuest

has LED lights on its shop floor, which emit certain light patterns. These light patterns need to stay consistent for the 3D vision system to work. "Otherwise you're screwing up the eyes of the vision systems, if that makes sense," he says. This consistent extra run time makes up for the fact that the cell actually moves slower than a human. The cell can keep running where humans need to take breaks and go home at the end of the shift.

Process control

As with any automation cell, process control plays a key element in its success. Harms notes that everything from fixturing to chip control needs to be taken into account. One aspect Harms highlights is tooling. Because this cell deals with castings that might have

foreign objects inside that could potentially damage a cutting tool or a machine, it's vital for the shop to detect abnormalities in cutting tool forces and stop the machine if it detects something unusual. "You have to use quality cutting tools and you have to get consistent life out of them," he says. Additionally, the shop uses tool management software and tool breakage detection on its machines. MetalQuest uses Tool Life Management and Cutting Status Monitor from its machine tool supplier, Okuma.

Automation impacts

Harms says the biggest impact of this cell has been on its employees, who are now freed from a physically challenging and mentally monotonous task. "Culture is so very important to us," he says, and automation plays a key role in the culture at MetalQuest.



The cell runs unattended during overnight shifts, though not literally 'lights out' due to the vision system's need for light. Tool life management and tool load software from Okuma help prevent crashes and other issues during unattended machining.

Source: MetalQuest Unlimited Inc.

"The people we have typically embrace something like this because it's a job that they don't really want to do and it's being automated," he adds. However, Harms also cautions that companies should never

approach automation with the intention of replacing people. Instead, companies should look for tasks that will make employees' jobs more enjoyable. "We have just changed the roles and responsibilities of our people,"

he explains. "Instead of loading the machine itself, they are making sure the robot has what it needs to do its job and the entire process itself is functioning as it's supposed to be."

Seeing into the future

According to Harms, 3D vision and robotics is a bit of a work in progress. For now, it's best suited to high-volume work. "There's just too much refinement and there's too much process you have to put in place," he explains. "Everything is down to pixels, so the system is looking at all these pixels and trying to translate them into known shapes, and then it has to convert that to geometric data the robot can use." The time and effort required to set up the system's hardware and software is prohibitive for lower volumes. But Harms expects that won't be the case indefinitely. "It's definitely an evolving technology," he adds. 

Harms cautions that companies should never approach automation with the intention of replacing people. Instead, companies should look for tasks that will make employees' jobs more enjoyable.



Source: MetalQuest Unlimited Inc.

Automation is an important element of MetalQuest's culture. By freeing employees from physically changing and monotonous tasks, they're free to take on more interesting and higher-value work.

CARVING A NICHE WITH PRECISION

Guhring India, a subsidiary of the global Guhring Group, has had a notable journey in the Indian market since its inception. It has evolved significantly by leveraging its parent company's extensive expertise in cutting tool technology and its commitment to innovation while serving diverse industries with tailored solutions that enhance productivity and precision.

Established in 1997, Guhring India initially focused on providing high-precision cutting tools and solutions to support India's burgeoning Manufacturing sector. Gautam Ahuja, CEO & Managing Director, Guhring India, reflects on this journey, stating, "Our evolution has been marked by several key milestones aimed at enhancing local manufacturing capabilities and customer-centric solutions."

From standard to specialized tools

Guhring India began with a range of standard cutting tools and gradually expanded its offerings to include specialized tools tailored to meet the specific needs

of various industries, such as Automotive, Aerospace, and General Engineering. Recognizing the importance of local manufacturing to better serve the Indian market, the company established a state-of-the-art manufacturing facility in Bangalore. Ahuja emphasizes that this facility not only produces Solid Carbide tools but also high-performance PCD tools according to customer requirements, ensuring flexibility and responsiveness.

Another cornerstone of Guhring India's success has been its focus on customer support and service. "We place a strong emphasis on customer support, offering technical assistance, training programs, and application engi-

neering services," he shares. "This approach has helped build strong partnerships with manufacturers across India who rely on Guhring for optimizing their machining processes." Furthermore, keeping pace with technological advancements, it has integrated Industry 4.0 principles into its operations and leveraged digital tools for tool management, predictive maintenance, and data-driven insights to enhance productivity and efficiency for its customers.

Innovation unleashed

Guhring is renowned for several product lines that have made a significant impact on productivity across various industries, including in India.

"While we benefit from being part of a global network with 70 manufacturing plants worldwide, we have our own local manufacturing facilities in India. These facilities are equipped with state-of-the-art machinery and adhere to Guhring global manufacturing standards, enabling Guhring India to produce high-quality cutting tools locally."

Gautam Ahuja
CEO & Managing Director
Guhring India



Twist Drills: Guhring's twist drills are highly regarded for their precision, durability, and efficiency in metal cutting and drilling applications. They offer a wide range of twist drills tailored to different materials and machining requirements.

Thread Cutting Tools: The company manufactures thread cutting tools such as taps and thread mills that are known for their high quality and performance. These tools are crucial for creating accurate threads in a variety of materials.

Milling Cutters: The milling cutters are designed for high-speed machining and are capable of achieving superior surface finishes and accuracy. They offer a comprehensive range of milling solutions for diverse milling operations.

PCD Tools: Guhring India has a top-notch production and inspection set-up for the manufacture / retooling of high-performance brazed-type Polycrystalline Diamond (PCD) tools in its Bangalore facility.

Micro Tools: Guhring also offers specialized solutions tailored to the precise needs of electronic component manufacturing. It provides micro drills with diameters starting from very small sizes, catering to the intricate machining requirements of electronic components. They are available in various configurations to suit different materials and machining conditions. The company offers a range of tools for printed circuit board (PCB) manufacturing, including routers and drills specifically designed for the PCB industry.

Ensuring quality and performance

Guhring India maintains rigorous quality standards across its operations, ensuring that its products not only meet

but exceed industry requirements. "The ISO 9001:2015, ISO 14001:2015, and ISO 45001:2018 certifications from Intertek stand testimony to the commitment of Guhring India for the above purpose," Ahuja points out.

The company ensures consistent quality and performance across its diverse product range through several key strategies and capabilities, including in-house carbide production, precision grinding machines, coating technologies, continuous improvement and innovation, stringent quality control, and a skilled workforce.

Guhring's ability to produce carbide in-house allows for strict control over raw material quality, ensuring only high-quality carbide materials are used in its tool manufacturing processes. "This control is crucial for achieving consistent performance and durability in our products. We utilize state-of-the-art grinding machines (made by the Guhring Machine Building Department) in our manufacturing processes," explains Ahuja. "These advanced machines enable the manufacturing of cutting tools to exact specifications, ensuring each tool meets the required geometry and cutting-edge quality for optimal performance."

Guhring's product lines like twist drills, thread cutting tools, milling cutters, and PCD tools are lauded for their precision and efficiency across automotive, aerospace, electronics, and medical sectors.



Guhring India integrates Industry 4.0 principles into operations, enhancing productivity through digital tools for tool management, predictive maintenance, and data-driven insights.

Guhring's expertise in coatings enhances tool performance characteristics such as hardness, wear resistance, and lubricity. With its coating facilities and technologies, Guhring can tailor coatings to specific applications and ensure consistent quality across its product range.

"By investing in research and development, Guhring India stays at the forefront of cutting tool technology, incorporating advancements that further enhance tool performance and longevity," Ahuja adds. Additionally, the company employs highly skilled engineers, technicians, and quality assurance professionals who uphold the company's standards of excellence.

Championing environmental responsibility

As part of its commitment to sustainability and green practices, the company undertakes several initiatives aimed at minimizing environmental impact and promoting sustainable manufacturing practices. "We focus on optimizing energy use in our manufacturing processes and investing in energy-efficient equipment and technologies to reduce energy consumption and lower carbon emissions," shares Ahuja. Waste reduction strategies to minimize waste generation are implemented in its operations, such as recycling materials and responsibly managing waste disposal.

"Operating in India requires compliance with local regulations and standards. We ensure that our manufacturing processes and products adhere to all applicable Indian standards, certifications, and regulatory requirements. This local compliance enhances trust and confidence among Indian customers."

Gautam Ahuja
CEO & Managing Director
Guhring India

Water conservation is another key focus, including rainwater harvesting, implementing water-saving technologies, recycling water where feasible, and promoting responsible water usage practices among employees. Emphasizing the green supply chain, the company collaborates with suppliers who adhere to sustainable practices and environmental standards. This ensures that raw materials and components used in manufacturing processes are sourced responsibly, minimizing environmental impact throughout the supply chain. Guhring India also explores the use of eco-friendly materials and designs in its products and packaging, reducing packaging waste, using recyclable materials, and designing energy-effi-

cient products.

Employee engagement in sustainable practices is also a priority. Guhring India educates and engages employees in sustainable practices and environmental stewardship, which includes training programs on energy conservation, waste management, and the importance of sustainability in daily operations. Furthermore, the company ensures compliance with local environmental regulations and standards. This includes monitoring emissions, managing hazardous materials responsibly, and conducting regular environmental audits to maintain environmental compliance.

Custom solutions for complex challenges

Guhring India distinguishes itself in the competitive cutting tools market through its customization capability and the Guhring Tool-Management Service (GTMS), offering tailored solutions that cater specifically to the unique needs of customers.

The company engineers work closely with customers to understand their machining requirements, challenges, and goals and develop bespoke tooling solutions that optimize performance, improve efficiency, and reduce machining costs. "The ability to customize tools extends beyond just modifying existing designs," he elucidates.

"Guhring can develop entirely new tool geometries, coatings, and materials to suit unique machining applications or materials encountered by customers." GTMS, on the other hand, is a comprehensive tool management solution that helps customers optimize their tooling inventory through analysis, planning, stocking, and replenishment based on usage patterns and production schedules. This service is particularly advantageous for large-scale manufacturing operations where efficiency and cost-effectiveness are critical. GTMS also includes ongoing technical support and training for customers' staff, ensuring operators are knowledgeable about the tools they use, maximizing productivity, and ensuring safety in machining operations. Offering custom-made tools and GTMS sets Guhring India apart from competitors who may focus solely on standard product offerings. This differentiation allows the company to address niche markets and complex machining challenges that require specialized solutions. "Customers appreciate the responsiveness and personalized attention they receive, leading to long-term partnerships and repeat business," he adds. "These capabilities strengthen Guhring's market position as a trusted provider of high-performance cutting tools and comprehensive tooling solutions, positioning it as a preferred partner for industries demanding precision, reliability, and efficiency in machining processes."

Global strengths, local excellence

Since Guhring has manufacturing plants across the globe, the cutting tool requirement of the local market is met by the respective Guhring subsidiary present in the region. "In

"We place a strong emphasis on customer support, offering technical assistance, training programs, and application engineering services. This approach has helped build strong partnerships with manufacturers across India who rely on Guhring for optimizing their machining processes."

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Guhring India

the same way, Guhring India majorly caters to the cutting tool requirement of the Indian Market. Few niche tools are exported to customers in Asia and Australia," informs Ahuja.

Guhring India effectively balances global expertise with local manufacturing needs, particularly in the context of the 'Make in India' initiative, through several strategic approaches. "While we benefit from being part of a global network with 70 manufacturing plants worldwide, we have our own local manufacturing facilities in India," he explains. "These facilities are equipped with state-of-the-art machinery and adhere to Guhring global manufacturing standards, enabling Guhring India to produce high-quality cutting tools locally."

The company understands the specific requirements of the Indian market and industries, as it leverages its global expertise in tool design, materials, and coatings, but also adapts these technologies to suit local manufacturing practices and materials commonly used in India.

"Operating in India requires compliance with local regulations and standards. We ensure that our manufacturing processes and products adhere to all applicable Indian standards, certifications,

and regulatory requirements. This local compliance enhances trust and confidence among Indian customers," adds Ahuja.

Despite local production, Guhring India is seamlessly integrated into Guhring's global supply chain network, allowing for efficient sourcing of raw materials, access to advanced technologies, and global best practices in manufacturing and quality control.

Additionally, the company invests in training and developing local talent to ensure that its workforce is skilled and capable of operating at international standards on manufacturing processes, quality assurance, and customer service, aligning with the company's commitment to excellence across all operations.

Engines of sectoral growth

Several industry sectors in India are expected to create more demand for cutting tools in the near future due to various factors such as technological advancements, infrastructure development, and evolving consumer demands, as per Ahuja. He identifies some of the potential sectors that are expected to experience increased demand for cutting tools, including:

Automotive: With increasing vehicle production, advancements in electric vehicle (EV) manufacturing, and requirements for lightweight materials, there is a growing need for high-precision cutting tools for machining components.

Aerospace and Defence: India's Aerospace and Defence industries are expanding, driven by government initiatives such as 'Make in India' and growth in civil aviation. This sector requires cutting-edge tools for manufacturing aircraft components, defence equipment, and space technology.

Electronics and Semiconductor: With the rise in consumer elec-

High-demand sectors such as automotive, aerospace, electronics, medical, infrastructure, renewable energy, industrial machinery, and oil & gas are projected to boost cutting tool demand in India.



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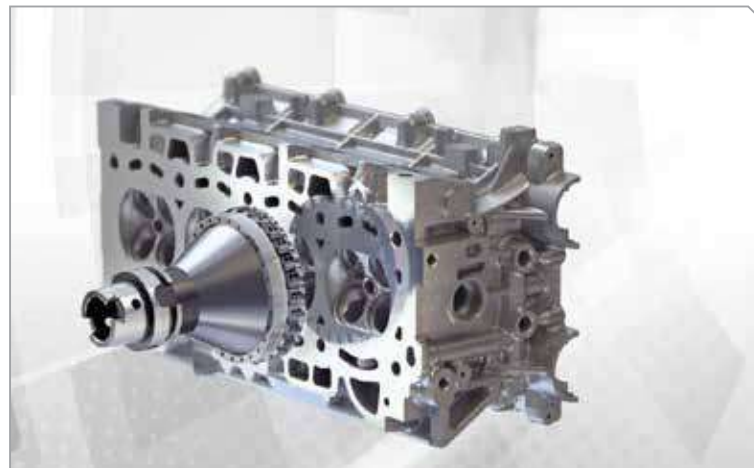
tronics, telecommunications, and semiconductor manufacturing, there is a rising demand for micro tools and precision cutting solutions. These industries require tools capable of machining small, intricate components with high accuracy.

Medical Implants & Devices: The Medical industry in India is experiencing robust growth, driven by increasing health-care investments and rising demand for advanced medical equipment. Cutting tools are essential for manufacturing surgical instruments, implants, and diagnostic devices.

Infrastructure and Construction: India's Infrastructure sector, including projects in transportation, energy, and urban development, is expanding rapidly. Cutting tools are crucial for manufacturing construction machinery, equipment parts, and structural components.

Renewable Energy: As India transitions towards renewable energy sources such as solar and wind power, there is a growing demand for cutting tools used in manufacturing components for renewable energy systems, including turbine parts and solar panels.

Industrial Machinery: Various industries involved in manufacturing machinery and equipment for different sectors, including textile machin-



Source: Guhring India

ery, packaging machinery, and agricultural machinery, require cutting tools for precision machining of components.

Oil & Gas: The Oil & Gas sector, particularly in exploration, extraction, and refining activities, continues to require specialized cutting tools for machining components used in drilling, pipelines, and processing equipment. "Overall, these sectors represent significant growth opportunities for cutting tool manufacturers in India, driven by technological advancements, infrastructure investments, and increasing demand for high-precision manufacturing capabilities across various industries," says Ahuja.

Strategic leap towards growth

Establishing a manufacturing plant and a service center in In-

dia represents a strategic move for Guhring to solidify its footprint in the region, capitalize on growth opportunities, enhance market competitiveness, and contribute to sustainable development goals. "This outlines a pathway towards leveraging local strengths while aligning with global strategies for innovation and operational excellence," asserts Ahuja. He further emphasizes the importance of localized production capability, stating that a local plant would enable Guhring to streamline logistics, reduce lead times, and respond more promptly to customer demands, enhancing supply chain efficiency.

In terms of market penetration and growth, Ahuja notes that strengthening local manufacturing capabilities can support Guhring's market expansion strategies in India, a rapidly growing economy with diverse industrial sectors.

Guhring India continues to set benchmarks in precision cutting tools and innovative solutions for India's Manufacturing sector. As the company looks forward to further growth and expansion, its journey shows Guhring's commitment to excellence and innovation in empowering Indian manufacturers with cutting-edge technologies that boost their global competitiveness. 



Source: Guhring India



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PRECISE TO THE BONE

Bone screws are high-tech medical products to fix fractures. The variety of screw types is vast due to the differences between bones. The following read on these special screws provides an insight into their production and features players who are creating them with the utmost precision needed.



The carbide grade IG35 is used for machining titanium alloys.

Sports injuries, car accidents, or mishaps at home – bone fractures can occur suddenly and unexpectedly. Not infrequently, they are so severe that surgery on the fracture is unavoidable. Depending on the injury, the treating surgeon decides between wires, screwed plates, or long bone screws to fix the fracture. Few patients know that bone screws, in particular, are high-tech medical products. The company hg medical GmbH from Raisting in Upper Bavaria is considered one of the leading subcontract manufacturers of these special screws.

It is a leading contract manufacturer of orthopaedic implants for the lower and upper extremities and the spine. To produce bone screws, hg medical relies on Swiss-type lathes from Traub and whirling tools from Paul Horn GmbH. In addition to conventional whirling, hg medical uses the high-speed whirling process. Skull, spine, or femur – each requires a specific type of screw for bone fragment fixation. The variety of screw types is vast, reflecting the differences between these bones. The surgeon selects the appropriate

screw depending on the nature of the bone, such as hardness, porosity, and bone marrow. In addition to self-locking screws with tapered threads or variable pitches, screws with a through hole are also used, through which bone cement can be injected for stabilization.

Conventional whirling

“The problem with the conventional whirling process is that the whirling and pre-turning of the diameter must always be done in individual steps. The inserts in the whirling head are not designed to cut the sometimes



High-speed whirling enables continuous cutting through concurrent turning.

larger outer diameters of the raw material,” says Sebastian Schmid, Process Developer, hg medical. As a result, the whirling attachment has to be repositioned several times in the threads, depending on the length of the bone screw. This results in so-called entry marks on the surface. Although these are biologically harmless, they could result in a weakness, leading to breakage at that point of the screw if too much stress is placed on it. Furthermore, a flawless surface is desirable as a quality feature of every implant.

Continuous cut

A significant step in the further development of the whirling process is high-speed whirling. The advance was developed through cooperation between the machine manufacturer INDEX/Traub, hg medical, HORN, and a university. In this process, the speed is so high that the turning can take place at the same time as the whirling. The turning tool positioned in front of the whirling tool reduces the volume of material that would otherwise have to be removed by the whirling tool. The whirling heads used are similar to conventional types: Only the inserts differ in their

geometry. The production of single- and multi-start threads is possible with only one set of inserts. The advantage over conventional whirling is, on one hand, a cycle time reduction of up to 30 percent and, on the other, higher quality of the workpiece. “The time advantage always depends on the application and geometry of the screw. We see a great benefit in the elimination of entry marks, since with high-speed whirling, the inserts are in a continuous cut,” explains Schmid.

Theoretically, high-speed whirling also has the advantage of increasing the service life of the inserts. This is due to the lower volume of material to be removed by whirling, due to the previous turning operation. “This would be an advantage, for example, when whirling short-chipping materials. However, we process almost 100 percent long-chipping titanium alloys. When whirling titanium at high speed, the whirling head serves as a chip breaker for the long swarf generated by the simultaneous turning operation,” explains Schmid. It diminishes the advantage of the longer tool life in this case. On average, tool life is similar to that achieved with conventional whirling. “We

turn or change the inserts in the whirling head in a specific order. The quality of the bone screws is always higher than the maximum service life that has been specified,” says Schmid.

High manufacturing precision

Bone screws are subject to strict criteria for manufacturing quality. “The production tolerances, especially for the diameter of the thread, are very tight depending on the screw,” says Schmid. Furthermore, a complete absence of burrs must be guaranteed during production. Any burr, no matter how small, poses a potential danger for causing a failure in service. “To achieve the required high quality and specification, the whirling tools and inserts must be manufactured very precisely. A major focus is on axial and radial run-out. The level of accuracy is crucial, especially in the transition between two different threads, or when restarting,” explains Stefan Benz, Field Service Representative, HORN. HORN grinds the inserts to length tolerances of less than 0.002 mm (0.079 mil). In addition, the insert seats in the whirling head are manufactured with high preci-

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NIKHIL NAYAK
Managing Director
NN Combined
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Pvt Ltd



The variety of screw types is vast. The surgeon selects the appropriate screw depending on the nature of the bone, such as hardness, porosity, and bone marrow.



Two whirling heads are equipped for whirling two different threads on a bone screw.



The kinematics of the Swiss-type turning machine allow effective and simultaneous machining with two, three, or four tools.

Source: Horn/NNCEA

sion. Another quality feature is the profile of the ground inserts. Defined inner radii of $r = 0.025$ mm (0.984 mil) with tolerances of ± 0.005 mm (0.197 mil) are not uncommon in precision grinding of the indexable inserts. For the inserts, HORN whirling tools mainly use the three-edged indexable type S302 variety or the two-edged type S274 insert. All whirling tools are special designs to suit customer requirements. HORN tool systems have been performing reliably in hg medical's factory for around ten years. In addition to thread whirling tools, the company also relies on grooving and boring systems from HORN. "We sometimes have very difficult tasks during new whirling projects. Luckily, we have a hotline to HORN's design department to discuss each application

and develop a tooling solution," Schmid explains and continues, "As a supplier, we offer our customers the highest flexibility and speed, and we expect the same from our suppliers and partners. With HORN, we have a tool partner at our side to offer this service and is always available for us."

Machine for high-speed whirling

The design of the TRAUB TNL20 sliding-headstock automatic lathe has been consistently adapted to the requirements of the user. The kinematics of the Swiss-type turning machine allow effective and simultaneous machining with two, three, or four tools. The generously sized, vertically orientated working area provides the necessary degrees of freedom as well as very high process reliability. The

automatic sliding-headstock lathe achieves a decisive productivity advantage with its high dynamics. The newly developed machine bed made of grey cast iron forms the basis for vibration-damping properties. The high rigidity and thermal stability also ensure optimum workpiece quality during Swiss-type turning and conventional turning.

HORN in India

Precision Tooling Solutions for the Medical industry from Paul Horn GmbH are available in India via NN Combined Engineering Agencies Pvt Ltd (NNCEA) in cooperation with select OEM partners. NNCEA provides complete logistics and supply chain management solutions for several major medical manufacturing industries in the Indian market. 

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WHEN PRECISION IS PARAMOUNT

In the intricate world of medical device manufacturing, where precision is critical and innovation saves lives, a strong production process is key. From crafting tiny bone screws to fabricating complex hip replacement parts, there is high demand for accuracy, reliability, and efficiency. The article effectively expounds on the importance of small part machining in supporting the precise and accurate manufacturing of medical device components.

The Medical Device industry encompasses a wide array of products designed to diagnose, monitor, and treat medical conditions. From diagnostic equipment to implantable devices, the industry caters to the evolving needs of healthcare professionals and patients worldwide. Today, there are an estimated two million different kinds of medical devices on the global market, categorized into more than 7,000 device groups, according to the World Health Organisation (WHO).

Challenges in medical device manufacturing

Manufacturing components for medical devices presents unique challenges that demand advanced machining solutions. End-users rely on these devices being manufactured to the highest quality, as any products that do not meet quality standards can cause huge

disruption. Entire operations could be paused, products recalled, organizational reputation damaged, and patients' lives at risk. Additionally, regulatory requirements are stringent in this field. There are international standards around quality management — such as ISO 13485, risk management, and ISO 14971 — as well as regional regulations such as 21 CFR and FDA for the US and EU MDR for the European Union, which all devices must meet. The requirement for such high accuracy means manufacturers cannot risk even a millimeter of differentiation between components, so having a robust machining setup is paramount.

Machining challenges

From a machining perspective, the size and complexity of device components require micron-level precision, so any manufacturing process that is used must offer accurate end products. The materials used for a wide range of medical device components — typically titanium, stainless steel, and special alloys — are selected due to their resistance to corrosion and wear, toughness, and biocompatibility. Machining such materials to a high degree of preci-

sion does not come without its challenges. In particular, they must address issues around tool wear, heat generation during machining, and surface finish on the component.

There's also the issue of productivity. In general, there is an imbalance between the cost of development and what the market is willing to pay for in any industry. To bridge that gap, manufacturers must continuously increase efficiency and productivity. Sandvik Coromant estimates that manufacturers waste between 10 percent to 30 percent of material in their machining processes, with a typical machining efficiency of below 50 percent at the design, planning, and cutting phases.

To overcome these challenges, it's essential to partner with specialists that can deliver on specifications required. Metal cutting solutions from Sandvik Coromant are focused on reducing non-cutting time, to ensure maximum productivity. Its tools are designed to be highly flexible and modular, and they make use of a high-pressure coolant to maximize uptime.

An example: bone screws

To illustrate Sandvik Coromant's medical device tool and machine success, let's take the example of bone screw manufacturing. Bone screws are the most common general purpose fixation devices, with many applications. They may be used alone in reconstruction or reparative surgery, or with other hardware devices, such as plates, to fix them to the bones. Typically, bone screw bars are between 4 to 12 mm in diameter and are made of titanium or stainless steel. With such a wide array of applications, bone screws typically are long and thin in shape,

and manufactured in many different sizes to cater to different body parts. They are generally produced in quantities of between 30 and 1,000 using a technique known as thread whirling — a machining process used to create high-quality, precise threads. A cutting tool is mounted on a rotating spindle, which is fed into the workpiece while it rotates. The cutting tool typically has multiple inserts arranged around its circumference.

During thread whirling, the workpiece rotates on its own axis while also being moved longitudinally along its axis. Meanwhile, the cutting tool rotates around the workpiece, cutting the thread profile into it. This simultaneous rotation of the workpiece and the cutting tool allows for the creation of threads with high accuracy and surface finish, and avoids bending and vibrations. However, challenges to avoid include burr formation in the tip while the thread whirling is underway and maintaining thread quality when high feeds are used.

Sandvik Coromant machining solutions for sliding head machines use the CoroMill® 325 whirling system, a dedicated whirling unit, and a high-pressure coolant pump with a filter. The CoroMill® 325 is a thread whirling cutter designed specifically for medical device manufacturing, which produces special thread forms quickly and at high tolerances. With multiple thread whirling inserts and holders available, the machine ensures that bone screws are produced

without the risk of bending or burr formation.

Additional benefits of Sandvik Coromant's cutting tool solution include increased productivity. The machine completes single-pass machining from stock diameter to reduce the cycle time by minutes and is easily set up to reduce downtime. All Sandvik Coromant thread whirling inserts are available in GC1105 — the first-choice grade for medical machining, increasing tool life, and reducing operational costs.

This is just one example of Sandvik Coromant's medical machining solutions. The metal cutting expert offers a large range of advanced tooling and machining solutions for many additional devices including hip joints, pedicle screws, and bone plates.

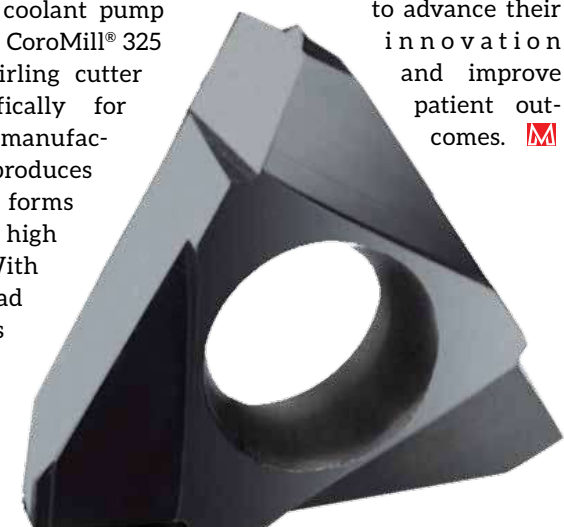
As the field of medical device manufacturing continues to evolve and become more competitive, driven by advancements in materials, design, and manufacturing technologies, precision machining is essential. Partnering with industry leaders like Sandvik Coromant and embracing cutting-edge solutions supports manufacturers to navigate the complex landscape of medical machining with confidence, to advance their innovation and improve patient outcomes. 

The CoroMill® 325 is a thread whirling cutter designed specifically for medical device manufacturing, which produces special thread forms quickly and at high tolerances. With multiple thread whirling inserts and holders available, the machine ensures that bone screws are produced without the risk of bending or burr formation.

ANNIKA LANGÉEN
Vice President
Offer Management
and R&D
Sandvik Coromant



Source: Sandvik Coromant



Source: Sandvik Coromant

FOR A LEAK-FREE WORLD

An interesting account of how Air Power East, a specialist in providing high-quality compressed air systems, resolved a dual challenge with an innovative approach from FLIR to maintain its commitment to quality and efficiency while addressing the specific needs of its clients...



Finding compressed air leaks using acoustic imaging is a fast, efficient way to reduce overall energy costs.

Air Power East, a family-run business with over 30 years of experience as a premier distributor of Atlas Copco, specializes in providing high-quality compressed air systems to various industries across East Anglia. Under the leadership of Jason Sewell, the company has established a strong reputation for delivering reliable and efficient solutions. However, the company faced a significant challenge in ensuring its systems were completely leak-free, a concern shared

by its clients, including an agricultural manufacturer managed by Paul Musgrove. Sewell highlighted the issue, stating, "Customers have been asking us to make sure that we can prove something is completely leak-free." Concurrently, Musgrove was seeking an effective way to manage and maintain their compressed air systems, with a specific focus on reducing energy waste and operational costs, emphasizing the need to 'save money where we can, especially

with energy prices as they are." This dual challenge called for an innovative approach to maintain Air Power East's commitment to quality and efficiency while addressing the specific needs of its clients.

Finding a Solution

To address the intertwined challenges, Sewell reached out to Baseline-RTS, an independent supplier of training and predictive maintenance equipment. The company introduced Air Power East to FLIR Si-Series

cameras: advanced acoustic imaging tools capable of accurately detecting air leaks. Sewell explained, "We sat down and did a bit of market research on a few different models and then came to the top. So, we contacted FLIR to come along and show us the FLIR Si124, and we have loved it ever since."

The Si124 is a lightweight, one-handed tool designed to quickly locate pressurized leaks in compressed air systems or detect partial discharge from high-voltage electrical systems. It is equipped with 124 microphones to produce a precise acoustic image that visually displays ultrasonic information. This image is transposed in real time on top of a digital camera picture, allowing users to accurately pinpoint the source of sound.

FLIR Si-Series cameras can detect issues up to 10 times faster than traditional methods, even in loud industrial environments. Additionally, they

are compatible with the FLIR Thermal Studio suite for offline editing, analysis, and advanced report creation, and can help facilities save money on utility

Acoustic Imaging Tools – FLIR Si-Series Cameras

Challenge:

Air Power East, a specialist in providing high-quality compressed air systems, sought to ensure its systems were completely leak-free, a concern shared by its clients including an agricultural manufacturer that was looking for an effective way to manage and maintain its compressed air systems, with a specific focus on reducing energy waste and operational costs.

Solution:

The company was introduced to FLIR Si-Series cameras of which the Si124 proved to be the perfect solution. It is a lightweight, one-handed tool designed to quickly locate pressurized leaks in compressed air systems or detect partial discharge from high-voltage electrical systems. Quantitative results underscore the Si124's impact. The camera enabled the detection of leaks amounting to approximately 100 cubic feet per minute (CFM), which is roughly 50 liters per second. This translates to about 18.5 kW of compressor power, leading to substantial energy and cost savings, particularly in light of rising energy prices.

are compatible with the FLIR Thermal Studio suite for offline editing, analysis, and advanced report creation, and can help facilities save money on utility

costs. The use of the Si124 camera brought about transformative results. Sewell explained the camera's effectiveness: "We have managed to walk around with the customer, showing them exactly what we are finding on our screen. And if we do find any small leaks, we can rectify them and then we can prove to the customer that their system is leak-free." This approach not only heightened the efficiency of the compressed air systems but also solidified customer trust in Air Power East's services.

Quantitative results underscore the Si124's impact. The camera enabled the detection of leaks amounting to approximately 100 cubic feet per minute (CFM), which is roughly 50 liters per second. This translates to about 18.5 kW of compressor power, leading to substantial energy and cost savings, particularly in light of rising energy prices.



Source: Teledyne FLIR, LLC

FLIR Si-Series

FLIR Si-Series cameras can detect issues up to 10 times faster than traditional methods, even in loud industrial environments. They are also compatible with the FLIR Thermal Studio suite for offline editing, analysis, and advanced report creation, and can help facilities save money on utility bills and delay the expense of installing new compressors.

This case study demonstrates the effectiveness of advanced tools in solving intricate industrial problems and highlights the importance of technology-driven solutions in optimizing industrial processes.



Source: Teledyne FLIR, LLC

FLIR Si-Series cameras are equipped with 124 microphones which produce an acoustic image that is then superimposed in real time on a digital camera picture.

Why choose a FLIR Acoustic Imaging Camera?

- **Effortless one-hand operation:** One can keep one hand free while inspecting components.
- **Superior sound detection with 124 microphones:** These sensitive microphones help one pick up even soft sounds from a long distance.
- **Optimal microphone performance:** Si-Series microphones use optimized dynamic range to balance frequency capabilities with how far sound travels.
- **Machine learning capabilities:** Machine learning helps to distinguish the other characteristics of the sound pattern created by leaks from background noise.
- **Enterprise scalability:** Connections to the FLIR Acoustic Camera Viewer cloud service allow one to automatically save images so they can be collected, organized, and shared across an inspection team.

Conclusion

Air Power East's adoption of the FLIR Si124 camera to address the complex challenges in compressed air systems illustrates the power of innovative technology in industrial settings. The successful detection and rectification of air leaks not only enhanced operational efficiency but also led to considerable energy and cost savings for the agricultural manufacturer. This case study demonstrates the effectiveness of advanced tools in solving intricate industrial problems and highlights the importance of technology-driven solutions in optimizing industrial processes.



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EXTRACTING VALUE FROM WASTE

The following study explores the innovative use of friction stir-assisted cladding (FS-AC), a promising way to recycle metal scraps, especially aluminum scraps, without melting while saving energy and preserving inherent material properties. This path-breaking approach could revolutionize how we handle industrial waste and improve manufacturing sustainability.

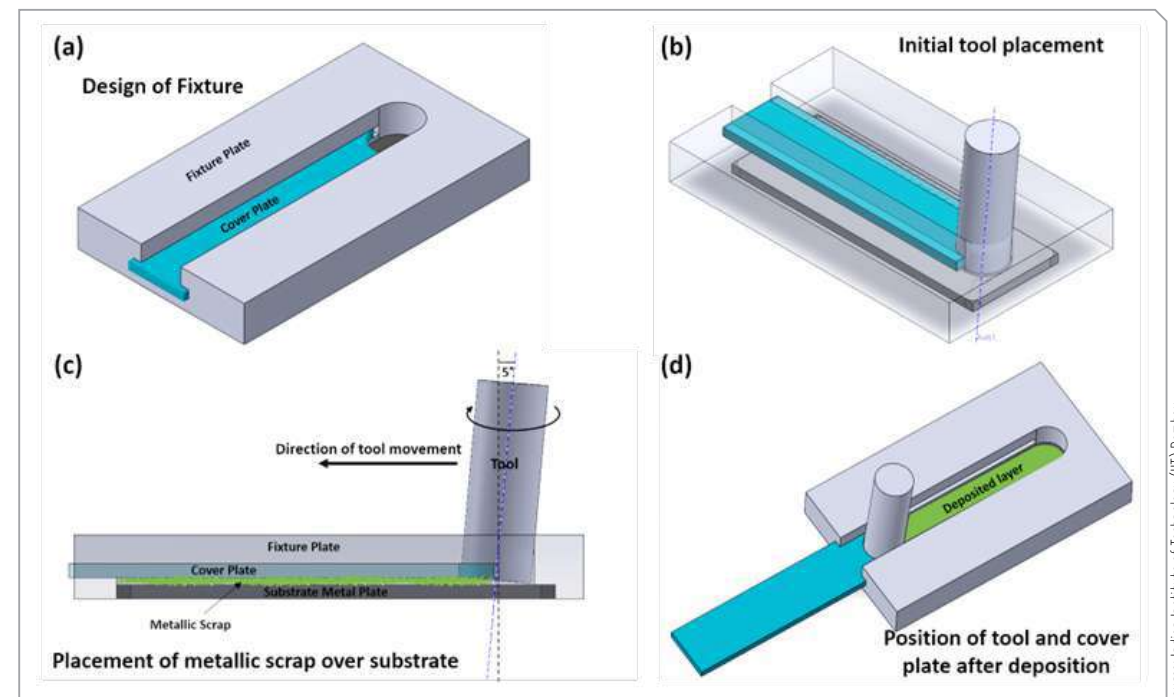


Figure 1. Schematic representation of fixture assembly and placement of the tool and metallic swarf used for friction stir-assisted cladding process

The Manufacturing industry, a cornerstone of modern economies, generates a substantial amount of waste in the form of manufacturing chips, which often end up as discarded byproducts. This waste not only poses environmental hazards but also represents a missed opportunity for resource efficiency and cost savings. Producing aluminum from ore demands approximately 20 times more energy than utilizing recycled metal. In contrast to traditional scrap recovery, the primary objective in aluminum scrap recovery is not only to minimize disposal costs but also to evade regulatory liability by extracting

metals from voluminous wastes. Aluminum scrap is typically processed in a reverberatory furnace as part of the recycling process. However, melting the scrap is an energy-intensive process. Also, the inherent properties of aluminum alloys generally get lost during melting due to the evaporation of various strength-imparting elements. The solid-state recycling of aluminum alloys results in huge energy savings while keeping the properties intact. The solid-state recycling of metallic scrap (especially aluminum) results in near to 100 percent yield of the material whereas fusion-based processes lead to a material wastage of

a minimum of 15-20 percent in fumes. The energy saving in solid-state recycling is enormous in comparison to virgin metal production or fusion-based recycling. Approximately 156 MJ/Kg of energy is required for primary aluminum production. A mere 10 MJ/Kg of energy is consumed in the solid-state recycling of aluminum, whereas the energy consumption in fusion-based recycling stands at 17.7 MJ/Kg. Therefore, solid-state recycling of aluminum is a highly economical and sustainable process due to its huge material and energy-saving nature. Hence, prioritizing secondary metal production offers multifaceted environmental advantages,

including energy conservation and waste reduction. This is particularly crucial in the case of aluminum, a widely used metal in industrial applications, where the recovery of manufacturing scrap contributes not only to cost efficiency but also to sustainable and responsible waste management practices.

Understanding FS-AC

This study explores the innovative use of friction stir-assisted cladding (FS-AC) as a sustainable and cost-effective solution for repurposing aluminum chips on a steel substrate without melting the material. The study investigates the mechanism of the FS-AC process, highlighting the conversion of metallic swarf into a feedstock material for cladding without entailing costly clad materials. A uniformly clad layer with an average thickness of 0.95 mm was developed in a single pass.

The process presents a valuable method for recycling machine shop floor scrap, transforming it into useful feedstock material for cladding purposes, and that too in an energy-efficient manner. This proposed approach has promising potential for processing different material combinations for additive manufacturing and exploring functionally graded material development using metallic swarf.

Methodology

A fixture was designed and fabricated to rigidly clamp the substrate sheet and hold the Al chips during processing using a cover plate. The cover plate was movable and slid along with the traverse movement of the tool. Figures 1(a) and 1(b) show the schematic of the fixture plate assembly and the initial tool placement. The metallic swarf/chips are placed on the friction stir welding machine table over the substrate, and the side view is shown in Figure 1(c).

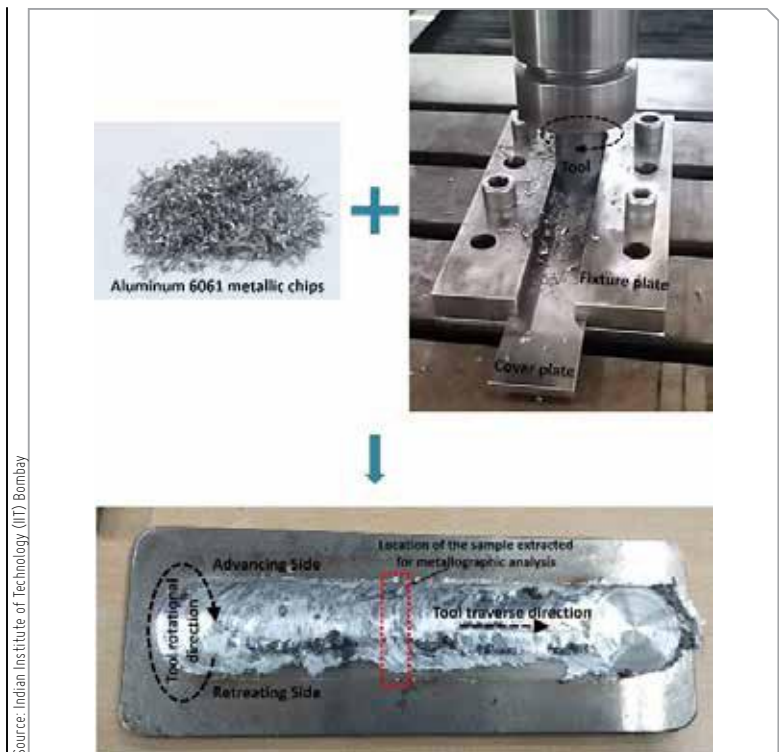


Figure 2. Photographs of aluminum chips and the FS-AC process, along with the cladding developed during the FS-AC process

Process mechanism

The aluminum metal chips of approximately uniform size and shape were placed to rub against the rotating tool of hard tungsten carbide material with the fixation of the cover plate over them. The rotating action of the tool generated the heat required for softening the metallic swarf, and the tilt angle of the tool enabled the compaction of metallic chips to form a cladding layer with increased density. The advancing side of the cladding plate represents the side where the tool rotational velocity vector and tool traverse velocity vector align in the same direction. On the other hand, the side in which the tool rotational velocity vector and tool traverse velocity vectors are opposite in direction is represented by the retreating side.

The thickness of the incoming swarf layer was equal to the gap between the substrate plate's upper surface and the cover plate's bottom surface. The thickness of the cladding layer

was controlled by the gap between the backward surface of the tool face and the upper surface of the substrate, as shown in the side-view representation of the FS-AC process in Figure 3. The axial downward pressure applied by the tool surface is responsible for the compaction/consolidation of the already softened swarf. The compaction increases the density of the cladding layer with respect to the incoming swarf. The continuous narrowing of the area available for the swarf to flow during the tool movement enables substantial compaction of the soft material. The pressure applied by the backward part of the tool face controlled the thickness of the exiting coating layer making it of uniform thickness.

The industrial implication, limitations, and further work Developing a uniformly thick clad layer over the substrate in a single-step process reduces the post-processing time for the fin-

Approximately 156 MJ/Kg of energy is required for primary aluminum production. A mere 10 MJ/Kg of energy is consumed in the solid-state recycling of aluminum, whereas the energy consumption in fusion-based recycling stands at 17.7 MJ/Kg.

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The FS-AC process could easily be presented as a solid-state alternative to additive manufacturing processes. Furthermore, using waste material as feedstock for additive manufacturing would aid the economic aspect of it.

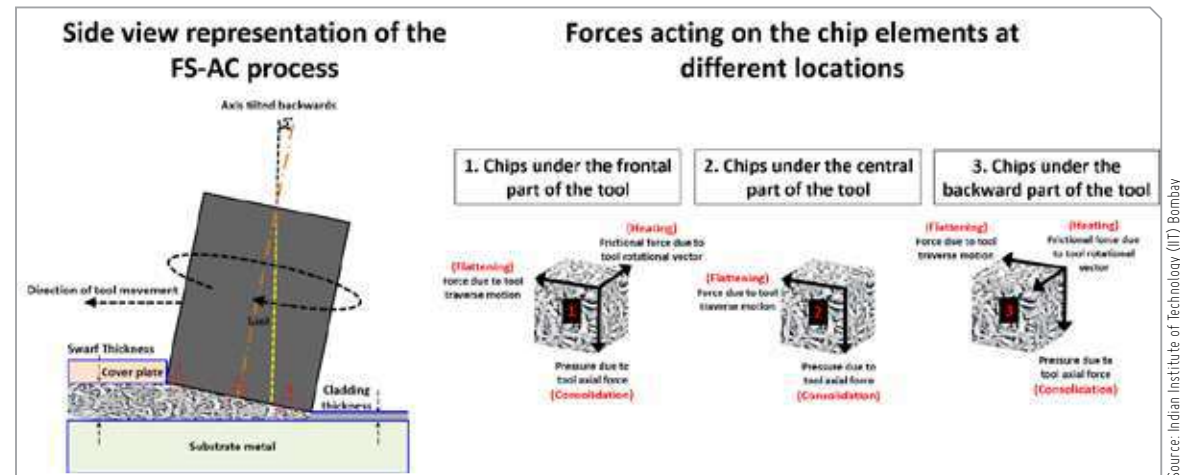


Figure 3. Side-view representation of the FS-AC process and the various forces acting on the chips placed at different locations with respect to the tool surface

ished product and, in turn, enhances the economic viability of this process. In this work, a novel process was developed to recycle the metallic waste scrap and clad it on a substrate with a controlled uniform thickness in a single step. Further advanced characterization studies are needed to confirm the diffusion

of the dissimilar materials into each other and the chances of intermetallic formation. The mechanical and chemical testing of the specimen would also give clear insights regarding the coating-substrate bond strength and corrosion resistance improvement base material. The FS-AC process could prove to

be a go-to process for recycling the metallic scrap without melting. This process could easily be repeated for multiple layers and presented as a solid-state alternative to additive manufacturing processes. Furthermore, using waste material as feedstock for additive manufacturing would aid the economic aspect of this process.

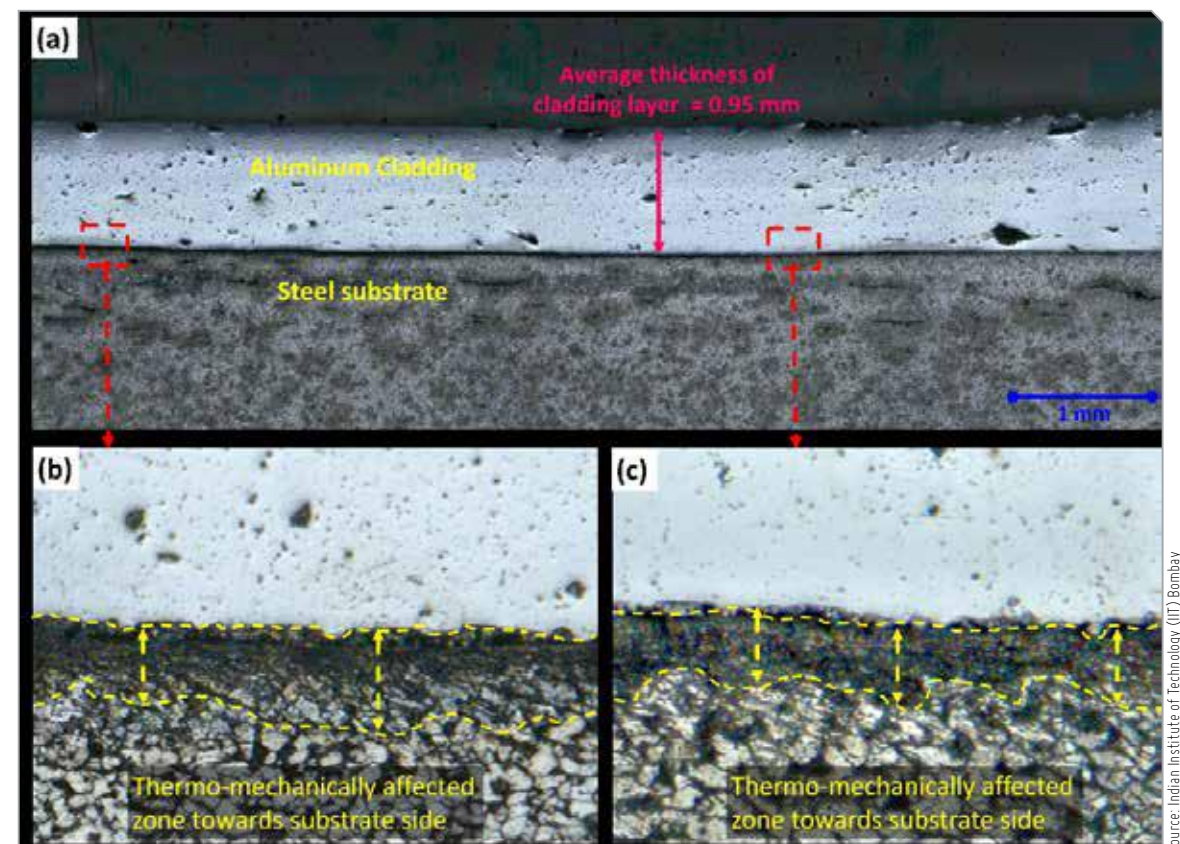


Figure 4. Optical microscope images of the cross-sectional view of the cladding depicting a uniform thickness of clad material and distinct thermo-mechanically affected region towards the substrate side



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UNLOCKING THE SKY

At Aakashe Innovations, the country's first instant drone imagery platform, drones are envisioned as pivotal tools in streamlining operations. Embracing this innovation could be a portal to a new era of productivity and growth in the industry.



L-R: Shankar Dixit, Co-founder & COO; Ankush Sengupta, Co-founder & CEO; Vipul Bhati, Co-founder & CBO, Aakashe Innovations Pvt Ltd

Founded by a splendid team of visionaries who collated their diverse expertise in drone technology, geospatial intelligence, and infrastructure development, Aakashe Innovations Pvt Ltd, leads the vanguard of innovation. Digging deeper into the concept of geospatial intelligence, the company does not simply offer drone imagery, it ventures forth with a mission to empower industries with seamless access to precise data.

Leveraging individual strengths

Ankush Sengupta, Co-founder & CEO, Aakashe Innovations, reflects, "I've always been fascinat-

ed by technology's ability to solve real-world problems. Drones, in particular, captivated me with their numerous applications beyond the conventional." Building on this fascination, the team set out to fully harness this technology's potential.

Vipul Bhati, Co-founder & CBO, Aakashe Innovations, leveraged his civil engineering background to steer the wheel of innovation and efficiency in geospatial intelligence. Alongside Bhati, Shankar Dixit, Co-founder & COO, Aakashe Innovations, applied his expertise in operations research in engineering to pioneer lean, scalable systems, that would enhance the user experience. This

strategic approach enhanced the company's capabilities in mapping and surveying while also forging new paths for technological advancements across diverse fields.

From ground to the sky

'Aakashe', drawn from the Bengali word 'Ākāśe' meaning 'in the sky', embodies the company's focus on aerial technology and its goal to lead India's infrastructure revolution. "The name signifies our commitment to providing instant access to drone data, driving productivity and growth without compromising quality and security," Sengupta explains. "Under this brand, we are dedicated to pushing the

boundaries of drone technology, offering innovative solutions that meet the evolving needs of our clients."

Catering to an array of sectors

In a world where speed and precision are important, the company's suite of drone imagery services, including instant drone imagery, caters to diverse applications such as infrastructure development, urban planning, environmental monitoring, and real estate. The company's platform tackles key obstacles in drone data management, offering solutions to delayed data access, high procurement expenses, and inefficient data handling. "Our platform provides a user-friendly interface where customers can easily search, view, and purchase drone data," he shares.

"By offering instant access to high-quality drone data through a subscription model, we eliminate the traditional delays associated with data procurement," he adds. With this capability, clients gain the power to make timely and well-informed decisions, significantly boosting project efficiency and accuracy. "Our services are particularly valuable in sectors that require precise site monitoring, volumetric analysis, and detailed topographical surveys," he adds further.

"Aakashe's platform addresses several critical challenges in drone data management. It promises to resolve issues related to delayed data access, high procurement costs, and inefficient data handling. By offering instant access to high-quality drone imagery through a subscription-based model, Aakashe ensures that users can obtain the data they need without the traditional waiting periods."

Ankush Sengupta
Co-Founder & CEO
Aakashe Innovations Pvt Ltd

Small project, big impact

The company's goal of affordability and accessibility in drone data management revolutionizes opportunities for small and medium-sized projects. Its subscription model aims to be economically inclusive, creating avenues for small and medium-sized projects that previously faced high barriers to drone data acquisition costs.

"By offering data on a per-tile basis and providing flexible monthly and annual subscription plans, we make high-quality drone imagery affordable for projects with limited budgets," he outlines. This democratization of drone data empowers smaller businesses to acquire advanced aerial insights, thereby boosting their competitiveness within

their sectors. To add to that, he states, "Our goal is to ensure that every project, regardless of size, can benefit from the precision and efficiency that drone technology offers."

Transforming industry practices

Speaking on the impact of drone technology in manufac-

turing, the company envisions drones playing a crucial role in various aspects such as inventory management, facility inspection, and site planning.

"Our instant drone imagery platform offers manufacturers the ability to optimize operations and increase productivity," he asserts. Expanding on that note, the platform can empower manufacturers to quickly pinpoint potential issues, streamline processes, and optimize resource management effectively with its delivery of precise and timely data. "Aakashe's instant drone imagery platform can significantly cut down the time required for data collection and analysis, allowing manufacturers to focus on optimizing their processes," he further details.

Educating for change

As a startup, the company has navigated a journey marked by challenges and rewards. "One of the primary challenges is raising awareness about the benefits of instant drone imagery and convincing traditional sectors to adopt this new technology," he mentions.

To address this, the company is actively engaging in targeted informative campaigns, educational webinars, and participation in industry events. These efforts aim to demonstrate the tangible benefits of its platform to potential users.

In addition to its outreach efforts, the company places significant emphasis on developing a robust and secure data management system. This includes investments in advanced encryption and storage solutions, ensuring the integrity and security of all data processed through its platform. "Through persistence, innovation, and a commitment to our vision, we are determined to establish Aakashe as a trusted name in the geospatial intelligence space," he concludes. 

Aakashe believes that drones will play a vital role in inventory management, facility inspections, and site planning. Its instant drone imagery platform enables manufacturers to optimize operations and boost productivity with precise, timely data insights.

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Source: Aakashe Innovations Pvt Ltd



GOING THE ELECTRIC WAY

The article highlights the significant shift towards EVs in India, the opportunities and challenges that ensue this transition, and the crucial role of automation in manufacturing battery packs to ensure efficiency, safety, and scalability.

One of the latest trends in the Manufacturing industry today in India is electric mobility (E-Mobility). This gradual shift towards electric vehicles (EVs) largely impacts the Auto industry. Most internal combustion engine (ICE) vehicle OEMs are cautiously navigating this technological disruption. The transition from fossil fuels to electric batteries has brought about notable changes in the manufacturing landscape of automobiles. The reduction from about 1,000 moving parts in an ICE vehicle to just about 200 parts in an EV impacts much more than what meets the eye. This disruption is challenging established manufacturing companies, governments, our lifestyles, and how we imagine our future to be.

Evolution of battery technology

Electric vehicles are not new; in fact, the first e-vehicle was built in Europe in the 19th century. The battery technology was then in its infancy and chemical engineers were struggling with battery technologies to provide higher speeds, longer ranges, safety, and convenience. Meanwhile, mechanical engineers were working hard on the ICE and refining it for better efficiency. However, the ICE had to be cranked manually. This shortfall was addressed by electrical engineers who introduced the starter motor. This made the ICE the preferred choice due to its reliability and convenience.



Source: Festo India Pvt Ltd

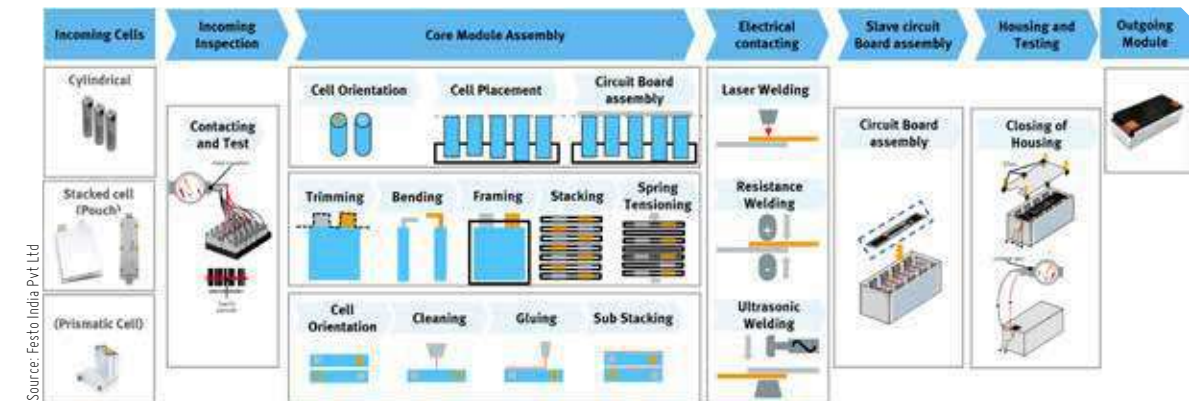
Opportunities in the Indian EV market

The battery technology has advanced by leaps and bounds and is today at a mature stage, providing longer ranges and safety, though there is more to come. Every disruption is also a huge opportunity, as is the case today. The Indian EV market is estimated to be about US\$ 100 billion by 2030.

The Government estimates an employment potential of 1 crore direct jobs and another 4-5 crore indirect jobs. It is also staggering to consider that 90 percent of passenger vehicles (PVs) globally could be electric by 2050.

Expanding the supply chain ecosystem

Established ICE vehicle manufacturers are refurbishing and repurposing their existing infrastructure to handle EVs, while large EV manufacturers are bullishly eyeing the market in India. This shift has given a new direction to design and development professionals in the Auto industry. The supply chain ecosystem in India is enlisting new players every day for batteries, motors, chargers, power electronics, charging infra, swapping, recycling, etc. Eventually, if India wants to make its mark on the global EV



Source: Festo India Pvt Ltd

map, it needs a robust and reliable supply chain ecosystem. The pole position is already taken by China which has sold about eight Mio e-cars in 2023, contributing about 40 percent to the total car sales in the country and leaving behind Europe and North America. In contrast, only 90,000 cars have been sold in India in 2023.

Adaptation of EVs in the Indian market

India is also a very adaptive market where technology can be easily adapted and proliferated to address genuine needs that are not addressed by the establishment. In 2023, the highest-selling EVs in India were not the self-owned PVs but 3-wheelers tailored to carry about six passengers at least. Most of them were sold in the state of Uttar Pradesh. The market for e-PVs calls for consolidation, standardization, infrastructure, shared resources, and efficient manufacturing. Skateboard designs are now moving towards standardization and the battery pack is integrated into the chassis frame, providing structural strength and a lower center of gravity for better road grip. This means body builders can buy these skateboards over which they can build vehicles to suit applications, including passenger vehicles, food carts, school carriers, goods carriers,

etc. The future for EVs in India seems exciting with auto majors like Tata Motors Ltd, Mahindra & Mahindra, Hyundai Motor Company, MG Motor, etc. all announcing their launches of new vehicles for the next two years.

Detailed anatomy of an EV

Let's look at the EV anatomy in perspective. The skateboard is where the EV differs from its ICE counterpart. It contains a Battery Pack, a Hub Motor with a simple transmission, a Rear Hub Motor if the vehicle is a dual motor version, and On-Board Electronics. The onboard electronics feature the rectifier to convert the AC power from the charging socket to DC power required to charge a Traction Battery Pack, a DC-DC converter that regulates the voltage and current required by the motor, and a Battery Management System.

When it comes to evaluating the costs, it is observed that 40 percent of the cost is taken by the battery pack, the motor takes a share of 15 percent, and the on-board electronics, including the charger, take 10 percent. The rest is taken by the other components of the car - the upholstery, the dashboard, lights, etc. This 35 percent may be common to both EVs and ICE vehicles.

Hence, when optimizing the manufacturing of EVs, the need is to focus on the efficient manu-

facturing of the battery pack and the motor.

Advancements in battery cell technologies

While various battery cell technologies are at various stages of development, it is the lithium-ion technology that has matured to find its place in the present EV vehicles. The cells are available in three forms - the cylindrical cell, the pouch cell, and the prismatic cell.

The supply chain ecosystem for the battery pack is completely dominated by the Chinese companies and it is not surprising that most of today's manufacturers in India are only engaged in the battery packs with cells imported from China. However, there is a serious effort to do backward integration led by companies like Tata Motor Company and Ola Electric Mobility.

Automation in battery pack production

The process of converting battery cells into battery modules and then into battery packs must be automated and scalable in order to be sustainably viable. Battery cells which form the cellular components of battery packs must be stacked, arranged, and tested. Mechanical testing is carried out to test the integrity of the cell for shock, vibration, etc. Electrical testing is carried out to

Festo has been involved in the end-to-end automation of battery packs for EVs - both PVs and 2-wheelers. Precision handling of battery cells for testing, welding, and packing has been accomplished using its portfolio of products.

RAMESH RAMACHANDAR
Head of Automotive
Industries
Festo India Pvt Ltd



The pole position is already taken by China which has sold about eight Mio e-cars in 2023, contributing about 40% to the total car sales in the country and leaving behind Europe and North America. In contrast, only 90,000 cars have been sold in India in 2023.



check the resistance, voltage, and current, and lastly, the leak test is conducted to ensure that the cell is leakproof. The tested cells are then assembled and welded to connect them either in serial or in parallel to form a module. A number of modules are then arranged to form a battery pack. The process has intricate procedures to be followed to ensure reliability and safety. This process needs to be

entirely automated to handle the volumes and ensure consistency and safety of personnel. In totality, automation is essential in the production of battery cells, assembly of battery modules and packs, and integration of the battery packs onto the vehicle belly. Dry and clean room conditions with automation components free from Copper, Zinc, and Nickel ensure safe and reliable automation.

Festo has been involved in the end-to-end automation of battery packs for EVs – both PVs and 2-wheelers. Precision handling of battery cells for testing, welding, and packing has been accomplished using our portfolio of products from end-of-the-arm grippers and linear motion modules up to energy-saving modules and cloud connectivity for traceability and diagnostics.

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PMTX 2024 & FACTERQ 2024: THE WAY TO THE WEST

Organized by Indian Machine Tool Manufacturers' Association (IMTMA), PMTX 2024 and FACTERQ 2024 facilitated an engaging space for technology enthusiasts keen to explore the latest offerings in metal cutting, metal forming, and factory equipment by industry stakeholders invested in innovating and redefining the manufacturing game.

The third edition of Pune Machine Tool Expo (PMTX) and the first edition of the Factory Equipment Expo (FACTEQ), were immensely successful in convening pivotal players in the field under one roof. The co-located shows, held from May 25-28, 2024, hosted 220 exhibitors in a massive 12,000 sq mt expo space at Pune International Exhibition and Convention Center, Moshi, Pune, to exhibit the latest innovative products and solutions and next-gen technologies to 13,195 visitors from 445 cities. Exhibitors at PMTX 2024 showcased metal cutting and metal forming technologies including automation and robotics, tooling systems, and CAD/CAM. Whereas, FACTERQ 2024 had exhibi-

An Overview of PMTX & FACTERQ 2024

- 220 Exhibitors
- 13,195 Visitors from 445 cities
- 12,000 sq mt Exhibition Space

tors showcasing modern factory equipment, security and safety systems, sustainable and environmental solutions for factories, material storage and transport, and other equipment to be used by the factories of tomorrow.

Starting right

The inaugural ceremony of PMTX 2024 and FACTERQ 2024 convened industry titans who, with their presence, ensured

a successful tone to the event. Farrokh N Cooper, Chairman & Managing Director, Cooper Corporation Pvt Ltd, and Amol Nagar, Executive Director - Global Supply Chain GE Aerospace, Cincinnati OH, were the Guests of Honor. Shri S S Survase, Joint Director of Industries, Directorate of Industries, Government of Maharashtra, was the Special Guest. Rajendra S Rajamane, President, IMTMA; Mohini Kelkar, Vice President, IMTMA; Rajesh Mandlik, Chairman - IMTMA Regional Council (West); and Jibak Dasgupta, Director General & CEO, IMTMA, also presided over the inauguration. Shri Survase said that Maharashtra is currently the largest GDP state as it contributes more than

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Source: Magic Wand Media

15 percent to the Indian economy. The Government of Maharashtra, he shared, is working towards the development of MSMEs, and a special cell is being set up for facilitating large and small investments including foreign investments. There are about 18,000 industrial units that are exporting and there is big potential for industries to invest for which the State Government would extend all possible support. Nagar pointed out that GE is a major player in the Aerospace manufacturing segment having a market share of more than 60 percent. He added that the Aviation industry's best practices could be emulated by manufacturing industries, especially on safety, quality, EHS, etc. Cooper talked about the legacy of Cooper Corporation, its long-term association with the Indian Machine Tool industry, and how the company has evolved from component manufacturing to engines and tractors over the years. He commended IMTMA for its exceptional contributions to India's growth. Speaking on the importance of the expo, Rajamane said, "PMTX is held to connect with industries at the regional level so that the cutting-edge technologies are taken to the doorsteps of the industries for their sustainable development.

IMTMA has a significant presence of members in the Western region, specifically in Maharashtra and the Association works closely with the Government to support the growth of industries in the state." He added that the expo has doubled in size and is the largest machine tool show in the region.

Acing the game

The exhibitors at PMTX and FACTERQ 2024 were thrilled at the response they received at the show. It is important to know their side of the story, which is the perfect gauge to measure the success of the show. AceMicromatic Group, India's largest machine tool manufacturer, offers a wide range of CNC solutions including Turning, Milling, Grinding, Special Purpose Machines, 3D Metal Printing, Sheet Metal, and Industry 4.0 solutions.

Ace Designer's Turning Machine CSJ 400 RG with Ace Manufacturing Systems' (AMS) Vertical Machining Center GV 40 garnered significant attention at the show, highlighting the Group's innovative offerings and drawing considerable interest from attendees. Other exhibits included Micromatic 360, AMiT IoT solutions, Eco solutions from amace solutions in Metal 3D printing and Sinar Sheetmetal Solutions. AMS-make VMC GV 40 with a learning industry tool CNC Simulator was introduced to the Maharashtra customers at PMTX 2024. The show was a great success for AceMicromatic Group, with over 1,000 footfalls and more than 300 leads generated over the four-day event at PMTX 2024. "This reflects the strong engagement and business potential that the expo provided. The presence of a significant number of Auto,



Source: Magic Wand Media



Source: AceMicromatic Group

"The show was a great success for AceMicromatic Group, with over 1,000 footfalls and over 300 leads generated. The presence of a significant number of companies from the Auto, Heavy Engineering, Aerospace, and Defence industries in Pune, combined with visitors from other industrial hubs in Maharashtra and the neighboring states, contributed to the high industry footfall and vibrant business environment at the expo."

Aravindan A
Business Head
Micromatic Machine Tools
Pvt Ltd
AceMicromatic Group

Heavy Engineering, Aerospace, and Defence industries in Pune, combined with visitors from other industrial hubs in Maharashtra and the neighboring states, contributed to the high industry footfall and vibrant business environment at the expo," shares Aravindan A, Business Head, Micromatic Machine Tool Pvt Ltd.



Source: Lakshmi Machine Works Ltd

"PMTX 2024 offered a valuable opportunity for us to connect with existing customers and build relationships with potential new customers. The interactions and feedback we received were insightful. Overall, it was a significant event for us, enabling us to not only showcase our innovations to the target industries but also to gain valuable insights from the broader industry landscape."

Shashank V Joshi
Senior General Manager
LMW Machine Tool Division
Lakshmi Machine Works Ltd

Leveraging opportunities

For India's largest CNC Machine Tool manufacturer, the Coimbatore-based Lakshmi Machine Works Ltd's Machine Tool Division, the response to its offerings at PMTX 2024 was exceptional, leading to significant business generation. "We received numerous high-quality leads and valuable



Source: Magic Wand Media

opportunities. Pune has consistently shown strong engagement during the PMTX show, and this year, we have set a new benchmark in our business performance," says Shashank V Joshi, Senior General Manager, LMW Machine Tool Division, Lakshmi Machine Works Ltd. According to him, the overall experience at PMTX 2024 was highly positive. The show provided an excellent platform for the company to showcase its machines and products. "Engaging with customers in and around Pune was particularly beneficial. PMTX 2024 offered a valuable opportunity for us to connect with existing customers and build relationships with potential new customers. The interactions and feedback we received were insightful. Overall, PMTX 2024 was a significant event for us, enabling us to not only showcase our innovations to the target industries but also to gain valuable insights from the broader industry landscape," he shares. The ratio of potential customers to existing customers visiting the LMW stall was likely equal. Given the year-on-year growth in industrial areas in Pune and the continuous influx of new prospects, the company's objective, shares Joshi, is to cater to the needs of every potential customer with its products and solutions. Its diverse customer base includes industries such as Die & Mold, Fittings, General Engineering, and Automobile. "Our JD4 - Compact Vertical Machining Center, launched at the event, garnered significant attention from visitors. The JD Series machines cater to industries such as Die & Mold and Automobile. Additionally, the S Turn I - Horizontal Turning Center, designed for industries like Automobile, Fittings, Oil & Gas, and General Engineering, also attracted a lot of interest," he reveals. "We have a comprehensive range of 55 products and 88 variants to

Farrokh N Cooper, Chairman & MD, Cooper Corporation, and Amol Nagar, Executive Director - Global Supply Chain GE Aerospace, Cincinnati OH, were the Guests of Honor. Shri S S Survase, Joint Director of Industries, Directorate of Industries, Government of Maharashtra, was the Special Guest.

The Government of Maharashtra is working towards the development of MSMEs, and a special cell is being set up for facilitating large and small investments including foreign investments.

meet the diverse requirements of various industries. Our exclusive display area for machining solutions tailored for the Oil & Gas, Fittings, General Engineering, and Automobile industries received a favorable response and generated significant enquiries," adds Joshi.

Getting it right the first time

Since it was the first time Meiban Engineering Technologies Pvt Ltd was participating in PMTX, the team was unsure of the outcome. "We had put in effort and a highly expectant team from Japan was also present during the show. We were thrilled to receive footfall which was beyond our expectations. Most known customers visited our stall, and, interestingly, those new to us also tried to locate us and showed interest in our products. The exhibition machines were sold, which is exceptional for us," shares Rishi Kapoor, AVP & Country Head, Meiban Engineering Technologies Pvt Ltd. Meiban Engineering is a solution provider in the field of Automation and Turnkey projects for manufacturing automobile and sheet metal components. It supplies and services sheet metal machines which include CNC Servo Turret Punch presses of various capacities, punching and shearing machines.

At PMTX, the company displayed its Twin Spindle CNC Chucker MW120EX with the fastest gantry loader in the industry. The machine is suitable for high-precision and hard part turning. The MW100HG twin-spindle CNC chucker is a powerful machine with the smallest footprint which generated the most enquiries.

Just like Meiban Engineering, it was the first time participation for NB Equipments & Engineering Pvt Ltd in FACTERQ 2024. "The show was insightful with the displayed



Source: Meiban Engineering Technologies

"Since it was the first time we were participating in PMTX, the team was unsure of the outcome. We had put in effort and a highly expectant team from Japan was also present during the show. We were thrilled to receive footfall which was beyond our expectations. Most known customers visited our stall, and, interestingly, those new to us also tried to locate us and showed interest in our products."

Rishi Kapoor
AVP & Country Head
Meiban Engineering
Technologies Pvt Ltd

machines and products reflective of the latest industry trends. We received significant industry footfall and leads. Our Scissor Lift (aerial works platform) was featured at the show. The maximum enquiries came from MSMEs in and around the Pune district looking to enhance safety measures for working at heights," shares Chintan Pandya,



Source: NB Equipments & Engineering

"The show was insightful with the displayed machines and products reflective of the latest industry trends. We received significant industry footfall and leads. Our Scissor Lift (aerial works platform) was featured at the show. The maximum enquiries came from MSMEs in and around the Pune district looking to enhance safety measures for working at heights."

Chintan Pandya
Director - Marketing
NB Equipments &
Engineering Pvt Ltd

Director - Marketing, NB Equipments & Engineering Pvt Ltd.

PMTX is impactful

Pankaj Jayawant Bandal, Regional Manager - Sales, Jyoti CNC Automation Ltd, one of the largest CNC machine tool manufacturers in India, points out that the Manufacturing



Source: Magic Wand Media



Source: Jyoti CNC Automation Ltd

"PMTX is gradually making an impact both in terms of technology displays and business opportunities that it offers. Pune is one of the major manufacturing hubs of the country, and a show of such caliber has the potential to bring together the manufacturing fraternity to connect and forge business bonds to progress."

Pankaj Jayawant Bandal
Regional Manager - Sales
Jyoti CNC Automation Ltd

sector has benefited greatly from PMTX 2024. "The show is gradually making an impact both in terms of technology displays and business opportunities that it offers. Pune is one of the major manufacturing hubs of the country, and a show of such caliber has the potential to bring together



Source: Quaker Houghton

"PMTX is an ideal opportunity to connect with the customers of the western part of India and, in particular, Pune, Nashik, Kolhapur, and Chhatrapati Sambhajinagar which are the main manufacturing hubs in Maharashtra. The 2024 edition helped us engage with enthusiastic visitors from different industries including Automobile, Auto Components, Aerospace, General Engineering, Capital Goods, and many more."

Sachin Mahajan
Marketing Manager - India
Quaker Houghton

the manufacturing fraternity to connect and forge business bonds to progress." The expo this year, he notes, attracted thousands of visitors from major industrial towns in Maharashtra and surrounding states like Gujarat. It displayed significant developments in manufacturing technologies,



Source: Magic Wand Media

with a particular emphasis on Industry 4.0, automation, additive manufacturing, and metalworking machinery.

"PMTX is an ideal platform to showcase our latest innovations and technologies directly to the industrial users. Our CNC Chuckers, Turning Centers, and VMCs for production and Die-Mold applications fetched maximum enquiries during the show. We also received a huge response for double-column machines and 5-axis machining centers," reveals Bandal.

Connecting customers from western India

Sachin Mahajan, Marketing Manager - India, Quaker Houghton, the global leader in industrial process fluids, finds PMTX an ideal opportunity to connect with the customers of the western part of India and, in particular, Pune, Nashik, Kolhapur, and Chhatrapati Sambhajinagar which are the main manufacturing hubs in Maharashtra.

"Industry fairs facilitate direct interactions between experts and customers that lead to a better understanding of the latter's preferences, requirements, and pain points. PMTX 2024 helped us engage with enthusiastic visitors from different industries including Automobile, Auto Components, Aerospace, General Engineering, Capital Goods, and many more. The show turned out to be a perfect medium to generate a potential customer base," he notes.

Quaker Houghton aims to stand out as a market leader with its range of sustainable solutions and promote itself as a one-stop solution for the customers' manufacturing needs. At the show, the company displayed its value proposition for metalworking and the segments covered were die casting, forging, heat treatment, and metal removal.

"IMTMA has a significant presence of members in the Western region, specifically in Maharashtra and the Association works closely with the Government to support the growth of industries in the state."

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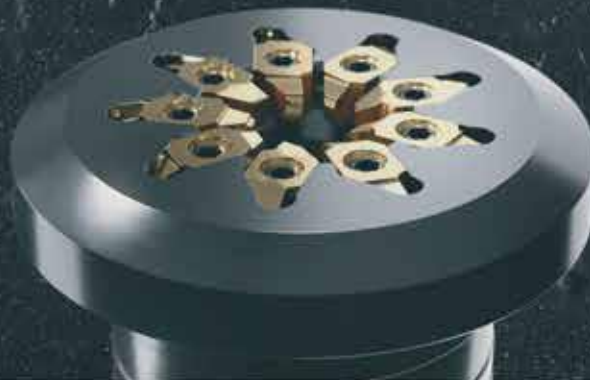




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