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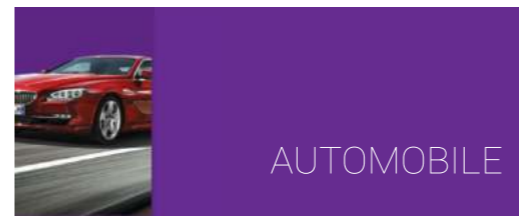
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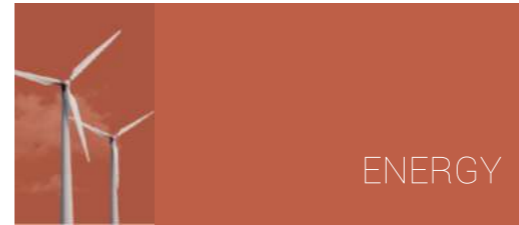
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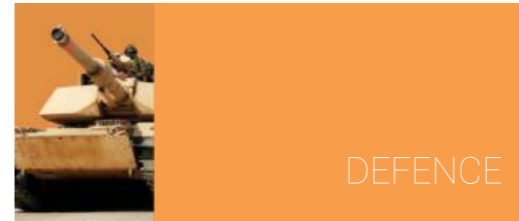
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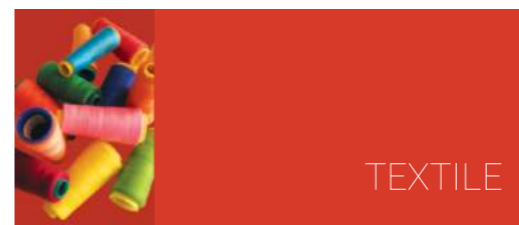
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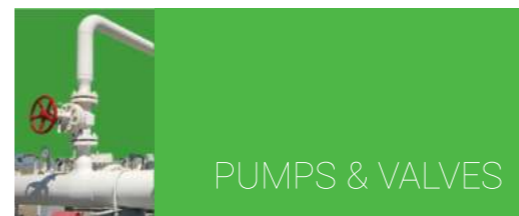
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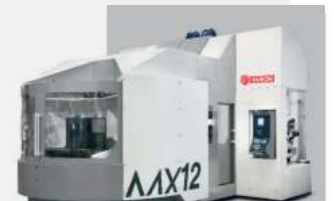
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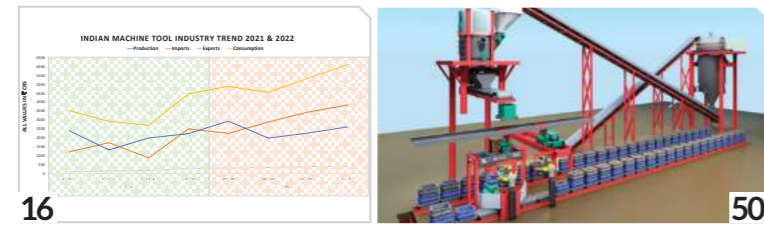
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# IMPRINT

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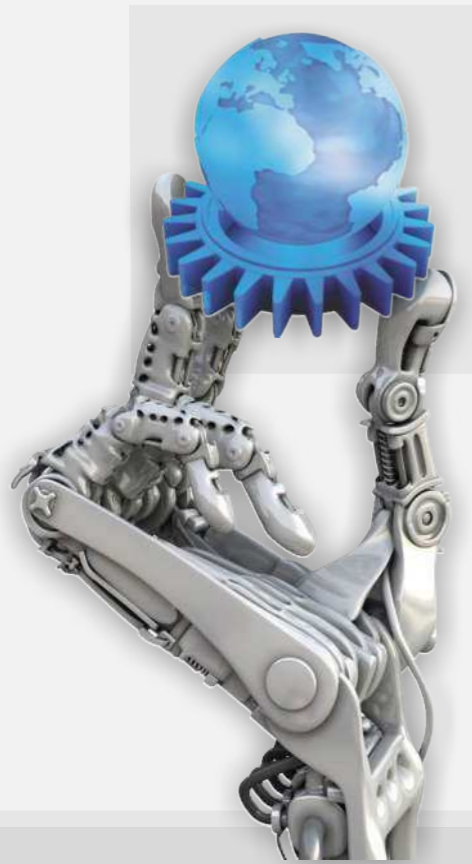


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## RESILIENCE MARKS INDIA'S GROWTH ASPIRATIONS



Source: BFW

**RAVI RAGHAVAN**  
PRESIDENT  
INDIAN MACHINE TOOL  
MANUFACTURERS' ASSOCIATION  
(IMTMA)

Dear Reader,

Indian Machine Tool Manufacturers' Association (IMTMA) began the year on a positive note. The Association held the 20<sup>th</sup> edition of its flagship exhibition IMTEX 2023 from January 19-25, 2023. It was exhilarating to see technologically advanced feature-rich machines that would take Indian manufacturing to the next level. Concurrent shows Tooltech and Digital Manufacturing generated curiosity, enthusiasm, and a good number of enquiries.

Exhibitors at IMTEX 2023, Tooltech 2023 & Digital Manufacturing 2023 reported estimated business enquiries of around ₹31,000 crore (around US\$ 3,787 million). The order booking was estimated to be around ₹2,200 crore to ₹2,800 crore (US\$ 269 million to US\$ 342 million). These pointers indicate the positive economic outlook for the domestic manufacturing industry and a keen interest in India's machine tool business.

India's recent budget presented by the Finance Minister sets a template for the nation to address global challenges to its economy. A sizeable 33 percent hike in capex along with the highest-ever capital outlay of ₹2.4 lakh crore would heighten the demand for machines and equipment. An enhanced corpus for MSMEs would help them avail of an additional collateral-free guaranteed credit of ₹2 lakh crore. This is a positive step to develop MSMEs and enhance their production capacities.

Meanwhile, from a broader perspective, the International Monetary Fund (IMF) in its January report stated that India was the fastest-growing economy.

*For the current financial year, the Indian Machine Tool industry's production is forecasted to grow by around 7-10% and consumption is expected to grow by about 20%. Based on these parameters, we can look at the upcoming financial year with renewed hope.*

India's manufacturing sector is on a steady pace of growth. As per S&P Global India with a manufacturing PMI of 55.4, India completed a record 19<sup>th</sup> successive monthly improvement in operating conditions.

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and consumption is expected to grow by about 20 percent. Based on these parameters, we can look at the upcoming financial year with renewed hope.

While IMTEX 2023 was largely successful with a good display of technologies and business generation, it is time for us to think ahead and raise the bar further.

Happy reading.

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**JIBAK DASGUPTA**  
DIRECTOR GENERAL & CEO  
INDIAN MACHINE TOOL MANUFACTURERS' ASSOCIATION

Dear Readers,

Modern Manufacturing India (MMI) magazine has been regularly publishing thought-provoking articles, reports, and news from manufacturing industries. I hope that the readers can connect with and benefit immensely from the content which we publish.

I am glad to share that Indian Machine Tool Manufacturers' Association (IMTMA) has begun a new series on the Indian machine tool industry outlook. This will help readers to understand how the machine tool industry is faring. It will also give a perspective on where the industry is headed in the coming quarters.

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IMTMA has been publishing numerous data reports and articles for the benefit of the manufacturing industry. All of these are available in digital form for readers to access. I call upon readers to share their valuable feedback, which will help us understand your requirements.



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## BEING SUSTAINABLE TO BE SUSTAINABLE

**T**he month of March is recognized as the observation of various environmental awareness days, such as World Water Day, Earth Hour Day, World Forestry Day, and so on, emphasizing the need to conserve our precious natural resources.

With each passing day, it is evident that the more we adopt sustainable practices, the better our future will be. Thankfully, we are seeing the emergence of the latest sustainability trends, which are bringing change across various sectors in India.

Keeping in sync with its global contemporaries, the Indian manufacturing sector is adopting sustainable practices to reduce its impact on the environment. Organizations are making investments in innovative technologies to drive sustainability across their operations. Starting from focusing on energy efficiency measures to circular economy initiatives, manufacturing enterprises are implementing sustainable water management practices, like reusing water, reducing water waste, and improving water efficiency.

To this end, we foresee the deployment of advanced technologies such as Artificial Intelligence (AI), Industrial Internet of Things (IIoT), Internet of Things (IoT), Automation, Industry 4.0, and Blockchain to track and monitor resource use, improve supply chain transparency, reduce waste, and accelerate sustainable practices.

Speaking of the latest technologies, the recently concluded IMTEX 2023, Tooltech 2023 & Digital Manufacturing 2023 showcased how new innovations are facilitating companies in adopting cost-effective, sustainable, and eco-friendly manufacturing processes.

In this present issue, we are privileged to share best practices, success stories, and

the views of industry experts on the future manufacturing trends that would contribute to making India a bigger economy globally.

*"If you want to save the humankind,  
you should first take care of Nature.  
It's the legacy that we leave behind,  
That brings us hope, that's for sure!*

*- Ana Claudia Antunes*

## Who did you notice more?

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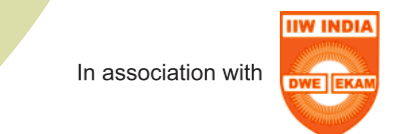
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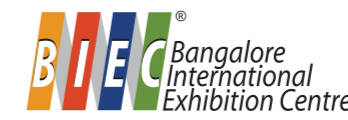
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## PAYING HOMAGE TO THE DESERVING

Since its establishment, IMTMA has been working towards consolidating the Indian machine tool industry's capabilities to carve out its own niche and achieve self-reliance in machine tools. It is crucial that we acknowledged the heroes who were instrumental in envisioning this and their past contributions that are now yielding fruitful results. Starting this issue, MMI attempts to reintroduce them and highlight their efforts in shaping the industry as we see it today.




Sir Dhanjishah Bomanji Cooper was the Founder President of IMTMA.

due recognition from Government and machine tool producers. It's truly regrettable that just when the Indian Machine Tool industry needed his help to solve the numerous challenges they were facing, he left for the afterlife.

### Remembering IMTMA's founding fathers

As a part of the Association's 75-year journey, IMTMA launched a special coffee table book and produced a short film that showcased the invaluable contribution of Sir Cooper. The book and film were released during the IMTEX event.

Sir Cooper was a prominent figure who served as an industrialist, politician, and the Prime Minister of the Bombay Presidency. During the pre-independence period, he dedicated himself to promoting social and industrial development in rural Western Maharashtra. He established the first iron plow manufacturing company in Satara in 1922 and held the position of President of Satara Municipality from 1923 to 1932. In 1934, he played a significant role in manufacturing the first diesel engine, which laid the foundation for the automobile era, and he became a pioneer in diesel engine manufacturing.

IMTMA considers itself highly fortunate to have been guided by such progressive minds on its path to growth. 

Sir Dhanjishah Bomanji Cooper was the Founder President of IMTMA who laid the cornerstone of the industry's future.

### Contributions galore

He was mainly instrumental in the formation of the Association. In the period of nearly one year during which he was actively associated with the work of the Association, Sir Cooper's valuable guidance and indefatigable efforts enabled the Association to be established on the sound lines with

**I**n 1946, 19 visionaries joined hands to form the Indian Machine Tool Manufacturers' Association (IMTMA), an industry association with a three-pronged vision: to develop the Indian machine tool industry, scale down reliance on imports, and help India become one of the five top machine tool building nations. This happened a year before India gained independence, and it was a significant milestone for the sector.

Source: IMTMA



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## INDIA RESILIENT DESPITE GLOBAL HEADWINDS

Given the optimistic developments in the rapidly changing Indian Machine Tool industry, it is vital our readers achieve a deeper understanding of the industry's present status. Starting this month, MMI has introduced a new segment that will help us gain that much-needed insight.

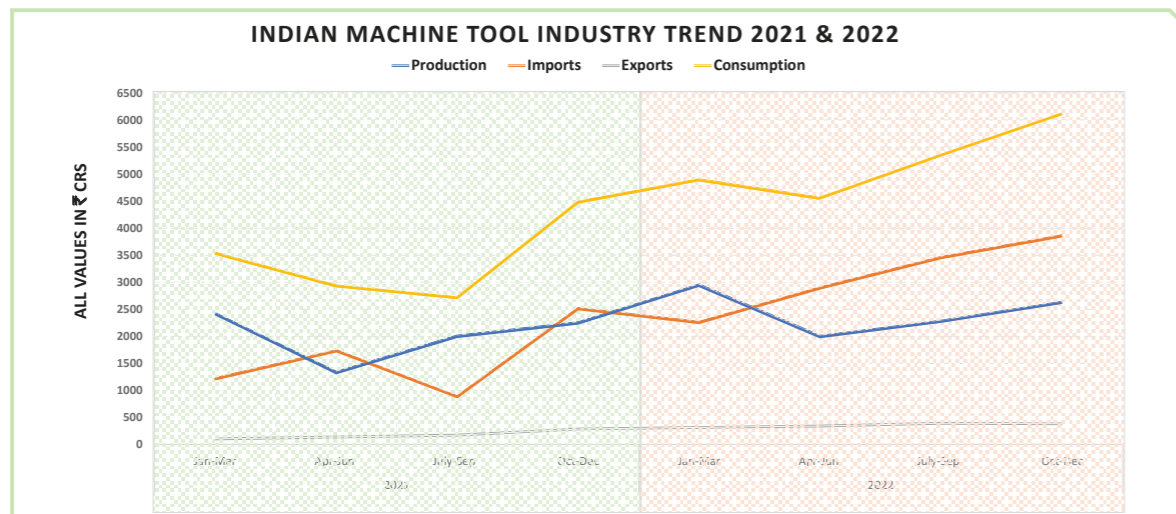


Table 1. Indian Machine tool industry Trend

Manufacturing PMI and services rose to a six-month high of 57.8 and 58.5 respectively in December 2022, according to S&P Global India estimates. The index of industrial production showed an upswing to reach 137 in November, indicating that the manufacturing sector's health was robust.

The Indian Machine Tool industry has been resilient to external shocks and continued to grow in the last four quarters. The industry has been doing well in all parameters whether it is production, sales, new order bookings, or consumption. Driven by the various PLI schemes, the Make in India initiative, and larger capex spending by the Government, manufacturing activities are expected to grow. The Indian Machine Tool industry's production and new orders are both estimated to have reported a healthy growth of over 20 percent in CY2022. In the third quarter of FY2022-23 (Oct-Dec 2022), production and order booked are estimated to have grown by 17 percent Y/Y and 4 percent Y/Y respectively (refer to Table 1 for the Machine Tool industry trend).

It is expected that the Machine Tool industry would continue its growth in FY2023-24. The global downturn projected for

FY2022-23 and FY2023-24 and the global geopolitical issues appear to have less impact on the Indian capital goods and manufacturing sector. However, the domestic Machine Tool industry is cautiously optimistic. Coming to the machine tool imports, the value was low during FY2023-24 which could be attributed to the post-pandemic days. Business activities started picking up in FY2023-24 with the value of imports growing by an estimated 96 percent in 2022 as against 2021, to reach ₹12,479 crore, i.e., about US\$1,586 million. The above positive indicators, domestic production, and imports are expected to drive domestic consumption to further reach the pre-pandemic level of FY2018-19, which was the highest.

**Indian Economic Scenario**  
Meanwhile, India's GDP for FY2023-24 is forecasted to grow between 6.6 percent to 7 percent year-on-year by most global

agencies. India is seen as a bright spot compared to other major economies. The country's purchasing managers index (PMI) for manufacturing and services remained in the expansion mode in the last quarter.

Readers can access more information on the Indian machine tool industry from the following publications:

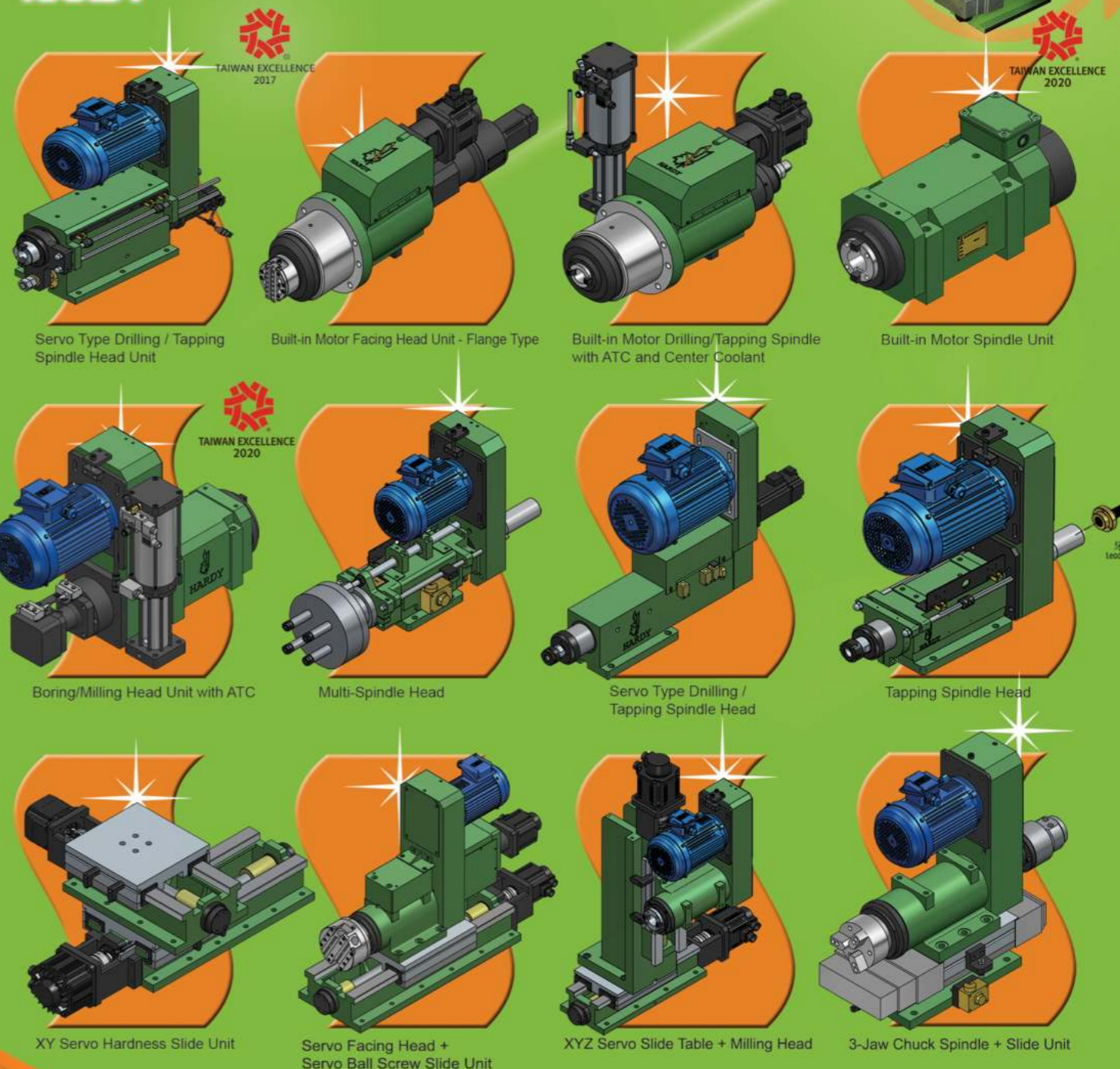
1. Comprehensive Report on the Indian Metal Working Machine Tool Industry 2023
2. Business Feasibility Study for Indian Machine Tool Manufacturers in Thailand 2023
3. Machine Tools User Sector Project Investment List 2023
4. IMTMA Directory of Members 2023
5. Ten Year Indian Machine Tool Industry Database in Power Bi (FY2023-24 to FY2023-24)

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Source: Data Analytics & Policy Group, IMTMA

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## IMTEX 2023: TAKING INDIAN MANUFACTURING TO GREATER HEIGHTS

IMTEX, Tooltech & Digital Manufacturing 2023 once again proved itself to be a comprehensive show that displayed an exhaustive range of visually appealing ergonomic machine designs and feature-rich machine types, from machine tools for metal cutting to digital and automation solutions, robots, 3D printing solutions, cutting tools, and more. The event also offered enough reasons for the displayed technologies to be implemented and utilized appropriately in the near future.



Source: IMTMA

**A**t IMTEX, Tooltech & Digital Manufacturing 2023, there was a significant focus on showcasing the relationship between man and machine in the working environment. The exhibition presented a wide range of visually appealing ergonomic machine designs, as well as feature-rich and diverse machine types, which was an exciting sight to behold. All categories, viz., machine tools for metal cutting, measuring equipment, digital and automation solutions, robots, 3D printing solutions, cutting tools, tooling systems, workholding

systems, fixture solutions, clamping solutions, and affordable ERP solutions were showcased. Exhibitors presented a range of high-speed, high-performance machines that featured smaller footprint. These machines also offered tailored solutions capable of multi-tasking. Additionally, the event featured digitalized solutions, and both original equipment manufacturers (OEMs) and suppliers presented Industry 4.0 solutions.

**Event standouts**  
International and domestic ma-


chine tool builders demonstrated a wide variety of machines. Exhibitors presented sector-specific solutions for Auto, EV, Die and Mould, Aerospace, Medical, and Electronic industries, etc. Overall, there was a shift towards multi-axis, multi-tasking, hybrid, and high-precision machines. Among the other prominent technologies visible at the exhibition were faster tool change and clamping, inspection based on vision systems, and laser profilers that could facilitate reduced cycle times, increased throughput, and improved performance.

Most OEMs, apart from offering sector-specific solutions, also showcased built-in IoT-enabled features as customized for industries. To quote an example, for the Electronics industry, domestic exhibitors offered drill tap centers with 24,000 rpm, auto loading/unloading, and faster tool-changing features that matched the performance of global players. Also on display were diamond turning machine capable of achieving nano level of surface finish. Visitors also had the opportunity to see combination machines for 5-axis manufacturing, high-precision micro 5-axis machining centers, spiral and bevel gear manufacturing machines, multi-axis gear hobbing machines, camshaft grinders, polygon turning machines, high-precision double-disc grinders, 3-axis moving head surface grinders, and high-speed energy-efficient slant turret designs with a removable chip tray instead of a chip conveyor (motor) for sustainability. Robot-based metal additive manufacturing machines and hybrid metal additive machines were also among the highlights of the event.

IMTEX 2023 saw a substantial number of exhibitors from Asia, Europe, and North America, with several Indian companies also showcasing their competing products and solutions.

**Digital Manufacturing**  
Industry 4.0 and solutions for transforming factories into smart and connected factories were a few of the biggest trends seen at the exhibition. Companies offered Industry 4.0-related networking, machine-to-machine communication, shop floor communication, data capture, and analysis customized solutions for industries, cloud-based solutions, ERP, CRM, and CAD/CAM solutions to industries. Solutions for cutting tool monitoring, vibration monitoring, and thermal monitoring of machines and sub-systems were also exhibited. Generally, extensive digitalization and automation solutions were offered as options. Under additive manufacturing, hybrid, as well as plastic and metal, were other visible trends. Ceramic 3D printers using digital light processing technology to produce ceramic parts with a provision for building production-level cell-based manufacturing plants were

exhibited. Entry-level and affordable 3D printers for both plastic and metal were also displayed.

**Customer focus**  
Most companies have moved to online service support for upgradation and installation. They have launched dedicated portals for customer connect, problem-solving, and spare parts selling. This aims to streamline end-user support and enable customers to remain connected with the company's engineers. During the exhibition, there was deliberation on how technology can revolutionize customer experiences. Robots for pick and place, machine tending, optical scanning applications, digitalization, and automation were identified as answers to this. IMTEX 2023 led to a significant influx of business inquiries valued at approximately ₹31,000 crore. A shift towards machine tool and shopfloor automation and automation of the entire manufacturing ecosystem was visible, which is likely to intensify in the coming years. Hence, it can be reasonably inferred that the technologies witnessed by attendees would be implemented and utilized appropriately in the near future. 

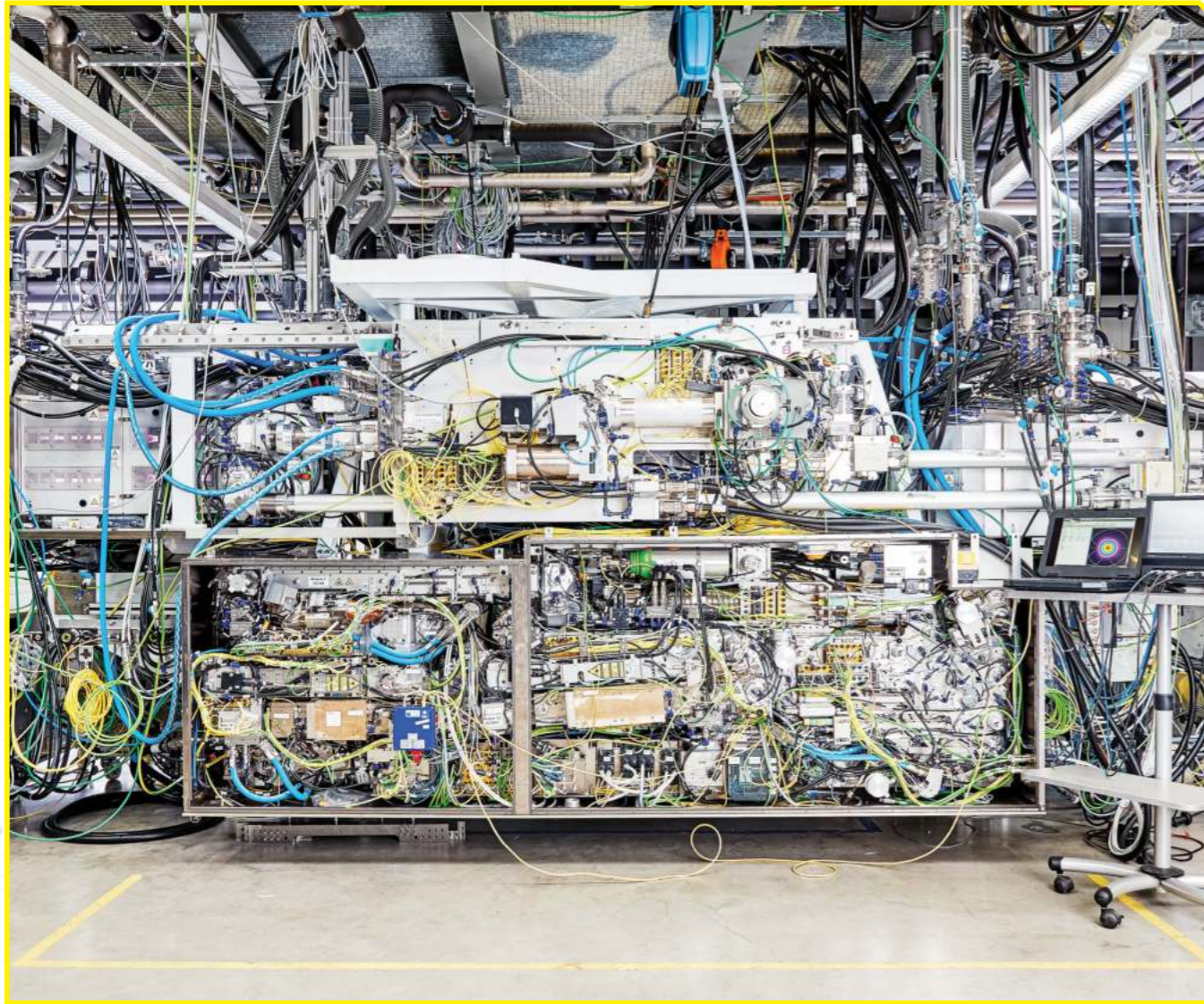
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**When Goals Matter!**

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# THE EMERGENCE OF LASERS IN THE DIGITAL AGE



Source: TRUMPF Group

**L**asers have become a household name ever since they burnt their way into public consciousness in the famous James Bond movie, Goldfinger, in 1964.

One of the first commercial manufacturing applications using lasers happened in 1965 when the Western Electric Company, US, adapted a pulsed system for the production drilling of diamond wire drawing dies. In this application, the processing time for drilling of a die was reduced from 24 hours using conventional methods to less than one hour with lasers.

A variety of commercial drilling applications have since been developed; one of the most successful being laser drilling of cooling passages in gas turbine parts. The success of these initial production applications hinged on the laser's ability to accurately deliver a precisely controlled amount of energy to a highly localized region of a workpiece.

### Cutting with Fiber Lasers

Fiber lasers emerged in the commercial laser cutting space in 2009. In 2007, the Italian technology company Salvagnini began heavily investing

in the development of fiber lasers that could cut sheet metal.

From the 1960s, in just six decades, laser cutting technology has advanced in leaps and bounds with fiber lasers now capable of cutting through steel 100 mm thick. Additionally, recent advances have also made laser cutting machines more affordable and widely available to small businesses.

### Lasers in Electronics

The buzzwords in the Electronics industry are faster, smaller, and more efficient, with increased miniaturization and production in extremely large volumes. Pradeep Patil, Managing Director, TRUMPF (India) Pvt Ltd, one of the leading laser companies in the world says, "As a result of unprecedented precision and good automation potential, laser technology can provide industrial solutions to these challenges. TRUMPF lasers play a fundamental role in the production of the latest generation of computer chips. Lasers also enable a large number of other process steps to be carried out, such as cutting and drilling silicon wafers, printed circuit boards, or entire electronics modules."

### Emergence of EUV Laser Technology

EUV or Extreme Ultraviolet Light is an optical lithography technology used in semiconductor device fabrication to make integrated circuits. It uses EUV wavelengths, roughly spanning a 2 percent FWHM bandwidth near 13.5 nm, using a laser-pulsed tin plasma, to produce a pattern by using a reflective photomask to expose a substrate covered by photoresist.

With the advancement of industries like mobile phones, 5G, Industry 4.0, new age medical technology, autonomous driving, artificial intelligence, etc., miniaturization and automation are exponentially increasing the requirements on computer performance.

This requires a lot more transistors to be placed on the semiconductors inside chipsets. In fact, Moore's law, named after Gordon Moore, one of the Co-founders of Intel, postulates that the number of transistors in a dense integrated circuit doubles about every two years. This law still applies today with semiconductors having integration densities of up to 100 million transistors to one square millimeter.


Patil says, "The size of semiconductor structures is inching closer and closer to atomic dimensions. High-performance laser amplifiers by TRUMPF play a central role in the production of these chips. They help to create a luminous plasma

that delivers extreme ultraviolet radiation (EUV) exposure to the substrate. In close cooperation with ASML, the world's largest manufacturer of lithography systems, as well as Zeiss, the optical systems manufacturer, TRUMPF has developed a one-of-a-kind CO<sub>2</sub> laser system which can process over 100 substrates an hour."

Without laser technology, the development of microelectronics, computers, and smartphones, would be inconceivable as logic and storage chips have structures in the nanometer range that can only be produced using complex exposure processes with laser radiation. The conventional approach with UV laser radiation from excimer lasers is increasingly reaching its limits and in the future, it will only be possible to generate smaller structures with even shorter wavelengths in the EUV range.

### EUV Lithography

The Semiconductor industry is constantly looking out for cost-efficient and mass-production technologies to expose even smaller structures on silicon wafers. New-age computer chips that come in nanometer dimensions can only be produced by complex exposure processes with the help of lasers. This is where the conventional approach with UV laser exposure by excimer lasers has its limitations. Smaller structural sizes in ranges of less than ten nanometers can no longer be created with UV laser exposure by excimer lasers. These fragile and intricate structures require exposure to even shorter wavelengths – rays in the EUV range.

Patil says, "The major challenge of EUV lithography is to generate radiation with the optimal wavelength of 13.5 nanometers. The solution: A luminous plasma generated by laser radiation that delivers this extremely short-wave radiation. A generator drops tin droplets into a vacuum chamber, then a pulsed high-power TRUMPF laser impacts the passing tin droplets – 50,000 times per second. The tin atoms are ionized, and an intensive plasma is created. A collector mirror captures the EUV radiation emitted by the plasma in all directions, bundles it, and finally transfers it to the lithography system for exposure of the wafer." 

*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.*

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# FUTURE TRENDS TO WATCH OUT

The recently concluded IMTEX 2023 offered the participants the Digital Manufacturing Pavilion as a dedicated space to explore the latest smart technologies. Industry stakeholders highlighted notable developments in the Indian manufacturing landscape, as well as their innovative solutions to meet current and future demands. Let's take a closer look at what caught their attention.



Team Airtech Pvt Ltd



Team Andreas Maier Workholding Technology Pvt Ltd

**D**igital manufacturing has been gaining momentum in the Indian Manufacturing sector in recent years. It refers to the use of advanced digital technologies such as IoT, AI, robotics, and cloud computing to optimize the manufacturing process, increase productivity, and reduce costs. The implementation of digital manufacturing techniques can help Indian manufacturers enhance their competitiveness and meet the demands of an increasingly globalized market.

The Indian Government has also launched various initiatives to promote the adoption of digital manufacturing, such as the 'Make in India' campaign and the National Policy for Advanced Manufacturing. IMTMA, at the recently held IMTEX 2023 & Tooltech 2023 and Digital Manufacturing 2023, assumed responsibility for showcasing digital innovations, educating Indian manufacturing participants on their advantages, and encouraging their adoption. The shift towards digitalization,

as observed by the participants, has already begun. The Association spared none of its efforts in ensuring that it plays the part of the catalyst in the process.

**Measuring success**

Anil Gupta, Managing Director, APM Technologies 3D Pvt Ltd, observed a noticeable trend towards Industry 4.0 and digital manufacturing among the newly launched products. APM Technologies, being a metrology company, can affirm that its measuring products are align-



Source: Magic Wand Media

Team Chennai Metco Pvt Ltd



Source: Magic Wand Media

Team Chiron India Machine Tools Pvt Ltd

ing with this shift towards digitalization in the industry. "Our booth received a majority of visitors from the Automotive industry who were interested in purchasing 3D Scanning and 3D Printing technology. We demonstrated our powerful 3D scanner, ScanBox, which measures four times faster than conventional methods. In 3D Printing, we showcased Formlabs 3L. Formlabs is known for designing end-to-end additive workflows. The Form 3L brings the Formlabs experience to large format 3D printing, in which no specialized technicians are required. It offers automatic resin dispensing, simple print preparation software, and a thoughtfully designed interface," he informs. Vikrant Saigal, Managing Director, Airtech Pvt Ltd, a leading manufacturer of high-speed

power chucks, rotary cylinders, and special work holdings for CNC lathes, believes that the exhibition has always held a special place for those in the Machine Tool industry, and the 2023 edition was no exception. "One remarkable aspect was the rapid integration of new software, hardware, and technologies like IoT, AR, VR, Smart Sensors, and Industry 4.0 into machines and their accessories. The adoption of 3D printing and other additive manufacturing technologies was also evident. Additionally, various types of machines, workholding fixtures, robots, and coolant tank systems stood out in the adoption of Industry 4.0. Smart Manufacturing could be seen in the way the machines were configured using 5th-Axis, multi-tasking turning machines, and turn-key solutions

provided by OEMs, leading to improved productivity and quality. It was encouraging to witness the localization of robots and CNC control systems." The company's customers are mainly split into OEMs, end-users, and dealers. "Most OEMs are very old customers, and they visited our booth at IMTEX 2023 to see our new workholding fixtures and solutions for various turning, grinding, gear-hobbing, and VMC applications. In the end-user category, we have a diverse range of customers from the Automotive industry; Oil & Gas industry; Industrial Automation; Fasteners, Pumps, and Valves manufacturers; Fans manufacturers; Turbine parts manufacturers; Steel Forgings and Castings manufacturers; Aluminium castings manufacturers; manufacturers of Material Handling

"One remarkable aspect was the rapid integration of new software, hardware, and technologies like IoT, AR, VR, Smart Sensors, and Industry 4.0 into machines and their accessories. The adoption of 3D printing and other additive manufacturing technologies was also evident."

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Team APM Technologies 3D Pvt Ltd



Team Blaser Swisslube Solutions Pvt Ltd



Source: Magic Wand Media

Team FIBRO India Precision Products Pvt Ltd



Source: Magic Wand Media

Team Gedee Weiler Pvt Ltd

**"IMTEX 2023 provided an opportunity to observe noteworthy advancements in the Indian machine and cutting tools space, including the integration of cutting-edge technologies in machines, workhandling, and automation and the adoption of competitive pricing and reduced costs in terms of productivity and set-up times, among other things."**



Team Jyoti CNC Automation Ltd



Team Quaker Houghton

equipment; various welding applications; and Aerospace, Defence, and Gear industries, and many others. The customers generally visit if they have any workholding challenge that needs to be addressed," he adds. The company also had customers from outside of India who showed keen interest in its products. TV Mohan, Country Head & Managing Director, Andreas Maier Workholding Technology Pvt Ltd, says IMTEX 2023 provided him an opportunity to observe numerous noteworthy advancements and progress in the Indian machine and cutting tools space, including the integration of cutting-edge technologies in machines, workhandling, and automation; the adoption of competitive pricing and reduced costs in terms of productivity and set-up times; the implementation of Industry 4.0; the utilization of AI for prototyping, virtualization, and innovation; the increase in global

market share; and the development of robots, 3D manufacturing, and comprehensive manufacturing/factory solutions. The company had a wide range of visitors from the Machine Tool, Fixture, Aerospace, Automotive and General Engineering industries. "Several leading manufacturers, such as LMW, BFW, Hurco, Philips, Makino, etc., had our workholding and clamping devices on their live machine displays," he adds. Andreas Maier's 'ZERO-POINT Clamping System', which is patented around the world and has widespread adoption across all industries, was the one that garnered the most attention.

**Together in customers' success**

As a leader in metalworking solutions, Blaser Swisslube's motto has been to help customers win. The company participated in the Digital Manufacturing Pavilion at IMTEX 2023 to showcase its digital advance-

ments and initiatives and help its customers stay competitive in the global market. "One of our unique new initiatives is the Smart Automated Coolant Management Solution. It is a modular approach to help customers adopt digitalization and gain transparency in data points and process reliability in their machining processes," explains Punit Gupta, Managing Director - West Asia (India & SEA), Blaser Swisslube Solutions Pvt Ltd. Liquid Tool Analyzer is a simulation tool that helps customers bring visibility to their machining data and establish a leverage effect on various cost drivers. "We have the know-how and do-how in a wide range of industries, applications, and materials. We are glad that during IMTEX 2023, visitors from a variety of industry sectors, including Automotive, General Machining, Die & Mould, Aerospace, Industrial Machinery and Equipment, Medical, Tool Maker, Oil & Gas,



Team Siemens Ltd



Team Taegutec India Pvt Ltd

and Aerospace, learned about Blaser offerings for their operations," adds Gupta. With its holistic approach and profound machining knowledge, the company offers solutions that help customers across different industries fully capitalize on the potential of their machines and tools and turn their metalworking fluid into a key success factor - a Liquid Tool.

**Gap getting bridged**

C Renganathan, Managing Director, Chennai Metco Pvt Ltd, noted that customers today are more interested in automated, robotic systems. What is happening in the west in advanced manufacturing is seeming to be catching up in India rather quickly. Indian manufacturing has now reached a stage where it has the need and the resources to bring digitization to the shop floor. "We received visitors from across industries. However, most belonged to the Auto

Components Manufacturing sector, which witnesses a trend of manufacturing being outsourced to India from the US and other countries. This is adding up to the global volumes in this sector," he adds. For Rajesh T Ghoshi, Managing Director, Chiron India Machine Tools Pvt Ltd, it was great to witness Indian machine tool companies developing their digital solutions to cater to Industry 4.0 requirements and offering digital and smart solutions along with their machine tools. "This demonstrates the industry's commitment to innovation and staying ahead of the curve in terms of technological advancements. In addition, the development of import substitute technologies displayed at the show came across as a positive sign of India's growing self-reliance in the Manufacturing sector," he adds. The company featured its Micro 5 high-speed, high-precision machining center for micro-precision parts catering to the Medical, Watch, and Jew-

elry industries, which has been well received in the market. "We also received prospective visitors from the same sectors at our stall, and we are already working on some projects," he shares. "Digital or smart manufacturing is currently the buzzword," notes Vivek Nanivadekar, Executive Director, FIBRO India Precision Products Pvt Ltd. The Indian manufacturing sector is gradually making headway in this direction, although the progress, as he points out, is slow. "The use of sensors, cameras, and Bluetooth devices is rapidly gaining ground in the manufacturing industry, enabling remote monitoring of factories. Furthermore, cloud computing of machining data contributes to enhancing overall operating efficiency," he adds. "However, in my opinion, the requirements for smart manufacturing differ significantly between the western world and India, particularly when it comes to the man-machine

**"The use of sensors, cameras, and Bluetooth devices is rapidly gaining ground in the manufacturing industry, enabling remote monitoring of factories. Furthermore, cloud computing of machining data contributes to enhancing overall operating efficiency."**



Team Rajamane Industries Pvt Ltd



Team S&T Engineers Pvt Ltd



Team UCAM Pvt Ltd



Team U-Tech Associates

The overwhelming response from corporations and customers in the MSME sector is indicative of a shift in the Manufacturing industry towards digitization. Another growing trend is observed among young professionals who are highly inclined toward digitized manufacturing practices.

combination," he adds. Most of the company's visitors at IMTEX were from the Auto sector, followed by Defence and Automation. "The rotary tables for automation and metal cutting as 4<sup>th</sup>/5<sup>th</sup> axis displayed in the booth were the main attraction for the visitors. All these tables are made in India. They are of German quality but not at German price," he informs. Anjay Goliya, Vice President – Sales & Service, Gedee Weiler Pvt Ltd (GEDEE Group of Companies), could observe a growing awareness among Indian manufacturers about the benefits of digital and smart manufacturing. "The benefits are significant, such as increased efficiency, productivity, and cost savings. Many companies are investing in technologies like automation, artificial intelligence, machine learning, and the Industrial Internet of Things (IIoT) to optimize their operations." "The majority of visitors, as per usual, came from the Auto sector. However, there was also a notable presence of visitors from the Aerospace, Defence, General Engineering, Agriculture, and Medical sectors. Encouragingly, visitors from all sectors were actively seeking solutions to address their common pain points, such as unskilled manpower, high costs of space, rejections, and the challenge of delivering faulty products to customers without compromising on productivity and quality," he adds. Almost all our machines attracted great numbers of visitors since they were Multitasking Machines. Our UT500DUO MT and UT350DUO model machines, doing Eccentric Turning and Simultaneous Machining, respectively, were of significant interest to the visitors. Our most affordable Turnmill machine model, Flexturn Neo TM, has already created ripples

in the highly competitive metal cutting market.

### Developing the seventh sense

At the exhibition, Jyoti CNC dedicated a special section to showcase its efforts in digitizing factories. Its Industry 4.0 initiative, 7<sup>th</sup> SENSE, played a significant role in positioning Jyoti as a leading provider of smart factory solutions. The overwhelming response from not just large corporations but also customers in the MSME sector highlights a growing interest in upgrading to modernized technologies offered by Jyoti. This encouraging response is indicative of a shift in the Manufacturing industry towards digitization. The company has observed a growing trend among young professionals who are highly inclined toward digitized manufacturing practices.

At IMTEX 2023, the company displayed MX 16, a multitasking machine with a hydrostatic rotary table, which became a showstopper of the exhibition. "In addition, our newly launched machine VST 160 – a vertical shaft-turning machine; ABX 40 – a 5-axis blade machining center; and Zebra – a next-gen productivity-oriented machine also were a hit. We received tremendous response from visitors belonging to Aerospace, Die-Mould, Automobile, and General and Heavy Engineering, which are boosters for economic growth," shares Himanshu Shaparia, President – Sales, Jyoti CNC Automation Ltd.

### Ecosystem for digitalization being built

Rohit Bhale, Senior Commercial Manager, Quaker Houghton, says that IMTEX 2023 made it clear that the ecosystem is getting developed to support digitization in manufacturing.

"Our industry-specific application expertise in fluids, combined with QH FLUID INTELLIGENCE™, our avant-garde Industry 4.0-ready technology, will be enablers for customers in their journey to digital transformation and smart manufacturing," he adds.

Quaker Houghton welcomed visitors from the Aerospace industry, and Transportation industry, and Industrial Segment. The visitors from the Government sectors, in particular, Defence and Aerospace were keen to understand the latest trends in manufacturing. "Visitors were enthusiastic to learn about QH offerings in terms of Synthetic Oil and Grindaix lubricoolant delivery system, which enhances coolant life and optimizes the use of coolant with minimum wastage," he adds.

Rajendra Rajamane, Managing Director, Rajamane Industries Pvt Ltd, felt that the demonstrated technology was of world-class caliber, as evidenced by the numerous applications showcased. "Several Indian companies showcased domestically-developed technologies at the event. Moreover, there was a significant demand for low-cost automation, which many Indian automation companies effectively demonstrated. In addition, there was a growing interest in complete project setups that encompass machines beyond cutting."

"We had visitors mostly from the Auto and Defence sectors. Many were from PSUs. Energy saving and high efficiency were understood as the most sought-out product features," he adds.

T Venkatesan, Vice President, S&T Engineers Pvt Ltd, "IMTEX 2023 made it clear that the Indian Manufacturing industry is increasingly embracing advanced technologies, such as Industry 4.0



Source: Magic Wand Media

and automation, to lower labor costs and enhance productivity."

"The event was an absolute hit with us. We received visitors from the Aerospace, Automotive, Die & Mold, and other Manufacturing sectors, as well as from Russia and the UAE," he shares.

"Digitalization is key for Indian machine tool manufacturing to move up the value chain. With the relevant Digitalization solutions showcased by Siemens, our customers did seem to be convinced that these are essential to fill technology gaps and leverage the growth opportunities to meet their growing requirements," says Vijay Pratap Singh, Country Business Unit Head, Motion Control, Digital Industries, Siemens Ltd. The company had a mix of machine tool builders and users across various industries like Aerospace and Defense, Automotive, General Engineering, and Electronics. Visitors could also experience many practical use cases of benefits that Digitalization can provide by combining the real and virtual worlds. "We were pleased to see our customers finding merit in our new innovations like SINUMERIK One, solutions for Additive Manufacturing, Xcelerator, and Shopfloor management software," adds Singh.

For L Krishnan, Managing Director, Taegutec India, Past President – IMTMA, "The vis-

itor profile was the most inspiring aspect, with a notable diversity of industry visitors spanning from Automotive and Auto Parts to Aerospace, Defense, General Engineering, and more. This shift highlights the spread of our manufacturing investments throughout the country, which is a positive development. As a cutting tool company, we are constantly seeking innovative solutions to enhance productivity and minimize manufacturing costs."

At IMTEX 2023, UCAM showcased its latest range of CNC machines, rotary tables, and other solutions for manufacturing, which generated a lot of interest among visitors from various industries such as Aerospace, Automotive, Construction, Defense, Energy, and Healthcare. "They had a unique set of requirements and were looking for products and technologies that could help them improve their manufacturing process," Vijay Zaritaklikar, National Sales Manager, UCAM Pvt Ltd.

The company also showcased its latest range of smart machines designed to increase efficiency, reduce downtime, and optimize the entire manufacturing process. "We noticed a significant interest from visitors towards digital and smart manufacturing, which indicates that the Indian Manufacturing sector is moving

towards Industry 4.0," he says echoing similar sentiments as other exhibitors.

Anant Deshpande, Executive Director, U-Tech Associates, notes that more and more people are looking towards including Industry 4.0 in their factories. "Although there are various companies involved in developing smart systems for the Machine tool industry, somehow the awareness was not there among the actual users. IMTEX 2023 has definitely helped in closing this gap by making end users aware of the systems available. In the next two to three years, digital/smart manufacturing will be a necessity for the industry as a whole.

U-Tech mostly had visitors from the Automotive and Aerospace industries. "One more interesting observation was that Russian business visitors were more. They were very seriously looking for partnerships with Indian companies," he points out.

### IMTEX 2023 emphasis on digitalization

Digitalization has become a crucial requirement for businesses in today's fast-paced and ever-evolving world. With the widespread adoption of digital technologies, organizations are leveraging these tools to streamline their operations, enhance efficiency, and improve their overall business outcomes. As a result, we can expect to see significant progress in the manufacturing industry in the coming years. Digitalization will enable manufacturers to create more personalized products, optimize their supply chains, and reduce costs, among other benefits. Overall, digitalization is the need of the hour, and those who embrace it will be better positioned to succeed in the future. 

Digitalization has become a crucial requirement for businesses in today's fast-paced and ever-evolving world. With the widespread adoption of digital technologies, organizations are leveraging these tools to streamline their operations, enhance efficiency, and improve their overall business outcomes.



Source: Magic Wand Media

## PLAYING THE PERFECT MEDIUM

As a premier platform for machine tool industry players, IMTEX has consistently attracted widespread interest. In its latest iteration, the event's emphasis on digitalization underscored the urgency for domestic companies to adopt intelligent technologies to remain competitive in the global marketplace. In this article, top industry leaders share their insights on the transformative benefits they derived from participating in IMTEX 2023.



### Airtech Pvt Ltd

The customer footfall was highly satisfactory this IMTEX. The conversion rate is also exceptionally high. IMTEX has always been a catalyst for order bookings, and this year is no exception. In addition to generating orders, the exhibition provides an opportunity to introduce one's brand to potential customers who may become future business associates.

**Vikrant Saigal, Managing Director**

### APM Technologies 3D Pvt Ltd

IMTEX 2023 was a great platform for the Machine Tool and Manufacturing industry to renew relationships, explore collaborations and partnerships, and network. The response to our products was overwhelmingly positive, with a large number of orders and queries for our 3D Scanning and 3D Printing products from both new and existing customers.

**Anil Gupta, Managing Director**



### Andreas Maier Workholding Technology Pvt Ltd

IMTEX 23 was a great success, as it happened post-COVID-19 and generated productive leads. We hope to penetrate new customer applications and prove to be the low-cost catalyst to dramatically increase productivity and significantly reduce manufacturing costs.

**TV Mohan, Country Head & Managing Director**



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### Blaser Swisslube Solutions Pvt Ltd



It was very encouraging to see customers receptive to Blaser's offerings. Mid- to senior-level customers across different departments including technical, operations, and purchase, showed keen interest in in-person meetings after IMTEX. Liquid Tool Solution is our value proposition to our customers. All of us at Blaser are convinced that it is the right way to move forward together with our customers.

**Punit Gupta, Managing Director - West Asia (India & SEA)**

### Chennai Metco Pvt Ltd

In our experience, IMTEX 2023 was among the most responsive editions. The significant increase in footfall could be explained by its taking place after the COVID-induced hiatus. As a result, we noticed a surge in visitor response. It has always been the case with companies like ours to depend on IMTEX for new inquiries for the following year. The inquiries have been excellent so far. It helps us add to the order books. We are highly optimistic about the outcome and anticipate a busy year ahead.

**C Renganathan, Managing Director**



### Chiron India Machine Tools Pvt Ltd



IMTEX 2023 was an opportunity to physically showcase our technology and meet with our existing and potential customers and partners. This presence enabled us to secure new projects, which was certainly beneficial to our business.

**Rajesh T Ghashi, Managing Director**

### FIBRO India Precision Products Pvt Ltd

As the IMTEX exhibition took place after a hiatus of four years, exhibitors and visitors had high expectations of each other. Fortunately, both parties were satisfied with the outcome. The exhibition attracted a lot of visitors seeking solutions to their specific bottlenecks. Nowadays, the focus is not on selling machines, but on providing solutions that benefit both parties in a mutually beneficial business. Customers are more interested in purchasing solutions that address their bottlenecks or problems rather than just buying a machine.

**Vivek Nanivadekar, Executive Director**





### Gedee Weiler Pvt Ltd

This was the most awaited IMTEX that has provided Gedee Weiler with a significant number of high-quality inquiries for both our high-end and standard machine models. As we look towards the next fiscal year, we see great potential for multitasking machines with integrated automation options in the Indian Machine Tool industry. The increasing demand for good quality machined components in exports has created a need for highly reliable, productive, and affordable machines like those offered by Gedee Weiler. The Indian Manufacturing sector has matured and is now a sought-after sourcing destination for machined components worldwide. This has led to a growing demand for high-technology machines, and IMTEX has come at the right time, providing a boost to Indian MTBs (Machine Tool Builders).

**Anjay Goliya, Vice President, Sales & Service**

### Jyoti CNC Automation Ltd

IMTEX is an important trade exhibition for the buyer and seller community, providing a platform for networking and gaining insights into market needs and wants. The exhibition not only helps to build confidence but also results in tangible business benefits. The discussions and interactions with decision-makers lead to the development of new strategies, policies, and products, paving the way for future growth and success. It is a highly valued event that provides a valuable opportunity for industry professionals to connect and collaborate.

**Himanshu Shaparia, President, Sales**



### Quaker Houghton



The Quaker Houghton team had the chance to engage with both current and potential customers at the event. The team was thrilled to witness the bustling activity within the Indian Manufacturing sector, with many existing and new players planning significant investments. This growth is driven by the Government-backed Production Linked Incentive scheme and spans across traditional automotive and auto-component manufacturing, as well as emerging sectors such as Aerospace and Defence. IMTEX 2023 created numerous business opportunities and avenues for Quaker Houghton to showcase its world-class solutions and participate in India's vibrant Manufacturing industry.

**Rohit Bhale, Senior Commercial Manager**

### Rajamane Industries Pvt Ltd

The exhibitors showcased a wide range of technology at its best, ranging from entry-level to advanced and large machines. They displayed machines catering to many of the sunrise sectors of the Government. As a result, I anticipate a surge in orders after the first quarter of FY 23-24. Given the Government's emphasis on infrastructure spending, I expect to see a plethora of orders for all the machine tool builders.

**Rajendra Rajamane, Managing Director**



### S&T Engineers Pvt Ltd

IMTEX 2023 helped us boost order books for the upcoming fiscal year. The event helped us secure several new projects and expansions from existing customers, particularly in the aluminum extrusion industry for applications like electric vehicles and lighting.

**T Venkatesan, Vice President**

### Siemens Ltd

More than the numbers, we were glad to see IMTEX take place in-person after four years. It gave us an opportunity to fill the gap of missing physical presence, meet, and talk to our customers and partners. It was the perfect opportunity for us to showcase our Digitalization & Control offerings.

**Vijay Pratap Singh, Country Business Unit Head, Motion Control, Digital Industries**



### Taegutec India Pvt Ltd



We believe that IMTEX 2023 has been one of the most successful IMTEX edition ever. This can be quantified in terms of participation by over 800 companies, a wide variety of displays, and extensive visitor profiles. The enthusiasm of visitors was palpable, as many arrived with a strong intent to invest. This resurgence is perhaps the most remarkable outcome of IMTEX 2023.

**L Krishnan, Managing Director, Taegutec India Pvt Ltd, Past President, IMTMA**

### UCAM Pvt Ltd

At IMTEX 2023, we received an overwhelming response from visitors and received many orders from various industries. The response was beyond our expectations, and we are delighted to say that we have started filling our order books for the next fiscal year. We are confident that our products' quality and competitive pricing played a crucial role in generating such a positive response. Overall, IMTEX 2023 was a great platform for us to showcase our latest products and technologies and connect with potential customers.

**Vijay Zaritaklikar, National Sales Manager**



### U-Tech Associates



IMTEX 2023 definitely helped us forge new alliances and partnerships with major OEMs. People from big machine builders had the opportunity to see our products and evaluate the quality standards we follow. This goes a long way toward establishing confidence in our ability to manufacture products for these OEMs.

**Anant Deshpande, Executive Director**

## BREAKING THROUGH THE GLASS CEILING

Dr Nandini Chakravorti, Associate Director, Technology Strategy, Manufacturing Technology Centre (MTC), shares her experience on the adoption of advanced manufacturing technologies and how, as a woman in engineering, she has overcome challenges, identified opportunities, and paved the way for other women to follow.



Dr Nandini Chakravorti, Associate Director, Technology Strategy, Manufacturing Technology Centre addressing the audience at IMTMA's ISMT.

**You recently addressed the audience at IMTMA's International Seminar on Manufacturing Technology as a Chief Guest. How was your experience at the event? Did anything specifically stand out to you about how the Indian Machine Tool industry is progressing, especially with the incorporation of Smart Manufacturing?**

**Dr Nandini Chakravorti:** Various OEMs, technology suppliers, manufacturers, and researchers from different countries were present at the event. Industrial automation, simulation tools,

data analytics platforms, robotics, IoT platforms, sensors, additive manufacturing machines, and CNC machines were demonstrated by a range of technology suppliers.

The visitor profile included representatives from diverse industrial sectors, such as Aerospace and Automotive. This cross-fertilization is critical for the horizontal innovation and diffusion of industrial digital technologies within manufacturing sectors.

The availability of technology solutions needs to be accompa-

nied by the right skills. IMTMA already provides specialized training, and this could be a potential area of collaboration with MTC.

**Industry 4.0 is not a new term; however, there has been an upsurge in the adoption of the same in the Machine Tool sector, especially in India. Will this now be the minimum benchmark, and what can we expect going forward?**

Industry 4.0 refers to a number of technologies, including robotics, automation, additive manufacturing, industrial con-

nectivity, cloud computing, and artificial intelligence (AI). Indian Machine Tool sector has seen an accelerated adoption of Industry 4.0, primarily due to a demand for improved productivity, increased efficiency, and enhanced quality control.

Going forward, the adoption of Industry 4.0 will see continued growth across the world. Through the availability of digital technologies, cheaper computing power, and access to low-code or no-code platforms, entry barriers for investment are being steadily removed. More demonstrable use of Industry 4.0 technologies and a clear return on investment will drive an accelerated deployment of these technologies. Product servitization, predictive maintenance schedules for production assets, digital twins of processes and facilities, and data traceability, will continue to be key trends in manufacturing.

**Automation and robotics seem to be the obvious step in upgrading a manufacturing process. However, a lot of companies are still wary of its incorporation. How do you see this technology impacting the sector?**

Manufacturing businesses today are under constant pressure



**“Proactively seeking out new opportunities for learning new skills, shouldering responsibility for technical teams at MTC, and leading three annual events in AI in Manufacturing at a national scale has helped me elevate my profile, refine my organizational skills, and widen my internal and external network.”**

**Dr Nandini Chakravorti**  
Associate Director  
Technology Strategy  
Manufacturing Technology Centre

to meet customer demands for faster, better, high-quality, bespoke products that can be delivered right the first time. And introducing automation and robotics may be the solution to making productivity gains. Although automation and robotics are used for reliability and accuracy, many organizations have concerns about the incorporation of automation and robotics, specifically in justify-

ing the upfront investment, the need for specialist skills, and the fear of jobs being displaced. There are a number of examples where manufacturers have seen their businesses expand and become more competitive as a result of introducing robots on their shop floor. Consequently, they employ more people, and these people work on more innovation-based, value-added, and, therefore, better-paid jobs. The impact of the adoption of such technologies will depend on how they are implemented. The best approach is to start small, focus on one process, and scale up through other processes. Robots and automation, similar to technologies such as AI, should be used where they are best suited.

**How are smart manufacturing technologies such as modeling and simulation and additive manufacturing helping companies become competitive? Please share examples if possible.**

Modeling and simulation is a powerful tool to boost operational efficiency, improve planning efficiency, and optimize factory layouts and the performance of businesses. MTC has been part of a collaborative project with Dowty Propellers to develop technologies within

Industrial shows like IMTEX 2023 are valuable for showcasing state-of-the-art technologies that are available to respond to the challenges faced within the metal-cutting machine tools industry.



Dr Nandini Chakravorti, Associate Director, Technology Strategy, Manufacturing Technology Centre, delivering the keynote address at ISMT.

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It is worth bearing in mind that with more data being available, considerations around interoperability between manufacturing systems and security (of data and systems) become more pertinent.

a new digital infrastructure, delivering benefits in propulsion performance and cost efficiency. Through this relationship, MTC has developed and demonstrated new smart factory concepts for more efficient production of propeller systems. The work involved the development of a discrete event simulation digital twin of the Dowty Propellers value stream to generate intelligent production schedules.

Additive manufacturing (AM) is making an impact on improving product and manufacturing efficiencies. This approach to manufacturing enables more complex geometries than those achievable through conventional methods, which means parts can be redesigned to consolidate what was 10s or 100s of separate parts into one larger optimized part, such as the well-publicized examples from GE Aviation:

- Leap fuel nozzle (20 parts to 1, 25% weight reduction, 95% inventory reduction, 30% cost efficiency improvement, 5x more durable).
- Advanced turboprop (855 parts to 12, 20% reduced fuel burn, 5% weight reduction, test schedule reduced from 12 m to 6 m)
- Catalyst engine casing (7 assemblies to 1, 50 sources to 1, 300 parts to 1, 10+lbs weight reduction)

As well as optimizing the product, the manufacturing process can be dramatically simplified, requiring fewer manufacturing approaches and sources of parts, more flexible manufacturing that enables more and later design iterations, faster time to market, and supply chain resilience. While there is a significant activity to exploit the full benefits of AM on end-use parts, AM is also being used to support conventional



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Associate Director  
Technology Strategy  
Manufacturing Technology Centre

manufacturing approaches by producing prototypes, tools, jigs, and fixtures, which are often quick wins for a company looking to benefit from AM!

The UK National Centre for AM, based at MTC, performs numerous projects each year to support companies in proving AM for their applications. Over a three-year period, MTC and Rolls-Royce collaboratively designed, set up, and operated an AM pre-production facility that supplied all of the titanium engine section stator (ESS) components required for the Ultrafan™ engine development program. Tens of thousands of equipment run hours with extensive data capture were used to gain insights for process optimization and product assurance. 240 aerospace standard components were delivered complete with full traceability for the flying test bed program.

**Artificial Intelligence and Machine Learning is a game changer. How do you see it impacting man-**

**ufacturing in the coming years?**

Artificial Intelligence (AI) and machine learning have a significant role in augmenting human operators within manufacturing. These technologies will continue to see increased use within a number of manufacturing applications, including those described below:

Traditional in-person inspection can be error-prone and time-consuming. Using AI for in-process inspection can reduce the time to market, enhance quality, and increase efficiency.

Using data from sensors and production equipment can optimize predictive maintenance schedules. This can be a game changer for enhancing the life of production assets and minimizing losses due to sudden equipment failures.

AI can be used for optimizing energy consumption throughout the production process and reducing greenhouse gas emissions.

**How have Big Data and Digital Engineering changed the way manufacturing companies operate?**

Big Data and Digital Engineering are providing a competitive advantage to several manufacturers. A few applications (not an exhaustive list) of Big Data and Digital Engineering in manufacturing industries are:

- Quality Control: Traditional in-person inspection is error-prone, time-consuming, and inconsistent. Access to data can provide predictive quality control, thus increasing the reliability and speed of inspections. Consequently, improving production efficiency and reducing time-to-market.
- Prediction of machine health and optimized maintenance schedules through the use of predictive analytics, reducing sudden downtime in produc-

tion due to unplanned machine failures.

- Enhancing sustainability and reducing waste through monitoring and predicting the environmental impact of the use of production assets.

**As a woman in engineering, what are the challenges you have faced in the industry? What strategies did you use to overcome these challenges?**

Learning to consciously switch off from work and deliberately make choices regarding the opportunities to engage and decline is crucial. It's important to have hobbies that keep me busy outside of work.

I consciously seek out mentors within and beyond my current organization. Building support networks within and outside the organization, e.g., being part of Women in Engineering and diversity events, is also what I engage in.

Being assertive, with a clear communication style, and growing in confidence through continuous learning is essential.

## FOCUS AREAS FOR WOMEN STARTING THEIR CAREERS IN ENGINEERING

- **Get a mentor:** A mentor can advise, provide support, and signpost opportunities.
- **Build your network:** Connect with your peers and other professionals, attend industry events, and support other women.
- **Be confident and believe in yourself:** Be assertive and do not shy from voicing your opinions. Don't become a victim of imposter syndrome.
- **Define what personal and professional success means to you:** This may evolve and change over time. But having deliberate goals is important.
- **Keep experimenting:** Don't shy away from stepping outside your comfort zone.
- **Keep developing yourself.** Learning is a constant in any profession. Be that within a technical capacity or more holistic personal development, e.g., influencing and negotiating.

**Women bring a unique perspective to all fields they end up in. From experience, can you tell us how you identified opportunities and made use of them to forge your own path?**

Don't be afraid to step outside your comfort zone. For example, lead a critical project or a

cross-functional team that would have a lasting impact on the business. For me personally, leading a very high-impact project, including a cross-functional team, helped me develop my leadership brand and enhance my ability to influence people at different levels within the organization.



L-R: Rajendra Rajamane, Vice President, IMTMA; Dr Nandini Chakravorti; Ravi Raghavan, President, IMTMA; and Jibak Dasgupta, Director General & CEO, IMTMA.

AI can be used to monitor waste in manufacturing and also identify opportunities for decreasing waste in production, enabling manufacturing industries to become more environmentally friendly.

# MAKING IMPOSSIBLE POSSIBLE

Bharat Electronics Ltd's accomplishment of manufacturing 30,000 ICU ventilators within 90 days is an intriguing case study.



Source: Bharat Electronics Ltd

**I**n April 2020, the Indian Government demonstrated its trust in Bharat Electronics Ltd (BEL) and its agile production system capability when it placed its order for 30,000 ICU ventilators, which were produced during the lockdown period. Due to supply chain disruptions, BEL received considerable assistance from different government bodies and managed to overcome numerous hurdles to accomplish the project. On August 14, 2020, the production of 30,000 ventilators was successfully completed, marking a significant achievement.

## Overcoming countless challenges

BEL faced key challenges as

it had entered into critical care medical equipment manufacturing with no prior experience, domain knowledge, or infrastructure. The company had set a target of designing and delivering 30k units within a short span of just 90 days. Importing critical components for medical equipment was challenging due to export restrictions and overseas domestic demand, which resulted in dynamic pricing and unpredictable lead times.

Subcontracting work packages to MSMEs had become necessary due to the closure of the nationwide lockdown. Logistics issues arose due to cross-border traffic and other related factors. Meeting various technical pa-

rameters during the concurrent production phase was difficult as the CV200 Ventilator was continuously being upgraded by the design teams (DRDO, Skanray, and BEL) to cater to indigenization efforts of critical components. Clinical trials and approvals by DGHS were required for the new launch of the CV200 ventilator.

Additionally, there was a need to realign the manufacturing facility to meet production of medical-grade ICU ventilators instead of defence products.

## Approaches resorted

The creation of a War Room helped BEL in making faster and dynamic decisions, which led to the success of the project.

Identifying TOT partners and co-locating the BEL and TOT teams helped in achieving the project goals. Infrastructure creation and realignment were done to support the production of critical care medical equipment. Cross-functional task force teams were formed with specific tasks to ensure efficient and effective production. Obtaining statutory certifications was a crucial step in the success of the project. Multiple/alternate sourcing for critical and long-lead parts ensured uninterrupted production. Timely indigenization of imported parts helped in reducing the dependence on foreign suppliers. Production at multiple business units helped meet the high demand for medical equipment. Online training of medical professionals for usage of the medical equipment was crucial for the success of the project.

Additionally, a pan-India installation network was established to ensure the timely installation of care medical equipment.

## Results that made it all worthwhile

The successful manufacturing of 30,000 ventilators in a record time of just 90 days was a significant achievement. An additional order for the manufacturing of 2,000 ventilators from GMSCS, Gujarat, was received in the year 2021-22, which was executed successfully. The experiences in the manufacturing of ventilators led to the formation of a separate business vertical for medical equipment.

The success of the project boosted confidence in manufacturing other medical devices like oxygen concentrators, hemodialysis machines, and patient monitoring systems, among others. The Indian Government entrusted BEL with an order for



CV 200 Ventilator System

the manufacturing of 17,000 oxygen concentrators, which was executed successfully in the year 2021-22.

BEL also took up the contract manufacturing of SPOC controller boards for Bharat Forge Ltd. Indigenization of components that were previously sourced from other countries helped in reducing dependence on foreign suppliers.

Delegates from South African countries visited BEL and found potential opportunities to export medical products, which highlights the positive impact of the project.

The successful manufacturing of critical care medical equipment, particularly ventilators, has led to precious human lives being saved across the country. The project has enhanced the healthcare infrastructure in society, which is a significant resource impact.

The existing defence manufacturing infrastructure was effectively converted into a healthcare manufacturing facility without a huge investment. BEL arranged online training ses-

sions on ventilator usage for healthcare professionals for a period of 18 months, which enhanced their competency.

The indigenization of critical parts has resulted in cost savings and has created employment opportunities. The project has enhanced the knowledge and competency of Indian suppliers in the manufacturing of healthcare components.

The success of the project has provided a thrust toward AtmaNirbhar Bharat in healthcare equipment. It has established India as a major hub for ventilator manufacturing.

The importance of creating a War Room for faster decision-making was highlighted. The benefits of indigenization and alternate vendor development were emphasized, even if it meant differential pricing.

Collaborative teamwork was identified as a key to success. Challenges and proposed solutions should be presented to top management for guidance and decision-making.

Total employee involvement once again proved to be essential for the success of any project. Resource optimization and multiple production line setups helped meet production takt time. Follow-up teams aided in coordinating and expediting deliveries from vendors. Digital dashboards were effective for project monitoring. Breaking down critical assemblies into smaller chunks was found to be helpful.

The project enhanced BEL's domain knowledge in medical equipment manufacturing. Methodologies for handling crash projects and critical projects during national emergencies were developed. The mass manufacturing of medical equipment was successfully carried out. Multiple sources for critical and long lead-time parts were established. 

The indigenization of critical parts has resulted in cost savings and created employment opportunities. The project has enhanced the knowledge and competency of Indian suppliers in the manufacturing of healthcare components.

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Source: Pahwa Group

## WHEN WATER IS NOT WELCOME

With humidity being a major deterrent to the profitability of industries, dehumidification solutions are extensively sought by industry players to minimize downtime, increase business profitability, and guarantee the timely and quality completion of the project. They also ensure the safety of workers and the continuity of complex processes.

DEEPAK PAHWA  
Director  
Technical Drying Services  
Pahwa Group



**T**he perils of high humidity have been a matter of concern across industries. Even refineries and power plants are immensely plagued by the mois-

ture menace. It intervenes with various processes and can even extend the completion time of the project, which, in turn, translates into a heavy financial burden on the company.

### Dehumidification solutions for surface preparation

Humidity has a deterring effect on industries. It interferes with the already complex surface preparation and coating pro-

ing problems keep recurring throughout the paint jobs. Also, the inadequate adhesion of the coating to the substrate is responsible for shortening the life of the coating system. Hence, it gives rise to the need to repeat the entire coating process all over again.

Hence, looking at the complications arising due to humidity, deploying dehumidification solutions can vouch for proper surface preparation for coating application. It is the simplest and most cost-effective technology that efficiently eliminates moisture during a blasting and painting job. The advanced technology is adept at achieving and maintaining humidity at the required level for inhibiting the process of condensation and rust blooming on the surface.

### The crucial role dehumidifiers play

Desiccant dehumidifiers maintain the relative humidity (RH) at less than 55 percent inside the tank throughout the blasting, painting, and coating processes. Additionally, they also maintain a constant -5° C dew point differential between the air and the surface to be coated, and a -12° C difference between the air inside the tank and outside.


Hence, dehumidifiers play an instrumental role in preventing condensation on the surface, which, in turn, alleviates inter-coating delamination and enhances curing properties. By ensuring a strong inter-coat adhesion, the advanced solution invariably increases the coating life. Considering the adverse effect of moisture, the coating process is halted at night during monsoons or high-humidity climatic conditions. Especially at night, the chances of condensation are very high due to the cold weather, ultimately encouraging corrosion

and blooming on the surface. Additionally, dehumidification solutions on rent come in handy and allow for the coating process throughout the year, irrespective of the weather conditions outside.

### For timely and quality completion of the project

It can, therefore, be said that dehumidification can immensely contribute to reducing the downtime of the plant, ultimately leading to the timely completion of the project. In addition to this, it aids in blasting of the entire surface in a single go, permitting an uninterrupted coating process on the surface. This is otherwise done in a phased manner in the absence of a dehumidification system, which is neither practical nor economical. In turn, it also eliminates the need to repeat the coating process, which arises due to the coating failure. All the factors together contribute to reducing the project time and cost.

Considering that blasting and painting processes are carried out in a confined space, they can pose severe health risks to the people working inside. Here, the dehumidification system becomes all the more essential as it provides ventilation solutions that create comfortable working conditions by providing fresh air inside the confined area. The technology increases productivity as well as the safety of the workers.

Conclusively, the dehumidification solutions are well-equipped with multi-faceted benefits, including ensuring the safety of the workers and the continuity of complex processes. They are highly sought by the industry players to reduce downtime and add to the profitability of the company by ensuring timely and quality completion of the project. 

Dehumidifiers play an instrumental role in preventing condensation on the surface, which, in turn, alleviates inter-coating delamination and enhances curing properties. By ensuring a strong inter-coat adhesion, the advanced solution invariably increases the coating life.

# FROM SMART GRINDING TO SMART FACTORIES

Advanced parameter monitoring is revolutionizing manufacturing processes. Read on to know how companies including Marposs have come up with solutions for machine monitoring during a grinding process that can pay particular attention to key parameters such as workpiece measurement, wheel imbalance compensation through vibration monitoring, and acoustic emission.



Source: Marposs

**I**n the modern Manufacturing industry, optimizing production processes is essential to achieve maximum efficiency and productivity. Marposs provides shop-floor solutions for quality control in the production environment. Marposs' solutions include gauging equipment of

mechanical components, before, during, and after the production process; monitoring solutions on machine tools; assembly and testing for many industry sectors; and automatic machines and inspection stations for production lines. Over the years, Marposs has gained enormous experi-

ence in the control of grinding processes to meet production quality requirements. Grinding is a machining process used to remove material from a workpiece by abrasion, characterized by a specific cutting tool – the grinding wheel – that rotates at high speed and removes material from the workpiece.

Grinding technology and machines are widely used in a variety of industries, including Aerospace, Automotive, Semiconductor, EV, and Medical, among others.

There are several types of grinding machines, each designed for specific purposes. The most common are the following: cylindrical grinders, which produce internal and external cylindrical surfaces; surface grinders, which use a horizontal spindle to grind the surface of a workpiece; centerless grinders, which do not use centers to support the workpiece but have an adjustment wheel and a grinding wheel; Orbital grinders, which are able to follow the movement of eccentric parts such as a crankshaft journal; gear grinders, which use a special worm-like grinding wheel; and many others.

The surface quality and dimensional accuracy of the finished part depend on the stability and accuracy of the grinding process itself.

However, grinding can be a complex process that requires careful monitoring to ensure that it is performed efficiently and effectively. Machine monitoring is an important aspect of the grinding process that allows operators to optimize the process itself and improve product quality. It plays a crucial role in ensuring that the grinding process remains stable and reliable over time.

In this article, we will discuss the role of machine monitoring during a grinding process, paying particular attention to key parameters such as workpiece measurement, wheel imbalance compensation through vibration monitoring, and acoustic emission. We will also explore how machine monitoring is important for Industry 4.0 integration in smart factories.

Workpiece measurement is the key parameter to monitor during a process and is strictly related to the size of the workpiece.

Wheel vibration, acoustic emissions, and power monitoring keep all boundary conditions that can influence the process itself under control.

### Dimensional monitoring

In-process measurement systems can provide real-time measurement of part dimensions during the grinding process. Being able to monitor the actual size of the workpiece during the grinding process allows for the optimization of the grinding wheel feed rate and reduction of cycle time. The grinding process takes place in several phases. First, rough grinding takes place, followed by one or more fine grinding phases. Finally, there is a finishing/polishing phase. Throughout these phases, it is important to regulate the speed at which the grinding wheel approaches the final dimension of the part.

During rough grinding, it is possible to maintain a high grinding speed because the workpiece is still far from its final dimension. However, as the workpiece approaches its final dimension, the speed must be reduced accord-

ingly. Good speed control is crucial to reduce cycle time and improve the quality of the finished part, leaving less responsibility to the operator.

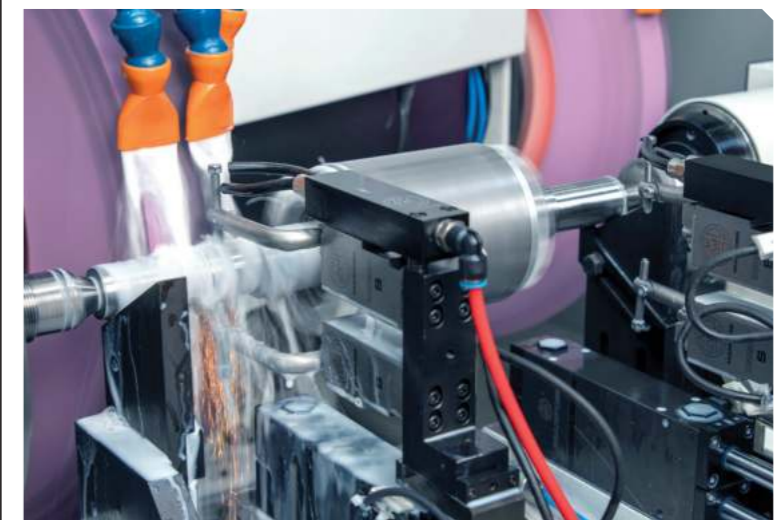
Post-process measurement systems are used to measure not only the dimension but also the geometry of the finished part after the grinding process is complete. By running a post-process cycle, deviations from ideal conditions can be detected and quickly corrected. This minimizes scrap and rework and reduces production costs.

### Control of wheel imbalance

Another critical aspect of the grinding process is the performance of the grinding wheel. In order to achieve a high-quality part, it is essential that the grinding wheel performs properly and removes the correct amount of stock.

When the spindle is rotating and the grinding wheel is spinning, an imbalance is always generated. This imbalance causes the grinding wheel to vibrate.

Even small imbalances in the grinding wheel or in the clamping device generate large centrifugal forces at high speeds, especially with larger grinding wheels. Forces mean vibrations. Vibrations lead to poor work-



Source: Marposs

Marposs provides shop-floor solutions for quality control in the production environment. Marposs' solutions include gauging equipment of mechanical components, before, during, and after the production process; monitoring solutions on machine tools; assembly and testing for many industry sectors; and automatic machines and inspection stations for production lines.



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**In-process measurement systems can provide real-time measurement of part dimensions during the grinding process. Being able to monitor the actual size of the workpiece during the grinding process allows for the optimization of the grinding wheel feed rate and reduction of cycle time.**

piece quality (marks, uneven surfaces, etc.), rapid wear of the spindle bearings, and rapid wear of the grinding wheel.

In this context, it is easy to understand the objective of reducing vibrations as much as possible. This is achieved by installing a system consisting of an accelerometer, which measures vibrations, and a balancing head. The balancing head is capable of moving two masses, which act as a counterweight to the imbalance.

There are several causes that can interfere with the process and cause vibrations. These include errors in the shape of the wheel, errors in the assembly of the wheel, or irregularities in the structure of the material. By using balancing systems, any imbalance can be detected quickly and remedied promptly. This allows users to maintain a consistently high level of part quality and extend the life of their machines and tools.

#### Acoustic emission and power monitoring

During a grinding or straightening operation, machine components produce a noise that can be measured in the ultrasonic frequency range. To detect these frequencies, an acoustic emission sensor must be mounted in a suitable position inside the grinding machine. The acquired signal is continuously transmitted to an amplifier. The purpose of this process is to keep the machine in proper working conditions, optimize the quality of the workpiece, reduce tool wear, and reduce the risk of damage after an accident. By analyzing changes in the acoustic signals, any variation in the condition of the machine can be detected and the necessary corrective actions can be taken quickly.


Acoustic emission analysis also plays a key role in reducing cy-



Source: Marposs

cle time by enabling a reduction in the air grinding cycle. Air grinding refers to the moment when the grinding wheel approaches the workpiece before touching it. The first contact produces an acoustic event that can be determined with micron-level accuracy. Instead of using acoustic emission (AE) analysis, an alternative is to monitor the power consumption of the spindle. This method can be particularly useful for the GAP cycle when it is not possible to install an acoustic sensor or when there is too much background noise for the AE sensor to work properly.

#### The future

Understanding how to effectively use the large amount of data generated by sensors within a machine is critical. All data from sensors can be collected and transmitted by a single general-purpose amplifier connected to the machine logic via two different channels. The first channel involves low-level communication with the machine logic, which is typically done via a fieldbus. This allows for the optimization of the process itself. 

The second communication connection uses an OPC UA channel, which makes all collected data available to other entities, such as the company's ERP or a digital platform. This allows for the integration of entities other than grinding machines, such as shop floor equipment dedicated to testing, quality control, and process monitoring, as well as quality management software. The primary benefit of this approach is quick and easy access to all plant information, with constant feedback on health and productivity, which can help identify areas for improvement and allow for timely action. In addition, this approach enables additional activities to be managed more effectively, such as predicting process deviations and identifying their root causes. This represents a smarter and more efficient way to manage processes. Cross-correlating data from different domains uncovers hidden relationships between well-known processes, revealing opportunities for improvement. Enabling companies to make more informed quality and production decisions is the future of data use.



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## BEING 'AMAC'INGLY INNOVATIVE

amace, a part of the largest machine tool conglomerate in India the AceMicromatic Group (AMG), is revolutionizing the manufacturing industry with additive manufacturing that has the potential to achieve new levels of customization, efficiency, and sustainability.



Source: amace solutions pvt ltd

**a**mace solutions pvt ltd was formed in the year 2018 with a firm belief in the potential of additive manufacturing and a vision to promote the advanced technology and make it more accessible. The company has a legacy of over four decades in machine building and is now well-poised to be one of the first indigenous manufacturers of metal-based additive manufacturing machines.

"amace came out as a part of the technological diversification initiative by the parent companies Ace Designers Ltd and Ace Manufacturing Systems Ltd. It was started as an R&D project in one of the Group companies, and when it was realized that

the project had enough potential to be spun off as an independent company, amace was established," shares Shreesha CV, Product Specialist - Additive Manufacturing, AceMicromatic Group.

AceMicromatic Group has always been customer-focused and developed products suiting the needs of customers. In this case too, when it was seen that some of the early adopter customers started showing interest in this technology, it became necessary for the Group to widen the product and technology offerings to its customers with additive manufacturing.

"Since amace is a venture started by AMS and Ace (Designers),

parts of both the companies' names were used to form amace. Also, the Group itself is mostly referred to as 'Ace' in short, and when we were introducing Additive Manufacturing (AM) from the Group, AM from Ace sounded like the perfect name for it. The name is also inspired by the word 'amaze', which is what the technology and its applications do to people," he notes, explaining the idea behind the name of the company.

### Garnering favorable response

When asked to elaborate on the company's journey and the current juncture it has reached, Shreesha says, "amace started as an additive manufacturing

service bureau to understand and learn suitable applications for the technology. This was a very crucial stage for amace as this enabled us to better understand the process and its limitations and essentially put us in the shoes of our future customers. Equipped with the learnings from the service bureau stage, our focus moved towards productionizing using AM, understanding materials, and qualifying new materials to suit the needs of the market, all of which contributed toward the creation of our own indigenously developed, high-productivity metal 3D printer."

"Since its introduction in July 2021, it has garnered immense interest from multiple market segments. Today, with multiple installations of the machines in the country and many more in the pipeline, we are happy with the way the market has received our offering," he adds.

With India becoming more and more self-reliant, there is growing scope for R&D and indigenous development, because of which, shares Shreesha, there is a good adoption of additive manufacturing, as options such as faster product development, ease of complex geometry generation, and light-weighting can be hugely beneficial. "Also, with the increase of machine presence in the market, there is a growing interest among manufacturers to adopt this advanced technology."

Today, the Bangalore-based amace has over 15,000 hours of metal printing experience and the parts produced are for diverse applications. "We have customers not only in India, but also in Singapore, the UK, the US, Israel, and France. The continuous endeavor for developing new materials and processes goes on. We have tested and proven over 12 different metal alloys suiting a wide variety of



Source: amace solutions pvt ltd

"With India becoming more and more self-reliant, there is growing scope for R&D and indigenous development, because of which, there is a good adoption of additive manufacturing, as options such as faster product development, ease of complex geometry generation, and light-weighting can be hugely beneficial."

**Shreesha CV**  
Product Specialist -  
Additive Manufacturing  
AceMicromatic Group

applications and many more materials under development. What we offer to our customers along with our state-of-the-art machine is our expertise in the field," he informs.

The company's major domestic and international clients include Auto OEMs and Ancillaries, Die and Mould Manufacturers, Aerospace companies, and Oil & Gas component manufacturers.

### Changing the game

The amace STLR 400 is the company's new offering that was launched in 2021 and showcased at a public event for the first time at IMTEX 2023 & Tooltech 2023 and Digital Manufacturing 2023. It is expected to bring in a paradigm shift in the adoption of additive manufacturing in India. "The amace STLR 400 is a large-format, high-productivity, industrial-grade metal 3D printer. It employs the most advanced

and technologically mature process in metal 3D printing, called Laser Powder Bed Fusion (L-PBF). Our machine has been designed and developed with a vision to elevate the outlook of additive manufacturing from a prototyping technology to a production technology," he elaborates.

Additive manufacturing has for the longest time been viewed as an expensive and low-productivity technology that has impacted the global adoption rate. amace solutions, with its roots in one of the most cost-sensitive markets in the world, India, has successfully created a product that challenges this status quo, launching a machine that is not only cost-effective but also offers a host of productivity features. The company is sure that the printer is sure to help in the faster adoption of the technology globally.

### AM benefits galore

amace solutions' other accomplishment is its work with Orxa Energies. It has provided 70 percent 3D printed components of the electric bike manufactured by Orxa Energies. The work has culminated in a two-fold impact. "One: 3D printing can immensely reduce the product development cycle by producing functional end-use parts that can be taken for real-world testing. We were able to optimize, print, and dispatch these parts for assembly within a week," shares Shreesha. "Two: 3D printed parts can be just as durable (if not better) than conventionally manufactured parts, which was showcased when Orxa took the bike on an over 14,000 km ride," he adds. This case study is a testament to what can be achieved when auto OEMs work closely with additive manufacturing companies right from the design phase, enabling them to take full advantage of the capabilities and possibilities of what the technology can offer.

Today, the Bangalore-based amace has over 15,000 hours of metal printing experience and the parts produced are for diverse applications. It has customers in India, Singapore, the UK, the US, Israel, and France.



The amace STLR 400 is the company's new offering that it recently unveiled at IMTEX 2023 & Tooltech 2023 and Digital Manufacturing 2023. It is expected to bring in a paradigm shift in the adoption of additive manufacturing in India.



Source: amace solutions pvt ltd

**Awards and acknowledgments**

Due to its awe-inspiring work in the field of additive manufacturing, amace solutions was recently recognized as a Winner of the National Startup Awards 2022 in the Industry 4.0 and 3D Print-

ing category by the Government of India, Ministry of Commerce and Industry, and DPIIT. Out of 2,610 applicants, amace was one of the very few winners of this prestigious award. The jury panel included key members from the Government, industry experts,

and investors who evaluated each participant over multiple rounds. This National recognition is an acknowledgment of the effort put in by the entire team in making amace to what it is today. The Government of India has been consistently trying to encourage and promote entrepreneurship with its various schemes and initiatives. The recent Union Budget too has many measures for boosting startups in the country. Sharing his views on it, Shreesha says, "We believe that the proposed changes in the 2023 Union budget will have a significant impact on the Indian Startup ecosystem, more so for companies in the initial few years of their incorporation. Being a startup ourselves, we cannot begin to emphasize how much of a respite the three-year extension in the carry forward and set off period for losses could potentially bring. This move will allow startups to reduce taxable income and tax liability, providing them with more capital to reinvest in their business, and plan their finances more effectively, giving startups the stability they need to grow and succeed." 



Source: amace solutions pvt ltd

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# ACCOMPLISHING A VISION

JPF Metacast had to undertake the challenging project of developing 28 different parts of the housing flywheel for its client Cummins India, which had to be done in just two years including the pandemic period. Here's how the project saw the light of day and the benefits it entailed...



Aerial view of the plant

**J**PF Metacast Pvt Ltd manufactures and supplies cast iron and ductile iron castings to several OEMs, including Cummins India Ltd, Atlas Copco Ltd, Ace Micromatic Group, Dynapac India Ltd, and others. The company was founded in 1981 and has since expanded to produce 400 tonne per month with machining. With 40 years of experience, the company has received various awards from the Government of India and quality awards from different organizations.

### Project Vision 2020

Indian Machine Tool Manufacturers' Association's National Productivity Summit provided JPF Metacast an opportunity to present its case study named 'Vision 2020'. The project presented an ambitious target of developing 28 different parts of the Housing Flywheel in just two years, including the COVID-19 period. JPF undertook the project for its customer Cummins India Ltd to offload its in-house activity

and utilize the capacity for engine assembly. It began with understanding the customer's needs, identifying the shortcomings, analyzing them, and preparing a time chart. JPF implemented the PDCA (Plan, Do, Check, Act) principle. The total requirement was 30 units per day but, with the manual production system, the company had a capacity of only 15 units per day. The challenge was meeting the resource requirement both at the

foundry and machining stages. With the current setup, it was not possible to meet the customer's requirements.

### Looking for the solution

Several manufacturing processes were evaluated, including jolt squeeze moulding machines, continuous mixers with track lines, and Nobake moulding systems. Various factors were analyzed, such as risks, costs, movement of manpower and machinery, failure modes, cycle times, manpower requirements, input cost reduction, space requirements, environmental impact, and energy efficiency. Following a thorough examination, the decision was made to introduce the Rhino high-pressure moulding machine, which is completely indigenized and made in India.

It was decided to install a high-pressure moulding line that could increase productivity by 60 percent, reduce manpower, reduce costs, minimize space, and, most importantly, take environmental factors into consideration (See Table 1 & 2). At the machine shop, different options were explored to improve the material flow, layout, and production process. This included the introduction of new toolings, online inspections, reducing machining allowances, and modifying fixtures change in the tool path. As a result of these improvements, the company was able to reduce the production cycle time and improve the productivity to 50 units per day. The system was closely monitored and found to be stable, with a cp of 2.67 and a cpk of 2.14.



Source: JPF Metacast Pvt Ltd

"The total cost of ownership (TCO) was significantly reduced, resulting in substantial savings. Along with improving productivity, the implementation of the system led to consistency in product quality. The PPM level was reduced from 31,016 to 1,000. The overall business increased from 38 percent to 50 percent, and the project generated a revenue of ₹3.05 crore."

**GAURAV PANDIT**  
Director  
JPF Metacast Pvt Ltd

Thanks to this project, JPF gained the confidence to handle high volumes of customer orders while maintaining consistent quality and high dimensional accuracy. This also earned the trust of the customer in JPF's expertise, establishing the company as a specialist in manufacturing housing flywheels.

Table 1: The below chart shows the statistics of the existing process v/s the planned process.

PLAN - FOUNDRY PROCESS - SHORTCOMINGS							
Customer Demand	Existing Process	Unit	Qty	Planned process	Unit	Qty Appr	
Finished parts 30 nos / day	Hand Moulding - Manual Process	Nos	15 Nos / day	High Pressure Moulding Process	Nos	50 Nos / Day	
	Mould Sand Houling	Mins	4 / mould	Mould Sand Houling	Mins	Nil	
	Mould Making Time	Mins	40 / mould	Mould Making Time	Mins	8 / mould	
	Mould Heating	Mins	10 / mould	Mould Heating	Mins	Nil	
	Mould Painting	Mins	10 / mould	Mould Painting	Mins	2 / mould	
	Box Closing	Mins	5 / mould	Box closing	Mins	2 / mould	
	Space	Sq Mtr	600	Space	Sq Mtr	300	
	Productivity	MT	150	Productivity	MT	250	
	Manpower	Nos	20	Manpower	Nos	12	
	Quality at Customer end	PPM	2,00,000	Quality at Customer end	PPM	1,000	
	Cost per Kg of mould sand	INR	3.92	Cost per Kg of mould sand	INR	0.6	
	<b>METAL</b>				<b>METAL</b>		
	Furnace capacity	Kgs	500	Furnace capacity	Kgs	750	
	<b>CORE MAKING</b>				<b>CORE MAKING</b>		
Less quantity - space constraint	Nos	20 / day	More quantity	Nos	60 / day		
<b>FETTLING</b>				<b>FETTLING</b>			
Less quantity - space constraint	MT	150 / month	More quantity	MT	250 / month		

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New technology driven production: Reducing use of natural resource – sand by initiating High Pressure Moulding Line – Green sand

Source: JPF Metacast Pvt Ltd

**Favorable results**

With the new investment, JPF was able to achieve a return on investment (ROI) in just 3.5 years.

The total cost of ownership (TCO) was significantly reduced, resulting in substantial savings. Along with improving productivity,

the implementation of the system led to consistency in product quality. The PPM level was reduced from 31,016 to 1,000. The

**Table 2: With the introduction of a new machine, there was a drastic reduction in the production cost as shown in the table below:**


Parameters	Before	After	Unit of Measurement
Energy saving	Furnace - 560 Units/MT metal	After - 500 Units/MT metal	Electrical Units
Reduction/elimination of waste generated	20%	0.1%	% per month
Toxic material elimination	Nil	Nil	
Preserving natural resources	22 Lakh	1.04 Crore	INR
User and societal safety enhancement	Manual. Hence more fatigue	Automatic. Hence less fatigue	
Mitigation of pollution/emission effects	A lot of wastage and also not environmental-friendly	The process is environment-friendly. Sand can be reused	
Reduction in carbon footprint		Avoided coke-fired oven and introduced electrical oven	
Direct raw materials, consumables, etc.	2.6 Lakh	1 Lakh	INR
Emission reduction/elimination as appropriate	Particulate Matter: 86.8 Sulphur Dioxide: 4.9 Oxides of nitrogen: 10.1	Particulate Matter: 81.26 Sulphur Dioxide: 4.8 Oxides of nitrogen: 9.7	Mg/m <sup>3</sup> . Reduction in emission
Waste reduction/ elimination as appropriate	21 Tonne	0 Tonne	Tonne/year



Source: JPF Metacast Pvt Ltd

overall business increased from 38 percent to 50 percent, and the project generated a revenue of ₹3.05 crore. Thanks to this project, JPF

gained the confidence to handle high volumes of customer orders while maintaining consistent quality and high dimensional accuracy. This

also earned the trust of the customer in JPF's expertise, establishing the company as a specialist in manufacturing housing flywheels. 



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# COLLABORATING FOR PROGRESS

The industry and academia bond can play a pivotal role in ushering in innovation and economic growth. Their collaboration offers room for academia to contribute its research and knowledge, while the industry can provide expertise, experience, and opportunities for the other to progress. Cognizant of the fact that the duo together can work wonders, IMTMA provides a platform for them to connect with each other during IMTEX.



Source: IMTMA

Every IMTEX, IMTMA offers Industry-Institute (i2) Academia platform for industry professionals and institutes to join forces that can bring in technological advancements, enhanced capabilities to manufacture high-tech products, increased product diversity, and reduction in imports. In keeping with tradition, IMTEX 2023 & Tooltech 2023 and Digital Manufacturing 2023 welcomed 22 institutes, including IITs, to present their R&D capabilities in the metalworking arena to the manufacturing fraternity gathered during the event and understand the requirements of the industry for them to be future-ready. Some of the participating institutes included Amrita Viswa Vidyapeetham (Kol-

lam) - Cost Effective Universal Form Tester; Indian Institute of Technology Kanpur (Kanpur) - Adaptive gain tuning for active damping of machine tool vibrations; KLS Gogte Institute of Technology (Belagavi) - Application of minimum quantity lubrication cooling technique for Aerospace material machining in an industry; and SSN College of Engineering (Chennai) - Ballistic performance of Aluminium 6061-T6 targets with 'Bio-inspired pattern' and internal grooves.

**Inspiration galore**  
Harshit Gawda TN, Reva University (Bangalore), explained, "We have developed a manufacturing technique with aluminum alloy (Al 7075) with a mixture of beryl (6%) and

graphene (2%) to increase the stiffness and lifespan of the metal. This can be used in the automotive industry for manufacturing outer body parts." V Adesh, Sona College of Technology (Salem), shared, "Our project is Developing Superhydrophobic Surface (coating kit) using IoT-based systems, by using an acid erosion method with an ultrasonic cleaner, making it a water-repellent surface. This will be used in Aerospace, Automobile, and other industries. We have received a grant of ₹15 lakh from the MSME Department, GoI through this project to set up a small business." Trilochan Nanda, Ph.D. scholar, IIT Madras, revealed, "We are showcasing New Generation Multi-Point/Single Layer Su-

## Some of the projects that were turned in by institutes during IMTEX 2023

Amrita Viswa Vidyapeetham, Kollam	Cost-effective Universal Form Tester
Bannari Amman Institute of Technology, Sathyamangalam	Design and Manufacturing of Wheel Knuckle for Electric Vehicle Using CNC Milling Machine
Chennai Institute of Technology, Chennai	TIG-based Additive Manufacturing of FGM Wall
Indian Institute of Technology Madras	New Generation Multi-point/Single Layer Superabrasive Tools
KLS Gogte Institute of Technology, Belgavi	Application of Minimum Quantity Lubrication Cooling Technique for Aerospace Material Machining in an Industry
N.M.A.M. Institute of Technology, Udupi	Design & Development of Low-Cost 4-Axis CNC Machine for Art Work Machining
PSG College of Technology, Coimbatore	Alternate Materials for CNC Machine Tool Bed
Sona College of Technology, Salem	Developing Superhydrophobic Surface Using IoT-Based System
T.S. Srinivasan Centre for Polytechnic College & Advance Training, Chennai	Automatic Laser Engraving Machine
Vishwakarma Institute of Information Technology, Pune	Microcontroller Based Tool Condition Monitoring System During Hard Turning of AISI 52100 Steel

perabrasive tools. We have developed our own tools through modifying commercially available (diamond) tools; they will directly go for stock removal processes up to 5 to 10 mm."

### Brilliant minds awarded


To encourage their engineering talents, a competition was arranged for the young innovators in the Academia Pavilion, where budding engineers showcased their projects targeting to improve engineering processes. Out of the 22 showcased projects, five innovative

works received cash awards and certificates.

The team from PSG College of Technology, Coimbatore, bagged the First prize worth ₹50,000 for their project titled 'Alternate Material(s) for CNC Machine Tool Bed'. The Second prize worth ₹25,000 was won by the students from the Indian Institute of Technology Madras, Chennai, for their project titled 'New Generation Multi-Point/Single Layer Superabrasive Tools'. The Third prize worth ₹15,000 was awarded to the students from KLS Gogte Insti-

tute of Technology, Belagavi, for their project titled 'Application of Minimum Quantity Lubrication Cooling Technique for Aerospace Material Machining in an Industry'.

Two consolation prizes each worth ₹5,000 were given to teams from N.M.A.M. Institute of Technology, Udupi, for their project titled 'Design & Development of Low-Cost 4-Axis CNC Machine For Art Work Machining' and Amrita Vishwa Vidyapeetham, Kollam, for their project titled 'Cost Effective Universal Form Tester'.

The recent i2 Academia event was a resounding success as industry stakeholders took a keen interest in the projects presented by participating institutes. The institutes, in turn, were equally eager to learn as much as possible from the latter. Such synergy is poised to usher in technological advancements and bridge the gap between the two entities, creating a skilled workforce that can effectively meet the demands of the future. 

### Acknowledging the Winners

Winning Institute	Prize	Reward
PSG College of Technology, Coimbatore	First	₹50,000
Indian Institute of Technology Madras, Chennai	Second	₹25,000
KLS Gogte Institute of Technology, Belagavi	Third	₹15,000
N.M.A.M. Institute of Technology, Udupi	Consolation	₹5,000
Amrita Vishwa Vidyapeetham, Kollam	Consolation	₹5,000

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To encourage their engineering talents, a competition was arranged for the young innovators in the Academia Pavilion, where budding engineers showcased their projects targeting to improve engineering processes. Out of the 22 showcased projects, 5 innovative works received cash awards and certificates

## FROM IMAGINATION TO REALITY

Dassault Systèmes' 3DEXPERIENCE World 2023, an annual event dedicated to the 3DEXPERIENCE Works and SOLIDWORKS community, brought together thousands of key stakeholders, engineers, and designers in the musical city of Nashville, Tennessee, on February 12-15. Woven around the theme of the power of imagination, the show translated into four verbs: learn, imagine, celebrate, and collaborate. An insight into key takeaways, presentations, and success stories that were showcased...



Source: Magic Wand Media

**S**OLIDWORKS and 3DEXPERIENCE Works help global innovators cooperate and boost job creation, innovation, and sustainable economies. 3DEXPERIENCE World 2023 featured thought leaders, over 320 technical training sessions, 30 meet-up sessions, certification opportunities, and a partner 'playground' displaying sustainable innovations over four days. This event on sustainable future technology allowed attendees to learn from experts, build skills, and network with peers and technology partners. To begin with, Gian Paolo Bassi, Executive Vice President, 3DEXPERIENCE Works, Dassault Systèmes, announced that every seat

of SOLIDWORKS will include Cloud Solutions from July 2023. All users will have the ability to share and mark up a model for 3D view, in any browser, with everyone safely—no license or installation needed. He shared that this would get a broader SOLIDWORKS community onto the 3DEXPERIENCE Platform by making it easier to adopt and serve as a leading platform for innovation and future proof companies.

### Virtual world ignites imagination

Bassi reminded the audience how the last three years made us realize the importance of being able to work from anywhere, stay connected, and always be up to date.

In this context, he shed light on how the virtual world created by the organization's platform gave everyone the freedom to imagine and create new solutions to respond to the pandemic quickly. Speaking on this year's theme, he said that imagination is more important than knowledge, because knowledge is limited to what we know, but imagination has no constraints. He stated, "We are here to be inspired, to push the limits of our own imagination." Bassi elaborated that the 3DEXPERIENCE Works innovation portfolio now includes machine learning, generative design capabilities, advanced simulation applications, and digital manufacturing, and is a true imag-



Source: Magic Wand Media

(L-R): Gian Paolo Bassi, Executive Vice President, 3DEXPERIENCE Works, Dassault Systèmes; Bernard Charles, Chairman of the Board, Dassault Systèmes; and Salvador Garcia, Chief Revenue Officer, Ocean-based Climate Solutions Inc.



Source: Magic Wand Media

(L-R): Guido Gioioso, Co-Founder, WEART; Fabio Pizzato, Chief of Entrepreneurs, e-Novia & Managing Director, WEART; and Gian Paolo Bassi, Executive Vice President, 3DEXPERIENCE Works, Dassault Systèmes



Source: Magic Wand Media

(L-R): Gian Paolo Bassi, Executive Vice President, 3DEXPERIENCE Works, Dassault Systèmes, along with Murali Sundaram

ination engine. It will cater to all manufacturing requirements, including CNC machining, 3D printing, factory automation, robot programming, virtual factory layout, and plant design. Bernard Charles, Chairman of the Board, Dassault Systèmes, gave an update on the Living Heart program, and how it has evolved from 2014 into the real-world use by doctors today. He explained how anything that was ever engineered, whether a part or a whole system, should be actionable, but the reality is that it ends up being millions of files that are inconsistent, misclassified, misnamed, etc. Hence, transforming these files into something that can be organized and classified is vital.

In this backdrop, he said that in the age of 3DEXPERIENCE, transforming the chaos of being able to quickly locate parts into order is now achievable on the cloud, thanks to Artificial Intelligence.

### Facilitating the startup ecosystem

Sharing the importance of being able to work together Manish Kumar, CEO, SOLIDWORKS, stated, "Startups are using SOLIDWORKS Cloud tools (3D Creator and 3D Sculptor) to design, collaborate, and bring that 'work from anywhere' promise to fruition. He assured that 3DEXPERIENCE SOLIDWORKS offers all the capabilities of desktop SOLIDWORKS but

adds collaboration and removes data management needs. In sync, Suchit Jain, Vice President, Strategy & Community, Dassault Systèmes, spoke about the growing ecosystem of entrepreneurs that now numbers over 7 million and their importance to the future of innovation. These startups are at the forefront of driving progress, developing electric vehicles, spacecraft, furniture, medical devices, and many more. And all these startups are using SOLIDWORKS and the 3DEXPERIENCE platform to drive innovation. Sharing his experience of working on the design of its exoskeleton that will be used to aid workers in avoiding injuries from heavy lifting, Ilya Mirman, Head, Marketing and Sales Operations, Verve Motion, a startup entity, said that the design was machined and 3D printed directly from the SOLIDWORKS models on a Nexa 3D printer.

### Validations matter


Dr David Hoganson, Assistant, Department of Cardiac Surgery, and Director, Computational 3D Visualization Program, Boston Children's Hospital, discussed how they are using SOLIDWORKS CAD and SOLIDWORKS Simulation solutions to create a revolutionary way to do preoperational planning for pediatric heart surgeries. Fabio Pissato, Chief of Entrepreneurs, e-novia, shared his perspective about working on amazing

innovations designed in SOLIDWORKS to support sustainability. Keynote speaker Jamie Siminoff, Founder, Ring, focused on innovation and how we all have the power to use our minds to build a future only we can imagine.

### Design tools help achieve goals

There were enriching sessions on Design, Simulation, and Manufacturing in this edition of the event. The Design domain sessions featured Boston Scientific, House of Design, and Sealed Air as success stories in using SOLIDWORKS design tools. Florian Fischer, CEO, X Custom Engineering, a prototype engineering company, shared that he aimed to streamline the overall process from engineering and prototype development to production in one complete system by combining PDM, CAM, CAD, and Simulation to reduce costs and improve innovation. The 3DEXPERIENCE platform has helped increase the team's efficiency by maintaining coherence across the design team, and real-time feedback improves collaboration.

### In conclusion

The in-person 2023 edition could easily be dubbed as the biggest event for mechanical engineers (3D MCAD). It is estimated that around 4,000 attendees physically attended the show, and another 10,000 participated online. 

The 3DEXPERIENCE World 2023 was all about success stories, advance technologies solving today's challenges, and bringing excellence in the future. The next edition will be hosted in Dallas from February 11-14, 2024.

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