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Indian Machine Tool
Manufacturers' Association

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ADDITIVE MANUFACTURING FOR SUSTAINABLE SUCCESS



INDUSTRY TIPS
Towards Transformation



18 FORMS AND GEARS: 50TH ANNIVERSARY
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34 OPED
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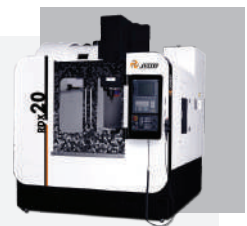
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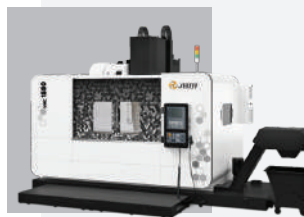
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IMPRINT

PUBLISHER

DIRECTOR GENERAL, IMTMA

EDITORIAL

Editor-in-Chief

Soumi Mitra

Chief Copy Editor

Poonam Pednekar

Correspondent

Arunima Nath

Sub-Editor

Sovan Tudu

Design

Magic Wand Media

SALES & MARKETING

Indian Machine Tool Manufacturers' Association
(IMTMA)

Murali Sundaram, Magic Wand Media Inc

murali.sundaram@magicwandmedia.in

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

Dear Readers,

We are on the cusp of a new financial year, with things looking promising for businesses. Industries were able to withstand the consequent waves of the pandemic with resilience. They have continued to grow in all verticals of manufacturing and are expected to reach the pre-pandemic levels of growth, which is very encouraging.

The recent Union budget has been a significant one for the Machine Tool and Manufacturing industries. The increase in capital expenditure on infrastructure projects by the Government is extremely encouraging; this helps in maintaining the growth momentum. It is important to note that Capital Goods not only result in direct employment but make for a big multiplier for indirect employment. Capex spend is a big driver for the demand for Capital Goods. Furthermore, from an economic point of view, these are direct and indirect multipliers. It is also important to highlight that the Government held extensive interactions with all major sectors to understand the pain points and the needs of businesses while preparing the budget.

Indian Machine Tool Manufacturers' Association (IMTMA), one of India's leading sectoral industry associations, celebrated 75 years since its formation. It is a matter of immense pride for IMTMA to have achieved this milestone in its endeavor to keep the Machine Tool industry of the country close-knit.

IMTMA is gearing up to host its flagship exhibition IMTEX FORMING 2022 with focus on metal forming and manufacturing technologies, along with concurrent shows - Tooltech and Digital Manufacturing, from June 16-21, 2022, at BIEC, Bengaluru.

Now, as the pandemic recedes, the Association is gearing up to host its flagship exhibition IMTEX FORMING 2022 with focus on metal forming and manufacturing technologies, along with concurrent shows - Tooltech and Digital Manufacturing, from June 16-21, 2022, at Bangalore International Exhibition Centre (BIEC), Bengaluru.

IMTEX 2023 - with focus on metal cutting and manufacturing technologies, along with concurrent shows - Tooltech & Digital Manufacturing, is scheduled from January 19-25, 2023, at BIEC, Bengaluru.

I wish all readers of MMI magazine happy reading and a great time ahead.

At Japan's historic New Product Awards Winner of the highest prize

第64回
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Best 10 New Product Awards — The Masuda Award

The Best 10 New Product Awards is an award system established in 1958 by the Nikkan Kogyo Shimbun, a leading industrial newspaper in Japan, with the aim of encouraging the development of excellent new products that contribute to the improvement of Japanese technology. Every year, from the products developed and put into practical use that year, dozens of products are carefully selected and commended, and the Masuda Award is given to the one recognized as the best among them. Okuma has won a Best 10 New Product Award 17 times, and the MA-8000H will be Okuma's first Masuda Award.

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Soumi Mitra

SOUMI MITRA
Editor-in-Chief
Modern Manufacturing India
soumi.mitra@magicwandmedia.in

INNOVATION, THE ONLY WAY TO THRIVE

Two years ago, the world's biggest lockdown was initiated to curb the rapid global spread of COVID-19 and flatten the curve of the pandemic, which affected lives and livelihoods worldwide. Healthcare and frontline workers desperately required Personal Protective Equipment (PPEs), face masks, and other medical devices for which governments around the world were not prepared.

Since necessity is the mother of innovation, Additive Manufacturing (AM) emerged as a solution to bridge COVID-led supply chain disruptions. Several 3D printing start-ups collaborated to address the shortage of critical medical equipment, including face shields and ventilator valves. AM enabled manufacturers to develop hygiene and safety products such as hands-free door handles and pedals.

While the world made the best of AM to navigate the crisis, India started to work towards becoming a global manufacturing hub to cater to next-generation digital manufacturing and mitigate the immediate disabilities of local industries. To this end, the Ministry of Electronics, IT & Technology has announced a 'National Strategy for Additive Manufacturing' recently. As per the Ministry, to keep pace with rapid global manufacturing prowess, India needs to adopt an integrated approach to AM in all segments, including defense and public sectors, especially within the nation's small-, medium-, and large-scale industries.

According to the newly announced strategy, innovation and R&D ecosystem will be encouraged in the public-private partnership (PPP) mode to transform the existing research knowledge base to develop AM grade materials, 3D printer machines, and

"We must prepare people to be nimble enough to adapt to an ever-evolving marketplace. And we must help them develop skills that will be valued no matter what tomorrow's jobs are - skills like creativity, critical thinking, problem solving, and collaboration."

- Tae Yoo

printed indigenous products for the vast domestic and international market. It is also slated to help overcome technical and economic barriers for global AM leaders to set up their operations with supporting ancillaries in India, facilitating the development of the domestic market.

In our endeavor to present an extended shelf-life issue, we reached out to the industry experts to learn about the advanced technology trends that are transforming the manufacturing landscape. We are immensely thankful to the thought leaders for giving us their valuable time and sharing insightful views on how India's manufacturing sector is inching towards more progress.

As usual, we solicit your feedback to keep continuing the practice of presenting curated content.

Who did you notice more?



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Source: IMTMA

First batch of Female Students who underwent training as part of the Tata Electronics and SkillSonics at IMTMA

MAKING AN IMPACT

The manufacturing ecosystem is undergoing a massive transformation, with more women stepping up to make huge strides and help the industry reap big rewards with their potential.

If women in factories stopped work for 20 minutes, the Allies would lose the war," Joseph Jacques Césaire Joffre, the commander-in-chief of the French forces during World War I, once famously remarked. Joffre's now popular words had back then drawn European women in large numbers to factory premises to work as welders, machinists, technicians, etc.

The need of the hour had perhaps triggered the entry of the female workforce into what predominantly used to be a male bastion. However, the percentage of women globally is still a far cry from what it should have been in more than a century since World War I.

Current scenario

The experience of the global pandemic taught us that a challenged world is an 'alert world' and often challenges pave the way for 'changes'. We have lived through unprecedented times in the last two years, battling and overcoming challenges related to lives and livelihoods. The uncertainty has brought more women to the fore where they can take charge and choose to challenge what has been traditionally holding them back. Companies, in recent years, have warmed up to hiring women with the requisite skills in various sectors, such as Automobile, Heavy Engineering, Mines, Earthmoving Equipment Handling, etc. In addition, organizations are establishing factories with a higher

percentage of females than males, and there are numerous new initiatives to encourage women to enter the workforce.

Women are holding top positions in various industries overall, and have been doing excellent work in their respective fields. Similarly, among the Indian Machine Tool Manufacturers' Association (IMTMA) member companies, we have women holding prominent positions. The positive outcome of this has been that they are encouraging other women to join the Manufacturing industry.

To aid this positive change, IMTMA conducts women's exclusive training programs to make women industry-ready. Presently, over 20 female candidates are undergoing comprehensive training on

Source: IMTMA



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To aid this positive change, IMTMA conducts women's exclusive training programs to make women industry-ready. Presently, over 20 female candidates are undergoing comprehensive training on 'Design and Manufacturing of Special Purpose Machines'. More such programs are on the anvil.



Participants at the IMTMA - FEDream Women Empowerment Initiative Inaugural

Source: IMTMA

'Design and Manufacturing of Special Purpose Machines'. More such programs are on the anvil.

Towards inclusive culture


Manufacturing has undergone significant changes from what it was in the 1980s to how it's being done now, and engineers need to acquaint themselves with the new ways of manufacturing. The mindset of co-workers and that of the top management is a significant challenge. However, this is changing fast, with women getting the same opportunities as men.

Industry analysts see this change already happening in a big way. For example, most electronic units have more than

60 percent women workforce. Metrology, inspection, and design departments are increasingly dominated by women workers. IT and various other sectors deploy a large number of the fair gender, and as automation takes over routine jobs such as the handling of heavy materials along with the use of artificial intelligence, robotics, and digital manufacturing, we will see more women workers in industrial units as well.

Industries believe that encouraging diversity, gender-neutral growth, training, competence building, and having women in managerial roles will pay rich dividends. As more women get educated

and financially empowered, the societal barriers will diminish. Moreover, Section 66 of the Factories Act of 1948 was amended in 2005, permitting women to do night shifts provided all safety precautions are enforced, which also bodes well for organizations looking to hire women workforce.

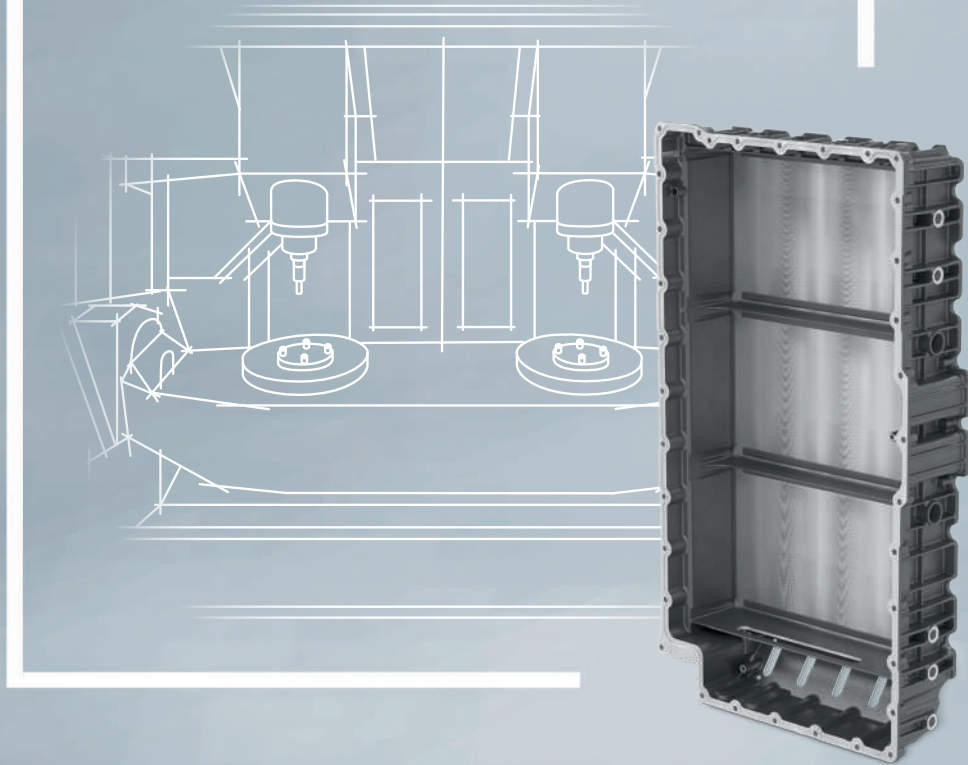
By breaking the barriers, they can perhaps share equal space with men in whichever field they may be - in exhibitions, manufacturing, policymaking, services, or any other sphere. The male-female divide in industries can be bridged when females have a say in the decision-making process, positively affecting the system. 



Women Engineers attending a session on International Women's Day at IMTMA

Source: IMTMA

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UNDETERRED BY CHALLENGES

The Indian manufacturing sector is bouncing back and is well on its growth path. Industry insiders share their outlook on what trends are needed to maintain this momentum and shape the future of the sector...



Sangeet Kumar
CEO and Co-Founder
Addverb Technologies

Industry 4.0 has revolutionized manufacturing

COVID-19 will have a continued impact on our lives in 2022 in many ways. The boom of digitization and virtualization, impacting the course of action for every business, will keep on accelerating. Much has been said already about the disruptions via Industry 4.0 and how it has revolutionized the manufacturing space. Below are some trends that will shape the future of the Indian Manufacturing sector in the coming year.

Robotics Automation

Autonomous Mobile Robots (AMRs), collaborative robots, or cobots, along with AI-driven intelligence, can automate routine tasks and help in investing more time in strategic activities where human skills are most required. They will help organizations reconfigure the future of their operations, upskilling their resources and redesigning the production processes to better equip humans to work alongside robots.

Artificial Intelligence

AI-driven intelligence will provide numerous ways to automate mundane, routine tasks. Every industry today is looking to AI to transform its operations. With the combination of AI, the Industrial Internet of Things (IIoT) and the emerging superfast networks, the future holds power and capabilities we did not have a few years ago. As per research, today, nearly 31 percent of production processes incorporate smart devices and embedded intelligence around the globe. India is also leading on the same track.

Digital Twin

Digital twin, as the name suggests, is a replica of a physical asset in the digital world that integrates the data of the physical world into the digital one and casts the results. This can enable companies to run a virtual simulation before making a sound investment in a deal.

3D Printing

The additive manufacturing process, or 3D/4D printing, can exponentially accelerate the time-to-market for products in the manufacturing space. It's a highly cost-effective technology that will make production faster and cheaper and transform the concept of mass production immensely.

AR/VR

Augmented and Virtual Reality may contribute to a myriad of areas for industrial manufacturing, ranging from setting up new plants and commissioning new lines to training personnel and

from modeling the existing shop floor to implementing predictive maintenance. Using AR, product developers can create 3D models of new products and introduce them to the assembly line. This virtual model lets employees check the quality of the new product before its release.

Foreseeing India's GDP

Growth remained fairly well supported in 3QFY21. It remains well on track for full-year growth of around 9.5 percent. Of late, the ease of doing business in India has improved by leaps and bounds, with many states now taking ownership to attract investments from Indian and foreign companies. Given these developments, a positive turn for GDP of 8-9 percent can be expected, assuming the economy continues on its current consistent path.



Nitin Lall
General Manager
Industrial Technique Business
Atlas Copco (India) Ltd

Automotive players await good news

In the wake of two years of mar-

POONAM PEDNEKAR
Chief Copy Editor
Magic Wand Media Inc
poonam.pednekar@
magicwandmedia.in



ket disruption, automotive manufacturers and suppliers are eager for positive news. Indisputably, 2021 was a tough year for manufacturers, suppliers, and OEMs. As we enter 2022 to notice and adapt to the many COVID-related setbacks, some predictions that are safe to bet on include:

Agility will be a priority

The Automotive industry has faced various paradigm shifts in the past year, largely driven by the unstoppable C.A.S.E. (Connectivity, Autonomous, Sharing/Subscription, and Electrification). These factors impact every sector of the industry - whether it is product design and development or manufacturing, distribution, sales, service, talent, and the aftermarket.

Electrification and Platforms

The industry has embarked on the process of electrification as the Government has underlined its emission reduction goals. In the coming time, hybrids may dominate, but light vehicles will, in time, become electric. Electric vehicle (EV) manufacturing looks certain to impact OEM assembly plants and suppliers.

As the Giga factories are growing, battery manufacturing will also become large-scale worldwide. New companies entering the market are producing only platforms for EVs for other traditional manufacturers to use. This will automatically speed up the process of local manufacturing - small manufacturing hubs based on a standardized agile manufacturing principle that can be replicated multiple times in multiple locations to sell to the local areas, reducing many of the costs associated with logistical transportation and plant size and scale.

These will bring remarkable changes. Engine assembly plants and the supply chains that support them will diminish or disappear. Vehicle assembly will also change

significantly, with lesser components and subassemblies. Already, OEMs are investing in battery and motor manufacturing.

Enhanced visibility will be a lifesaver

With the help of software, manufacturers are saving the day by managing supply chains for every OEM. While manufacturing microchips might not help, with the technological advancements, the supply chain is certainly a strategy that every automotive OEM and supplier can apply. There are tools available for supply chain planning that can help manufacturers monitor inventories, deliveries, shipping routes, expected deliveries, and the impact on sales orders if a delivery is delayed.

IIoT

A part of Industry 4.0, the Industrial Internet of Things (IIoT) will let manufacturers and integrators provide their lines with low-cost sensors that stream data to the cloud for analysis.

The data analysis shows the performance of the operation right down to the component level. Post-analyzing, the data is paired with a digital twin that enables operations to build an accurate representation of the process to aid problem resolution, continuous improvement, remote visualization, change management, and flexible planning.

Manufacturers nowadays are looking for smarter, multi-configurable solutions to align the autonomy and efficiency of their day-to-day operations with future change, minimizing disruption and cost while maximizing asset output potential.

Connectivity and Autonomy

Connectivity in vehicles has transformed the entire Automotive industry in a good way. Users have increased expectations of the same internet connectiv-

ity that they have at home in their vehicles. The Automotive industry is moving toward every vehicle having a standard software download. The configurable systems can then be added any time during the ownership of the vehicle using the internet through WIFI or 5G.

Connectivity will also enable vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications that will help in reducing accidents and improving traffic flows in increasingly congested cities.

Many manufacturers and developers have accepted and believed that the solution is a combination of cameras and LIDAR with artificial intelligence (AI). Advanced Driver Assistance Systems (ADAS) like automatic braking are popular features among consumers.



Zurvan Marolia
Senior Vice President Head,
Manufacturing Council
Godrej & Boyce Mfg Co Ltd

Key ICT trends

Internet of Things (IoT)

IoT is widely utilized in manufacturing to minimize human intervention - from selecting programs from a program library to production scheduling to optimize capacity utilization to operation sequencing right up to packing and dispatch. The entire cycle may be handled by machines interacting with one another and passing on informa-

tion needed to perform the next operation in a specified sequence. These systems aid in project-wise material planning, production planning, tracking factory capacities and job-loads, production reporting, and asset-level planning to augment production and operational efficiencies. This directly ensures that a customer receives a superior quality product for the most optimum price in the least possible time and with visibility on the status of the order throughout.

Artificial Intelligence

It may be utilized to give a layer of predictability to processes by building consistency into processes as well as being taught to interpret multiple signals received from strategically located sensors to provide early warning signals of any potential disruption – from quality deviations to breakdowns. Advanced systems would be able to go a step further into self-diagnosis and self-regulation.

Cloud Computing and Analysis

It is the third trend to look forward to. It is now simpler for the Manufacturing industry to implement technology that assists in moving a company's journey towards smart manufacturing, thanks to increased access to inexpensive equipment paired with cloud computing and analytics. Analysis is where the investment in digitization begins to pay back for itself and is the meeting point where the gigabytes of data are used to perform iterative 'what if?' scenarios. This, in turn, helps arrive at optimal solutions for capacity utilization and quality assurance, which together can make manufacturing possible at optimal costs and lead times, thus making us globally competitive.

3D Printing (Metal)

This is a big leap forward from the early days of 3D printing and has a multitude of applications in a world where 'batch size 1' is becoming an increasingly frequent requirement to meet the needs of customization. It will also find applicability in quick-working prototypes and service and maintenance requirements. 3D printing by itself is not new as an additive process, but the development of sintered metal as a material for printing has opened up a whole new set of possibilities for the Manufacturing sector.

Use of Cobots

Cobots, bring in a factor of 'co-working', which by their very definition, works along with the fact that they are more easily programmable than industrial robots because they are capable of 'learning' on the job.

2022 to be positive

While the view for 2022 is positive, certain challenges remain. A post-pandemic boom is anticipated in the wake of green shoots that have already been apparent in recent months. In India, the cost of doing business is a worry, and recurrent waves of the epidemic are disrupting supply chains and manufacturing, particularly for small- and medium-sized businesses, which are the economy's backbone. Over the previous three quarters, the economy has grown steadily. Despite a glitch in the first quarter, we achieved year-over-year increase for the quarter. Both the manufacturing and services sectors have experienced growth in recent months, with their respective PMIs reflecting increasing expansionary momentum. We are already approaching pre-pandemic levels on certain measures. Export growth has also been strong this year, greatly above pre-pandemic levels. The trend is expected

to continue in the fourth quarter, with over US\$ 400 billion in revenue for the fiscal year.



Praveen Shetty
Senior Director, Engineering
Honeywell Technology Solutions
Lab Pvt Ltd - Performance Materials
and Technologies

Digital twin to lead the growth of the sector

India is on its way to becoming a global manufacturing hub, with the potential to add more than US\$ 500 billion annually to the global economy by 2030. The application of technologies like digital twin will lead to the growth of the Manufacturing sector, as will innovations that are smart, connected, efficient, and reliable. Autonomous systems and controls are the prime areas of investment by manufacturing companies.

Companies are also focusing on their sustainability agenda, with many declaring their net-zero roadmaps. For the Manufacturing industry, this translates into reducing effluents and carbon footprints and improving renewables in their inputs – from energy mix to products.

There is no doubt that Industry 4.0 is the way forward for companies looking to modernize their manufacturing processes. Connected devices and data will play a pivotal role in improving outcomes for this sector. A high level of data computing capability based on the enormous data

available from various sensors in the manufacturing plants is enabling good insights for the plant managers to improve the safety, reliability, and efficiency of the manufacturing units and operation staff. Cybersecurity by design and a resilient 360-degree security approach from edge-to-cloud, infra-to-APIs, pipeline to delivery and supply chain will become imperative. The safety of employees is the topmost priority of any manufacturing unit, and it is critical to ensure employee retention as well. Besides ensuring physical security, companies must invest in technologies like predictive maintenance, which can increase the safety of their workers. A lot of focus on immersive technology-based learning using AR/VR is helping the remote manufacturing units achieve the required skills for operation and maintenance. Finally, the industry is moving towards 4.0 with 3D printing technology, enabling chain efficiency, reducing lead time and costs, and providing flexibility in daily operations. The increased human-machine interaction with the IoT will significantly affect digital transformation.



Raghav Gupta
Director
Kanchan Metals Pvt Ltd

Towards sustainable automation

The Manufacturing sector will be looking for high productiv-

ity and maximized sustainable automation. At the same time, it needs the flexibility to be able to adapt to changing scenarios that have become highly dynamic due to external factors. Less dependence on physical labor will always be a driving need. Also, consistency in quality and deliverables with high automation will be the target. So, with the changing times, I see that the Manufacturing sector will move towards automation through augmented reality (AR), robotics, and artificial intelligence (AI). Although there is a fear of the third wave of COVID-19, we are confident that the GDP will sustain at around 8-8.5 in the next fiscal. If we manage our businesses with a more eagle-eye view, we can create a fundamentally strong environment for the economy to grow further.



Manish Kumar
CEO, SOLIDWORKS
Dassault Systèmes

Manufacturing, the economy barometer

Manufacturing is a key indicator of the real strength of any economy, and it has been under severe stress in the last few years. Following trends are helping this industry overcome the challenges:

Connectivity

Ability to capture and seam-

lessly share information generated from various sources has never been easier, whether it is data generated by machines or human beings. 5G is going to make it even easier going forward.

Artificial Intelligence and Data Analytics

The use of captured data and massive compute power at cheaper costs gives the ability to capture the knowledge and know-how to optimize operations predictably. We are seeing its massive adoption in the fields of planning and control, order management with personalization, real-time tracking, enterprise resource planning, and so on.


Onshoring

Disruptions in the supply chain are here to stay. Over-reliance on offshore facilities and low inventories is causing disruptions. Boosting onshore manufacturing capability is a growing trend to counter this disruption.

Advanced Engineering

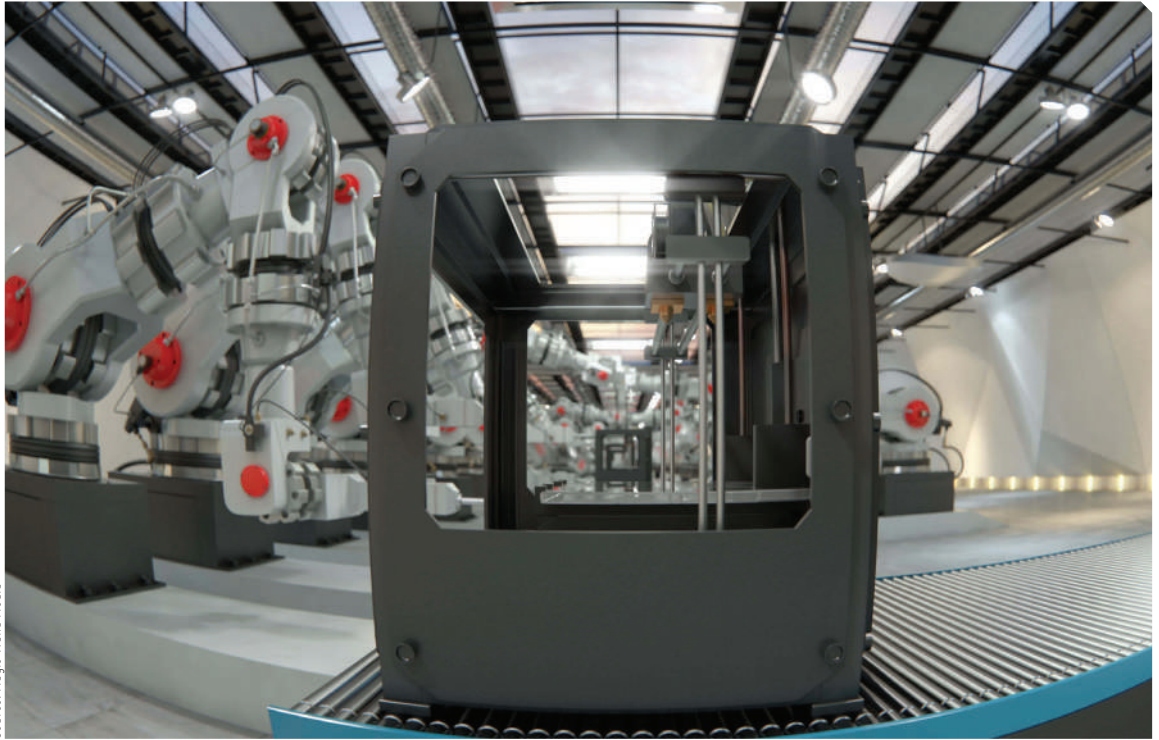
The labor shortage has hit the Manufacturing sector pretty hard. Reskilling is being done. Advanced engineering is helping as well. Virtual twin and running simulations of processes, real product usage, and manufacturing automation are reducing time and resource wastage while delivering better quality products.

Sustainability

Customers are becoming aware of environmental and social factors. Even the cost of capital is getting linked to sustainability. The leading-edge manufacturing firms are already embracing sustainability, and it will become mainstream soon. 

TOWARDS TRANSFORMATION

Where will additive manufacturing go in the next 10 years? Stephanie Hendrixson and Pete Zelinski offer six ideas in the latest episode of the AM Radio podcast.



Source: Magic Wand Media

When stereolithography was invented more than 30 years ago, would anyone have guessed that 3D printing technology would explode, expand, and come to change the way that production parts are made? Likely not. While some of the issues around additive manufacturing (AM) have remained the same, the techniques, materials, and applications have grown exponentially. And we predict that this growth will continue, though perhaps in different directions than it has thus far.

In the most recent edition of the AM Radio podcast, I challenged co-host and AM Editor-in-Chief Peter Zelinski to come up with some predictions about where AM is headed over the next 10 years. We each shared three ideas, summarized below.

Six predictions for additive manufacturing's next 10 years:

1 Service parts will lead to a re-engineering of the entire product lifecycle. 3D printing has great potential as a source of aftermarket and spare parts, but only if 3D printable files exist for those parts. In the future, we will rely less on 3D scanning and reverse engineering because those digital files will exist from the beginning, and be created as part of the product's initial development.

2 Increasingly irregular and organic designs. There is some extent to which today's designers and engineers hold back on using additive manufacturing to its full geometric

capability, simply because the consumers and users of 3D printed items must feel a sense of trust and recognition of these objects. As humans become more accustomed to generative designed and topology optimized forms, the door will open to increasingly complex, asymmetric, and optimized objects, whether they be aerospace brackets, automotive engine components, or consumer products.

3 The arrival of a new category of machine shop that specializes in metal AM parts. Additively manufactured parts are unlike the stock, blanks or even castings most machine shops are accustomed to handling. A new class of machine shops staffed and equipped to fixture, locate, ma-

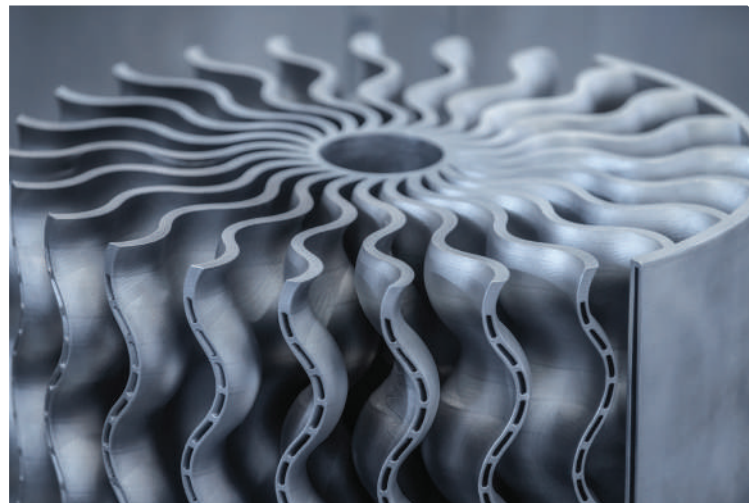
STEPHANIE HENDRIXSON
Executive Editor
Additive Manufacturing



chine and inspect the often irregular parts possible through 3D printing is on the horizon.

4 More intentional material usage enabled by AM. 3D printing allows for material conservation by encouraging the use of material only where it is necessary, but it also increasingly supports the use of gradients and the joining of different materials. These capabilities will challenge the notion that one part should be made of a single material and enable more innovative designs and better conservation of high-value materials. Expanding options for sustainable materials from bio-based or recycled sources will also support this material intentionality.


5 Inventors as a new category of manufacturers. There is a hard line today between product development and manufacturing, where design and ideation must stop to enable production through in-



Source: Magic Wand Media

jection moulding, machining, or some other conventional method. Not so with additive manufacturing; without tooling, the design of the product can continue to change even as the item goes into production – and the inventor can continue to be involved, even to be the manufacturer through 3D printing.

6 New kinds of 3D printing that we have not

yet imagined. The past year alone has revealed a handful of unexpected means of constructing parts layer by layer; there's no telling what the next ten might add to the available options. 3D printing methods that today are only in development, only the seed of an idea or perhaps not even in existence at all could prove to be the next important advance in AM's next decade. 

As humans become more accustomed to generative designed and topology optimized forms, the door will open to increasingly complex, asymmetric, and optimized objects, whether they be aerospace brackets, automotive engine components, or consumer products.



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FUTURE TRENDS IN AEROSPACE

Characterized by growth for decades, the aerospace industry has never been in as deep a crisis as COVID-19. Now that the markets have returned to the levels of growth last seen in 2006, how can aerospace manufacturers get back on track? The answer lies in more sustainable manufacturing. An expert in the field explains how collaboration will play a vital part in the recuperation of the industry.



Source: Sandvik Coromant

The Aerospace industry had been growing consistently for 14 years when the pandemic struck. There's no doubt that trends and the future of aerospace have been immensely affected by the unprecedented coronavirus pandemic. There has been an exponentially reduced business or vacation travel, while airlines have had to adjust to substantially lower levels of profitability.

It isn't all bad news. The Aerospace sector has seen some improvement in the first half of 2021. Success, though, is tied to several factors like vaccinations and the global economic outlook, with Chinese economic prosperity, business, and holiday travel recovery also having an influence. Projections estimate the indus-

try will be back to where it was pre-crisis within the next two to three years. The speed of this recovery will vary in different countries and regions. Nevertheless, over the long term, the number of new airplanes could still be reduced by 25 percent by 2040.

Design changes and challenges

Another big change, from an engineering perspective, is that airplanes will be single-aisled rather than twin-aisled and, therefore, less wide-bodied. They will also be required to have a longer flying range. Engines and frames are closely connected: one doesn't go without the other, but with engines, we can say the focus is on sustainability. This means a

reduction in weight, noise, and emissions and higher efficiency with less consumption. These single-aisled crafts must satisfy a wide range of uses without increasing the size or quantity of engines.

There are different ways of approaching these design challenges. One is to find alternative fuels using existing engine tanks, such as synthetic fuel, biofuel, or hydrogen. Then you have a new engine architecture with large manufacturers presenting new types of engines, which is a longer-term approach. Then we have alternative forms of engines that are electrified, battery-driven or electromagnetic, or hybrid engines where current engines are assisted by electric power motors.

SÉBASTIEN JAEGER
Industry Solution
Manager, Aerospace
Sandvik Coromant





Other obstacles

If we look at the Automotive industry, it is already making great progress with new electrified and hybrid systems. Aerospace original equipment manufacturers (OEMs), meanwhile, are still working on these systems, and many of these developments are not expected to find widespread use before 2035. With smaller aircraft, which hold two to ten people, for example, these technologies could appear earlier.

Reductions in noise, weight, and emissions will, of course, affect how these electric systems perform, but there are challenges. If there are issues with an electric vehicle (EV) like an automobile then it can stop at the side of the road. However, that's not an option 10,000 feet up in the air. What's more, batteries are heavy when designers and engineers want planes that are lighter to travel longer distances. So, there are technical obstacles to work with.

For a component like the aircraft's fuselage, OEMs are going in two different directions. On the one hand, we are seeing increased use of aluminum, although aircraft components require new types of aluminum with greater strength, fatigue

resistance, and other attributes. This approach adheres to traditional aircraft designs where you have, to put it simply, a big tube with wings and an engine.

Another approach is to explore other shapes of aircraft like delta shape, blended wing body, and strut-braced wings, or where the engine is more integrated into the fuselage. Here, engineers will more likely turn to composites, or composite-ceramic combinations, or mixed materials. Whether these designs become popular remains to be seen. For now, we can be sure that more aluminum will be used, and also heat-resistant super alloys (HRSA). HRSA are typically used for aircraft parts that face extreme performance demands. Their high strength at elevated temperatures means the materials can retain their hardness when facing intense heat.

However, even the best aircraft component manufacturers can be inexperienced in manufacturing these tougher materials. This is where Sandvik Coromant's expertise has proved useful.

Component solutions

Sandvik Coromant offers component solutions in response to the growing pressure on machinists

to multi-task. Rather than focusing on one machine, today's engineers can operate four or five machines at a time, which gives them less time or opportunities to focus on specific processes. But, what do we mean by a component solution? It refers to taking a more holistic perspective, which means it's not just about the tools Sandvik Coromant provides but also about assisting with the complete process.

That was the case when a Sandvik Coromant customer in aerospace was experiencing challenges when machining HRSA materials. The customer's existing approach required multiple machine tools, with poor chip control and long cycle times. There were issues with inconsistent tool life and unreliable processes, and the machining operation often required full-time monitoring by an operator.

For high-value projects like these, the component solution from Sandvik Coromant consists of several stages. They include looking at the machine requirements, time studies to examine the cost-per-component, and analyzing production methods at the run-off related both to Methods-Time Measurement (MTM) and end-user processes. It also

Projections estimate the Aerospace industry will be back to where it was pre-crisis within the next two to three years. The speed of this recovery will vary in different countries and regions.

If there are issues with an electric vehicle (EV) like an automobile then it can stop at the side of the road. However, that's not an option 10,000 feet up in the air.



SAC346 - CoroPlus ToolPath for PrimeTurning action

Source: Sandvik Coromant

includes computer-aided manufacturing (CAM) programming and project management of local or cross-border projects.

These analyses revealed that we needed to change the customer's programming strategy to solve its chip-breaking problems. In combination with the tool, Sandvik Coromant's specialists developed a new strategy with dynamic drive curves, which allowed us to control the chip breaking at every moment. We called this new approach 'scoop turning' and now have a patent on it.

Scoop turning resulted in very good savings for the customer. In addition to chip control, the customer also achieved an 80 percent cycle time reduction and doubled tool life. It was able to reduce its use of four machines down to one, reducing the need for multi-tasking with more secure machining processes and green light production.

This shows how a more holistic approach can benefit a manufacturer's bottom line. Software also plays a vital role, such as the CoroPlus® Tool Guide, which is part of Sandvik Coromant's digital portfolio. Customers can make crucial decisions on the choice of tool and cutting pa-

rameters before they have even commenced production.

More sustainable turning


Aerospace manufacturers are taking different approaches to tackle sustainability. Nevertheless, Sandvik Coromant found it was possible to develop a bespoke solution for one customer that has since benefited entire industries.

To help the customer perform better turning operations on HRSA, Sandvik Coromant's response was to develop the S205 turning grade. The insert is coated with second-generation Inveio® coating for high wear resistance and long tool life, while post-treatment technology strengthens the S205 insert by modifying its mechanical properties. The material has an Inveio® layer characterized by tightly packed, uni-directional crystals that create a strong protective barrier around the insert. This maximizes thermal protection and improves crater wear with better flank wear resistance.

The grade is well-suited for machining components such as aircraft engine turbine discs, rings, and shafts. Our customers have reported 30 to 50 percent higher cutting speeds with S205 com-

pared with competing HRSA turning grades, and these results were achieved without compromising tool life. S205 has since benefitted several manufacturers in Aerospace and other industries. These results were achieved with a holistic approach, specifically with Sandvik Coromant's PrimeTurning™ ethos that allows all-directional turning for maximized productivity.

The PrimeTurning™ methodology is based on the tool entering the component at the chuck and removing material as it travels towards the end of the component. This prioritizes all-important metal removal rates for faster, quality production and changeovers. In some cases, our customers have completed production runs with just one tool changeover when, with a competitor's tool, they would have needed five.

Aerospace may be facing one of its biggest crises yet, but there is light behind the clouds. Sandvik Coromant continues to support all the leading aerospace OEMs in their post-pandemic recovery by marrying sustainability with better tools and optimizing cutting parameters with a holistic approach to tooling. 

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WOMEN IN MANUFACTURING ECOSYSTEM

The manufacturing industry is undergoing a transformation with more women contributing and adding value to it, making the sector inclusive with equitable opportunities for all. Here we have Helen Blomqvist, President, Sandvik Coromant, and Mohini Kelkar, Director, Business Development, Grind Master Machines Pvt Ltd, giving us a sneak peek into their roles as leaders in the industry and challenges encountered in performing them, and also proffering wise counsel to those seeking to tread the same path.



Helen Blomqvist
President
Sandvik Coromant

Mohini Kelkar
Director, Business Development
Grind Master Machines Pvt Ltd

Manufacturing has generally been a male-dominated industry, with women accounting for less than one-third of employees. However, the industry is at a crossroads, and its future is dependent on a diverse workforce. Despite recent progress, women continue to be underrepresented in the Manufacturing industry. Helen Blomqvist and Mohini Kelkar share their experiences of closing the gender gap, highlighting the opportunities that abound in the sector and making an impact, empowering and inspiring more of their clan to join forces.

How did you get your start in manufacturing, and what drew you to this industry?

Helen Blomqvist: My PhD in structural chemistry was the catalyst that set everything in motion. I then joined Sandvik Coromant in 2003 as an R&D engineer in materials characterization, utilizing my PhD knowledge to support my role. My natural interest in materials technology led me to Sandvik Coromant. I have been with Sandvik Coromant for 19 years in various roles, and I believe that as president in 2020, I have proven that women can do anything in manufacturing.

Mohini Kelkar: I studied Production Engineering because I was interested in manufacturing methods and the types of machines used. So, in general, manufacturing technology piqued my interest. Even though there were no female production engineers at the time, I enrolled in the production engineering course at VJTI, which included subjects in manufacturing technologies, becoming the first female production engineer to graduate from VJTI in 1981.

Could you please highlight some of the common misconceptions

SOVAN TUDU
Sub-editor
Magic Wand Media Inc
sovan.tudu@
magicwandmedia.in



“Women currently make up 18 percent of Sandvik Coromant’s workforce and 30 percent of its next-generation managers, which is higher than the industry average. It is possible to be accepted and welcomed into this industry. So don’t be afraid of it. Knowledge is powerful, regardless of gender.”

Helen Blomqvist
President
Sandvik Coromant

that women have about working in a manufacturing environment?

Blomqvist: One common misconception is that women are not accepted in traditionally ‘male-dominated’ industries such as manufacturing. This is largely due to the values associated with the male gender role in workplace culture. However, according to the Bureau of Labor Statistics, nearly 1 million women entered the labor workforce in the United States in 2021. This demonstrates that attitudes are changing, and women are prepared to enter a stereotypically male-dominated industry.

Furthermore, there are many successful women in manufacturing who are the brains behind many exciting projects. And the number of women employed at Sandvik Coromant confirms this. Women currently make up 18 percent of Sandvik Coromant’s workforce and 30 percent of its next-generation managers, which is higher than the industry average. It is possible to be accepted and welcomed into this industry. So don’t be afraid of it. Knowledge is powerful—regardless of gender.

Kelkar: Manufacturing set-ups are constantly changing. There is a significant difference between how manufacturing was done in the 1980s and how it is done now. Hence, it is criti-

cal for women and men to educate themselves on the new manufacturing set-up. For example, now that Industry 4.0 is gaining popularity and most shop floors are well connected digitally with offices or decision-makers, knowledge updation, rather than misconceptions, plays a more important role here.

Can you discuss some of the major challenges that women face while working in the Manufacturing industry? How would you like to approach these issues?

Blomqvist: One of the biggest challenges women face is based on perceptions and gender stereotypes. However, the Manufacturing industry is facing a major skills gap, with research predicting that there could be 2 million manufacturing jobs available by 2025. In fact, manufacturing employment in India has dropped by almost half in the last five years, to 27 million. As women hold less than 30 percent of manufacturing jobs, there is a great opportunity for women looking to enter this industry. Another challenge relates to maternity leave. Studies have shown disparities between the career paths of women and men following childbirth. For instance, only 28 percent of women work full-time three years after childbirth, compared to 90 percent of men. Besides this, 17 percent of women leave employment completely in the five years after childbirth, whereas this is as low as 4 percent with men.

To address this, industry leaders must do more to encourage women into this industry by demonstrating the possibilities and potential out there. They must also ensure they are flexible and more accommodating of commitments outside of work. Rigid workplaces will miss out on skilled workers.

Kelkar: The biggest challenge is the mindset of co-workers and the top management of the company. However, it is changing very fast, and women in manufacturing are increasing their numbers every day. The shift is also due to an increase in the number of female directors or owners, as well as next-generation daughters, stepping into and successfully running their father’s business. Women are also getting increasingly ambitious and finding jobs at higher levels in the Manufacturing industry. At the same time, the industry is also accepting them very well.

The challenges will be fewer with time because of digital manufacturing and automation. The jobs that were done manually in manufacturing earlier are no longer required to be done manually. Most Manufacturing industries have adopted automation in material handling and other labor-intensive jobs in a massive way. So, the challenge for women to lift heavy things is no longer there. Moreover, while operating the machine, there is a lot of digitalization and minimal physical work, which is why it is now much better for women in manufacturing.

Furthermore, companies should address the male-female divide in industries at the top level once they have established a gender equality policy or hired a certain percentage of female employees. Also, more decision-making positions should be given to women to truly convince them that they are capable of doing more than just clerical work. Once there is a female decision-maker in place, the effect will be noticeable down the line.

What skills do you believe are essential for success in today’s Manufacturing industry?

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Blomqvist: Critical thinking and flexibility are two essential skills for those working in manufacturing. As a result of digital transformation and the fourth industrial revolution, manufacturing now encompasses many different roles and technologies that require highly skilled individuals who can adapt to a changing landscape.

Workers in manufacturing must ask questions and apply logic and reasoning to pinpoint strengths and weaknesses, which necessitates critical thinking. Flexibility ensures workers can carry out various tasks, from operating machinery on the factory floor to working on computers. To perform the various tasks that the industry now offers, this skill also necessitates a willingness to learn and an open mind.

Kelkar: As I previously stated, the skills are frequently changing. The process of unlearning and learning has to be very fast. To be able to cope with the new methods of manufacturing or

“There is a significant difference between how manufacturing was done in the 1980s and how it is done now. Hence, it is critical for women and men to educate themselves on the new manufacturing set-up. With Industry 4.0 gaining popularity and most shop floors well connected digitally with offices or decision-makers, knowledge updation plays a more important role here.”


Mohini Kelkar
Director
Business Development
Grind Master Machines Pvt Ltd

to be successful in the Manufacturing industry today, one has to unlearn and acquire new skills rapidly.

What advice would you give to your coworkers and job seekers interested in pursuing a career in manufacturing?

Blomqvist: Just do it. Don't spend time thinking about why you shouldn't take up a career in manufacturing. The industry needs more women to fill critical skill and gender gaps. It is important to challenge

industry perceptions by making noise and recognize the organizations that encourage diverse workplaces. So, look for those organizations that will value your ideas and diversity and champion women in manufacturing.

Kelkar: Currently, India has huge opportunities in manufacturing, partially due to various other worldwide events like the COVID-19 pandemic, the recent Russia war, and so on. These are creating more opportunities for India, and more manufacturing will happen in India, which means there will be many more job opportunities in manufacturing as a career. For the same reason, there are prospects for starting your own business in manufacturing, and there will be alternatives to becoming a part of the global supply chain. Many international companies are looking into outsourcing options from India, so becoming a manufacturing entrepreneur could be a viable career option. 



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ADDITIVE MANUFACTURING FOR SUSTAINABLE SUCCESS

More and more companies are finding out how additive manufacturing is a viable and effective tool for design, prototyping, and production. It's becoming an essential tool in the manufacturing toolbox. It's not just that it is novel; it has tangible benefits for one's business.

TIM DEROSETT
Director of
Product Management
Additive Manufacturing
Jabil Inc.

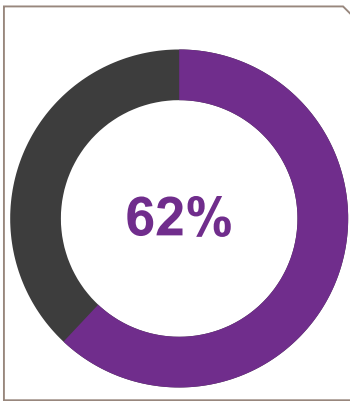


In a world of such rapid business and technological advancement, it is remarkable that today's manufacturers remain constrained by the eternal triad of quality,

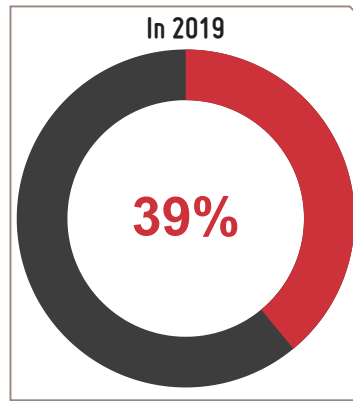
speed, and cost. Achieving the right balance is complex and difficult to generalize, but the good news is that additive manufacturing has reached new levels. But how do additive manufac-

turing opportunities complement conventional manufacturing and transform business models across industries? Analysis from Jabil's 2021 3D Printing Technology Trends sur-

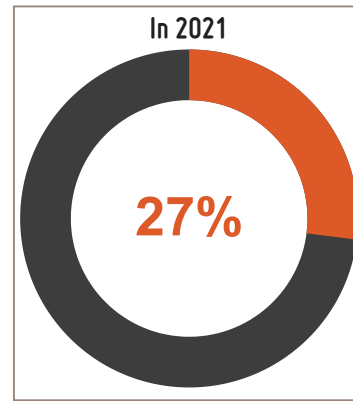
Source: Jabil Inc.



Decision-makers at companies that use additive manufacturing say they use the technology for production parts today



Participants of the Survey said that they didn't have confidence in the reliability of 3D printed parts



Participants of the Survey said that they didn't have confidence in the reliability of 3D printed parts

vey revealed that additive manufacturing is already enabling unique and better ways for manufacturers to serve their markets. In the last few years, highly regulated industries with precise and rigid standards for safety and quality, such as Healthcare, Aerospace, Defense, and Automotive, have positioned themselves enthusiastically among those championing the strategic benefits of additive manufacturing. Embracing digital technologies will help manufacturing companies across industries participate in market transformations and not be disrupted by them. This transition is driven both by value metrics and the growing momentum toward a digital approach to manufacturing. As organizations open themselves to additive manufacturing processes, they can become more agile, collaborative, and streamlined. This article will discuss the four key ways additive manufacturing supplements traditional manufacturing: Quality, Speed, Efficiency, and Creativity.

Moving from prototype to production

Although its roots have traditionally been in ideation, design, and prototyping, additive manufacturing has moved well

beyond these narrow origins to include jigs, fixtures and tooling, bridge production, and even modest volume parts production. According to Jabil's 2021 3D Printing Trends survey of over 300 decision-makers, 62 percent of participants say their company is currently using additive manufacturing for production parts, up from 27 percent in 2017.

This ultimately represents the outposts of distributed manufacturing networks, which are today's reality. Global networks of additive manufacturing assets, like the Jabil Additive Manufacturing Network, offer capabilities to companies that can produce their part or product closer to delivery. This model takes advantage of digital agility because one can upload design files in Chicago, for example, to be printed at a site in Singapore, closer to its final destination, thereby gaining significant supply chain efficiencies.

The additive manufacturing industry has witnessed recent advancements, which are underpinning the case for distributed 3D printing manufacturing, speeding progress and driving more practical use of related technologies. Here are just a few ways 3D printing supplements manufacturing.

Quality

The term 'additive manufacturing' is elegantly self-descriptive: objects are created ('printed') through the addition of material, one layer at a time. In contrast to the additive manufacturing process, traditional methods are focused on eliminating material or altering an object's geometry with subtractive manufacturing. For manufacturers, 3D printing technology has extraordinary utility, producing unique geometric shapes and complex designs with consistent quality and at a low cost. In fact, additive manufacturing can make it economically feasible to manufacture a lot size of few, and in some cases a lot size of one.

Print quality and machine reliability have increased considerably in recent years. This means that 3D printers are creating better parts with improved dimensional accuracy and surface finish. When we first asked this question in a survey in 2019, nearly four in 10 said they didn't have confidence in the reliability of the parts produced. That number has dropped to 27 percent of participants in just two years.

In addition, material, platform, and software solutions are enabling companies to overcome significant hurdles relat-

According to Jabil's 2021 3D Printing Trends survey of over 300 decision-makers, 62 percent of participants say their company is currently using additive manufacturing for production parts, up from 27 percent in 2017.

As more and more factories implement additive platforms, smarter designs lead to more efficient engineering, lighter weights, greener processes, and overall improvements in part performance.

ed to batch-to-batch and machine-to-machine repeatability. This makes it possible to reduce the time and cost associated with set-up and change-over, which enhances the manufacturing system's response to new inputs and market demands.

Speed

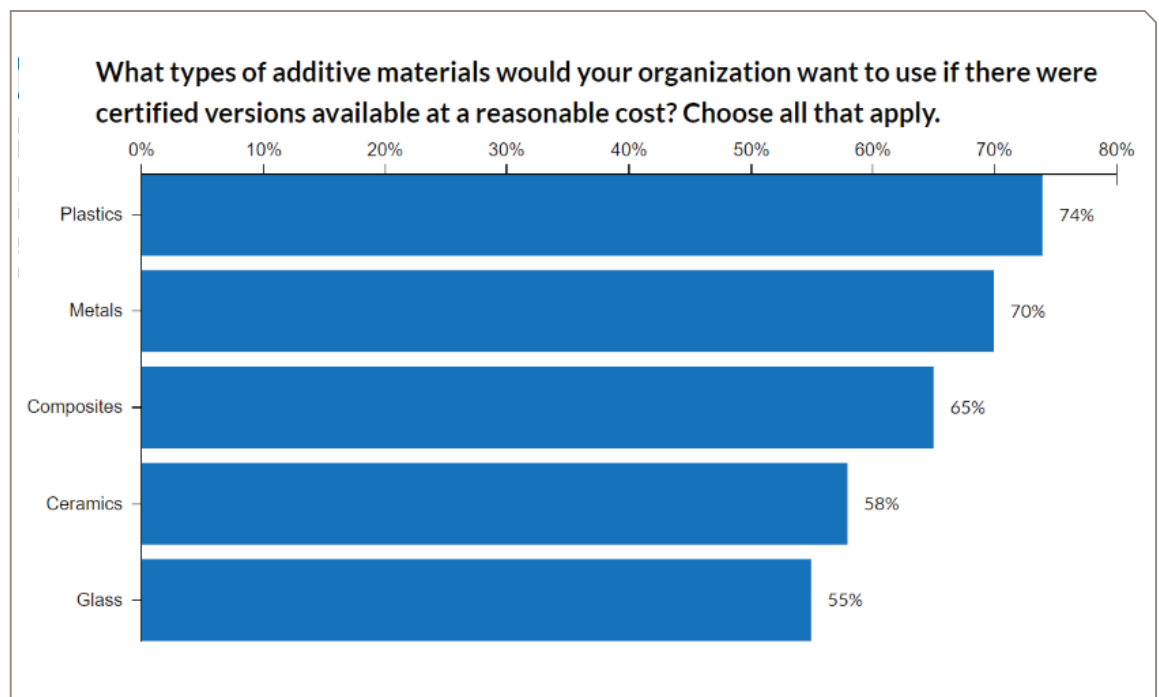
Additive manufacturing, combined with an intelligent digital supply chain, is helping virtual teams across the globe collaborate on new designs, compare actual physical representations of a product, save time from concept to prototype to pilot to production, and even move production closer to consumers. When we think about this in comparison to launching a product in a conventional manner – with its investment in tools, parts, equipment, partnerships, and time to release first articles – the benefits of additive manufacturing are compelling. It's undeniable that additive manufacturing applications can im-

prove the product development process end-to-end.

Efficiency

Additive manufacturing leads to a simplified Bill of Materials (BOM) for a given product, which streamlines supply chain management and speeds production. As more and more factories implement additive platforms, smarter designs lead to more efficient engineering, lighter weights, greener processes, and overall improvements in part performance. By having a simplified BOM, the entire production process – and often the end part or product itself – is improved. When companies apply design for additive manufacturing (DfAM) principles to part consolidation and system-level design, the resulting BOM consolidation and reduction of part numbers enable companies to realize exponential savings and, in many cases, a more reliable product. Another cost benefit comes from 3D printing's ability to build high-

ly complex parts with a single machine. With 3D printing capability, you can reduce the economies of scale associated with large, centralized factories. The distribution of manufacturing across the value chain becomes more feasible. Spare parts, rapid tooling, and more can be made at distributed sites closer to end customers, reducing everything from transportation costs to inventory and warehousing costs. Plus, by converting to a more digital inventory, manufacturers can free up capital, which gives them more flexibility to develop new products and manufacturing processes and/or invest in other segments of their businesses. When fewer parts are held in inventory, users can cut the number of part bins on the shop floor and use less on-site storage. Reducing the BOM with 3D printing cuts the overhead associated with the extra documentation, inspection, mass production planning, and inventory control. Fewer parts also result in



"New, innovative materials do more than help the bottom line. Ground-breaking approaches with new polymers can solve important challenges in sustainability, healthcare, transportation, environmental care, and aerospace."
 -- Elizabeth Gardner, Senior Chemist & Materials Engineer, Jabil Inc.

Source: Jabil Inc.

Source: Jabil Inc.



Additive Manufacturing has improved the product lifecycle

less time and labor on the product itself, contributing to extra savings in manufacturing costs. Additive manufacturing also enables manufacturers to explore multiple iterations and design options in the product development and manufacturing process through rapid prototyping. As healthcare, automotive, and aerospace OEMs contend with accelerating innovations in their industries, 3D printing applications in manufacturing have become key to keeping pace with more proactive and agile product lifecycle management strategies. Similarly, the ability to change a product mix on short notice is a considerable benefit. Every build on a 3D printer can be different, therefore parts can be made to order. Manufacturers are able to react more quickly to changing market conditions, and they can modify production rates to match demand.

Bottom line - additive manufacturing can potentially reduce time-to-market for a new or refreshed product from months to days.

Creativity

Additive manufacturing's exciting potential cannot be realized without a robust catalog of additive materials to choose from. At Jabil's Materials Innovation Center in Chaska, Minnesota, engineers, chemists, materials scientists, and production experts consult with customers in the development of custom, feature-rich powders and filaments for improved performance, durability, flame-retardancy, conductivity, and lubrication.

Our survey reports growth in all types of additive manufacturing materials, with the most popular being plastics, polymers, and composites, followed closely by metals. Metal 3D printing isn't as common as plastics and polymers, but many companies use both. That's true today, and as we look ahead, survey respondents said they want to use all types of materials in the future.

The additive process evolution

The future of 3D printing is dynamic, and we're seeing growing

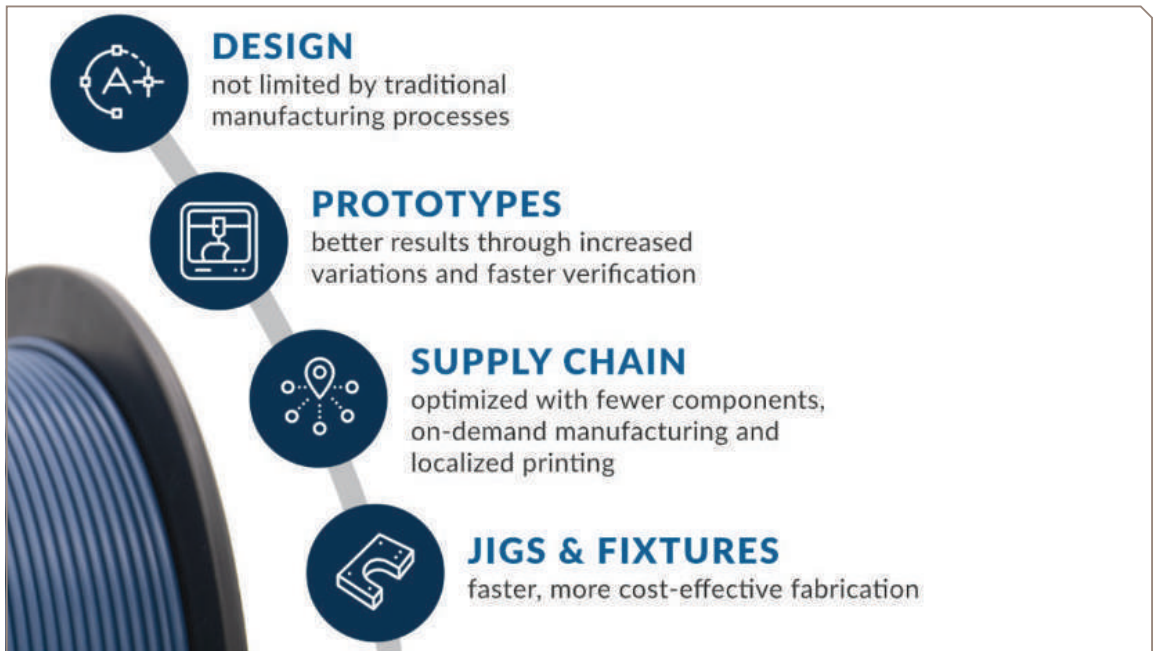
adoption in recent years. As we look to the convergence of digital technologies (including scanning, integrated information systems, and additive manufacturing), it is obvious that manufacturers are looking to these digital solutions to gain efficiencies and speed in the development and production of products.

This evolution has implications for today's business leaders. "There's so much activity going on, so much money and creativity now being applied," Richard D'Aveni writes in *The Harvard Business Review*, probing, "What's the risk if you wait?" Indeed, as new capabilities increase both the pace and power of 3D printing manufacturing, I am certain that successful companies will be the ones that choose to match this speed, rather than implementing the solution by degrees.

More and more companies are finding out how additive manufacturing is a viable and effective tool for design, prototyping, and production. It's becoming an essential tool in the manufac-

When companies apply design for additive manufacturing (DfAM) principles to part consolidation and system-level design, the resulting BOM consolidation and reduction of part numbers enable companies to realize exponential savings and, in many cases, a more reliable product.

Additive manufacturing's unique technologies, engineered materials, processes, and capabilities place it at the heart of the digital transformation underway in multiple industries. It's undeniably reshaping how companies around the world design and produce their products.



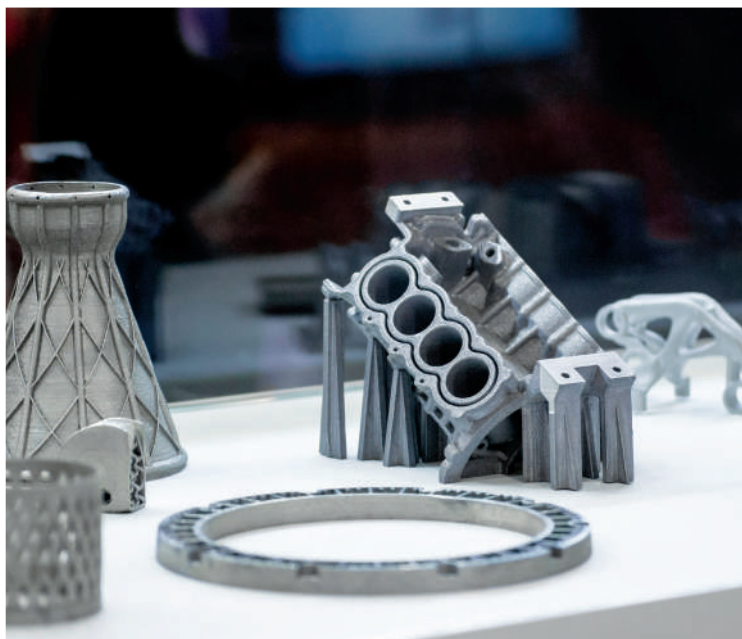
Additive Manufacturing is the process of creating parts and products by depositing one thin layer at a time.

Source: Jabil Inc.

turing toolbox. If you can iterate and improve on your designs using 3D printing to test prototypes, you will end up saving time, money, and errors in the production phase. It's not just that additive manufacturing is novel; it has tangible benefits for your business. Begin by looking to your customers. It's essential to under-

stand what they want and how those needs can best be fulfilled. 3D printing solutions are fundamentally transforming prototyping, tooling, fixtures, and production parts. Business leaders who eagerly embrace these capabilities – and design for additive manufacturing – will be better positioned to achieve sustainable success.

D'Aveni advises revisiting current operations. "As additive manufacturing creates myriad new options for how, when and where products and parts are fabricated, what network of supply chain assets and what mix of old and new processes will be optimal?" he asks. Finally, it's critical to investigate the strategic implications as entire marketplaces begin exploiting additive manufacturing technology. Manufacturing is at least a 150-year-old business and, by its very nature, is reluctant to change. However, we are seeing adoption increase, and more than half of top leadership surveyed views additive as strategic to their business – an increase from past years. Additive manufacturing's unique technologies, engineered materials, processes, and capabilities place it at the heart of the digital transformation underway in multiple industries. It's undeniably reshaping how companies around the world design and produce their products and Jabil has positioned itself squarely at the intersection of additive and traditional manufacturing processes. 



Source: Magic Wand Media

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BUILT TO LAST

It's a unique milestone for Forms and Gears as it finishes 50 years of fixture building. It thus makes for an opportune time to capture the feats accomplished, honor its past, and look forward to its innovations in the future...



Large-sized component fixturing

Source: Forms and Gears

This year marks the 50th year of one of Asia's oldest and best-known fixture building company Forms and Gears. A pioneer on the fixture building front, it has been at the forefront of a number of landmark projects in India and abroad for over five decades.

The company was founded in 1972 by RT Varghese, a Mechanical Engineer from IIT Kharagpur. After his passing away in 2001, the company has been run by his son and daughter Reji and Annu Varghese.

Three generations of employees

Reji Varghese, Managing Director, Forms and Gears, says, "When I joined the company in 1987, my father put me on the Burkhart Jig Boring machine. I worked as an operator on this machine for a few years. As Tool Room is a highly specialized profession, we have a robust apprenticeship system, and most of our senior management including me have come up through this apprenticeship training."

"One of our strengths is our loyal, skilled, and experienced workforce, and we have people whose fathers and grandfathers worked with us. In this day and age, having three generations of employees working with one company is rare and is a testament to the company and its culture," he adds.

Director of Special Projects, Annu Varghese, a Masters in Mechanical Engineering from the University of Texas at Austin, USA, shares, "I joined the

POONAM PEDNEKAR
Chief Copy Editor
Magic Wand Media Inc
poonam.pednekar@
magicwandmedia.in





Source: Forms and Gears

“One of our strengths is our loyal, skilled, and experienced workforce, and we have people whose fathers and grandfathers worked with us. In this day and age, having three generations of employees working with one company is rare and is a testament to the company and its culture.”

Reji Varghese
Managing Director
Forms and Gears

company in 1993, and I have been in the Design and Engineering division ever since. Forms and Gears’ design IP and the skilled workforce is one of the reasons why we have been in the business for 50 years.”

“In fact, for around 47 of those 50 years, we did not even have a sales department; not even one person in sales. All sales were by referrals and repeat clients,” she adds.

Joint venture with ASM Technologies

In 2018, a majority stake in Forms and Gears was acquired by ASM Technologies, a publicly listed Engineering Services and Design company. It has 1,200 engineers in Bangalore and there is now a separate dedicated design team for Fixtures, Special Machines, etc. at Whitefield.

Rabindra Srikantan, Managing Director, ASM Technologies, says, “We, at ASM Technologies, have seen both – promising growth as well as opportunities



Source: Forms and Gears

“At Forms and Gears, we have built fixtures that have helped our clients foster innovation, increase productivity and save costs for five decades now. The award signifies the indispensable role of fixture building companies on the modern-day shop floor. Smart fixtures, in particular, have the potential to catalyze the next revolution in the digitalization journey of manufacturers.”

Annu Varghese
Director of Special Projects
Forms and Gears

into new industries – with Forms and Gears joining our fold.”

He adds, “Forms and Gears are pioneers in making workholding devices. It is a company that is built on a strong design by an amazing team with a great experience. The impressive customer list developed over the past fifty years is a testament to the same. Their domain knowledge and value engineering capabilities have been leveraged to expand business from the Automobile and Engineering industries to other verticals like Electronics and Semiconductor. Additionally, the foray into Industry 4.0 with our very own SmartFix 4.0, which is a product built by the best in manufacturing, hardware, software, and analytics, places us at a desirable vantage point. We look forward to carrying this momentum to expand to the western markets by engaging with world leaders of these industries.”

World-class facilities

Forms and Gears has two state-of-the-art factories at Guindy, in the heart of Chennai, housing one of the best-equipped private tool room facilities in the country. The company exports fixtures to over 10 countries now. It has recently added a large number of Japanese Machining Centers and allied equipment in phase 1 of a four-phase expansion plan.

Smartfix 4.0

In 2018, Forms and Gears launched ‘SmartFix 4.0’, which is the world’s first-ever Industry 4.0 solution for Fixtures and Workholding. Industry 4.0 is commonly referred to as the fourth industrial revolution and is the ability of machines, devices, sensors, and people to connect and communicate with each other via the Internet of Things. SmartFix 4.0 has been jointly developed by Forms and Gears and ASM Technologies and is a Precision Workholding Device with the ability to collect, transmit, and analyze data in a useful format for the end-user. Developed for the first time in the world, it takes Workholding devices and Fixtures into the digital and cyberspace.

As the Fixture is in continuous contact with the component, it is the ideal device to collect and analyze data at the component level. Sensors to monitor vibration, pressure, sequence of clamping, component presence, etc are mounted on the fixture. And sensors to monitor oil levels, oil contamination, and temperature are mounted on the powerpack. The high volume of data collected from these sensors is continuously transmitted wirelessly to the cloud where it is parsed and stored for analysis. The raw data is then analyzed using Data Analytics and Artificial

SmartFix 4.0 has been jointly developed by Forms and Gears and ASM Technologies and is a Precision Workholding Device with the ability to collect, transmit, and analyze data in a useful format for the end-user.

To keep up with the advancements in the Machine Tool and Cutting Tool technology, Workholding technology has also to keep pace so that the capability of the machines and the tools can be fully utilized.



Source: Forms and Gears

Industry 4.0 is the ability of machines, devices, sensors and people to connect and communicate with each other via the Internet of Things. SmartFix 4.0 is that revolution in the fixture building business.

Intelligence tools and sent back to a custom-built Dashboard of the end-user, which resembles their factory floor, showing all the machines in action as well as a quick summary on the health of each machine, fixture, and powerpack.

Reji says, "Over the last 50 years, we have seen seismic shifts in manufacturing. We used to do Workholding for conventional machines in the 70s which slowly transformed into Fixtures for indigenous Machining Centers and then to advanced Workholding solutions for high-speed imported Machining Centers. To keep up with the advancements in the Machine Tool and Cutting Tool technology, Workholding technology has also to keep pace so that the capability of the machines and the tools can be fully utilized. Over the last few years, we have come to the conclusion that the next revolution in Workholding would be to make fixtures smarter by making them IoT- and Industry 4.0-enabled and that's how we have come up with SmartFix 4.0. Smartfix 4.0 can also be used on existing fixtures, test rigs, and special equip-

ment, making it a highly flexible and easily adaptable system."

Winning accolades

In December 2020, Forms and Gears was awarded the prestigious Confederation of Indian Industry (CII) Industrial Innovation Award 2020 under the 'Top 25 Most Innovative Companies' category for having developed Smartfix 4.0.

Talking about the award, Annu Varghese says, "At Forms and Gears, we have built fixtures that have helped our clients foster innovation, increase productivity and save costs for five

decades now. The award signifies the indispensable role of fixture building companies on the modern-day shop floor. Smart fixtures, in particular, have the potential to catalyze the next revolution in the digitalization journey of manufacturers."

"The award is a validation of the capabilities of our expert development team and deep understanding of fixtures, which is the reason why the world's best companies trust Forms and Gears. Our solutions leverage emerging technologies such as cloud computing, artificial intelligence data analytics, and



Source: Forms and Gears



Industrial Internet of Things to power the Industry 4.0 journey of manufacturers,” says Nikhil Rabindra, Head of SmartFix 4.0. The awards were announced in a virtual ceremony hosted by CII during the India-Portugal Technology Summit. In the event, the apex industry body felicitated the top 25 companies across large, medium, and small segments for their innovation prowess.

Built to last

Whether it's the machine grade castings and other input specs used or the way the fixture is processed, Forms and Gears fix-



Source: Forms and Gears

“We, at ASM Technologies, have seen both – promising growth as well as opportunities into new industries – with Forms and Gears joining our fold. Forms and Gears are pioneers in making workholding devices. It is a company that is built on a strong design by an amazing team with a great experience. The impressive customer list developed over the past fifty years is a testament to the same. Their domain knowledge and value engineering capabilities have been leveraged to expand business from the Automobile and Engineering industries to other verticals like Electronics and Semiconductor.”

Rabindra Srikantan
Managing Director
ASM Technologies

tures once installed run for decades maintaining the tolerances the fixture was designed for. Hand scraping, for example, is a technique that was first introduced during the industrial revolution in England for finishing sliding or datum surfaces.

Due to technical advancements and quality improvements, processing machines have taken the place of this old technique.

Reji Varghese says, “When you want sub-ten-micron accuracies on a 1-meter fixture with around 40 to 50 elements on it, we need to control the accuracy of each single element at each stage of processing. Our fixture bases are still finished using hand scraping. This technique is used by manufacturers of ‘mother machines’, which are super high-precision machines used to build other machines. For example, Yasda Jig Boring machines guideways are still mounted on the meticulously hand scraped surfaces. This not only results in high precision and high rigidity but also influences the long service life of the machine and maintains the accuracy of every machine.”

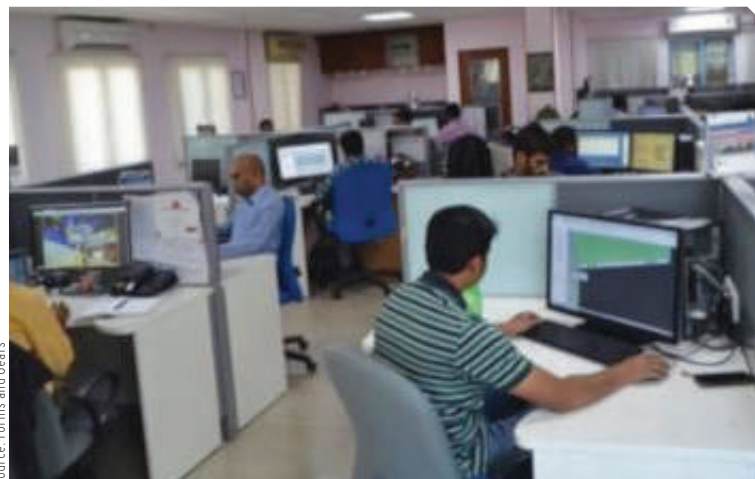
To achieve the required level of precision and rigidity, Forms and Gears fixtures are designed and built in ways that set them apart from typical fixtures. They feature components that are designed and manufactured with tighter-than-normal tolerances, as well as improved rigidity, stability, and vibration-damping capabilities to ensure accuracies and long life.

The company, in its small way, has left an indelible mark on the Manufacturing industry in India. For 50 years, it has survived the ups and downs of the industry – recessions, slowdowns, technology changes, disruption, boom, and bust.

Many people think of legacies in material terms including big factories, windfall profits, technological achievements etc. Leaving an impact, though, can be a more powerful legacy. Sometimes what you leave behind is not what is engraved in stone monuments, but what is woven into the lives of others. At Forms and Gears, they have done just that.



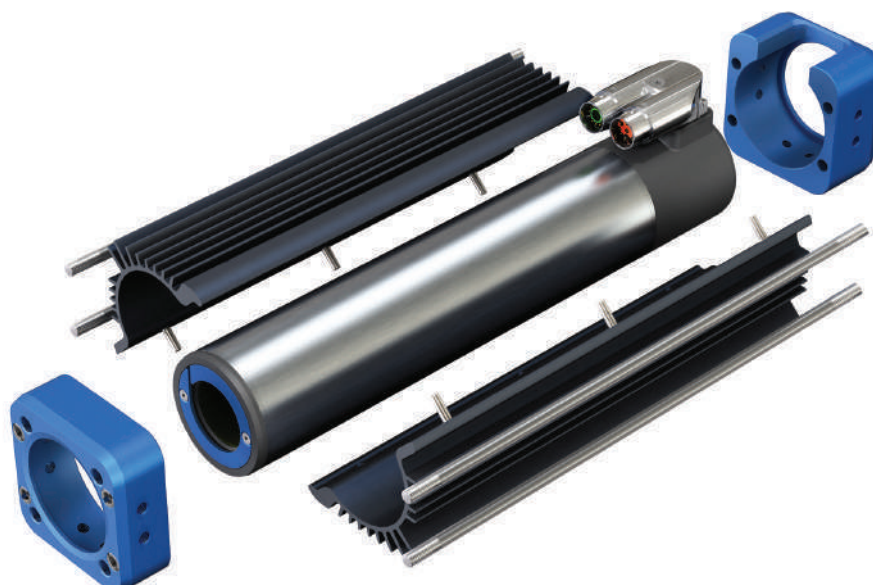
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Source: Forms and Gears

FOR GREATER PRODUCTIVITY

Tubular linear motors are outperforming their counterparts by offering a slew of significant benefits, including their applications in harsh environments and automated warehousing.



LinX M Series HERO_EXPLODED

Source: ANCA Motion

There is stored energy, and there is kinetic energy or movement. Motors turn the first into the second. As with everything else, ways to create movement have evolved.

One comparatively recent kind of actuation – tubular linear motion – is gaining favor applications as diverse as machine tool building, factory automation, packaging, printing, and material handling.

LinX tubular linear motors
ANCA Motion is an Australian developer and manufacturer of motion control systems, hardware, and software. ANCA CNC Machines is its sister company. Since 2014, ANCA has used LinX tubular linear motors in its globally renowned tool and cutter grinders, first introducing them in the FX Linear and MX Linear tool grinding machines. Customers in the precision toolmaking industry, where micron-level

resolution and throughput are critical, have welcomed improved surface finish, increased efficiency, and reliability gains at a lower operating cost after incorporating LinX tubular linear motors into their machines.

Pneumatic

Pneumatic actuators have a history going back roughly to World War II. Today they are a factory staple, used to quickly (and noisily) move between two set points.

They are a major user of electricity in factories. According to one estimate, using compressed air to perform a task directly takes ten times the energy of using electricity directly due to the waste heat created. One huge bottleneck they can create is their inflexibility. Recalibrating air pressure between different batches can sometimes take hours.

Though inefficient, pneumatics are well-understood and wide-

ly used. Depending on the size of a factory, getting compressed air to a source might require multiple compressors and a complicated reticulation system. Leaks throughout such a network are expensive.

ANCA Motion's LinX motors, on the other hand, work on servo-based, closed-loop control, and changing setpoints is quick and painless, resulting in minimal time between batches. They have an integrated position sensor with 10 µm of resolution that eliminates the need for an external encoder, simplifies system integration, and allows for higher quality and throughput. The savings on energy costs quickly offset the upfront cost, and the payback period versus pneumatics is generally 18 months.

Ball screw

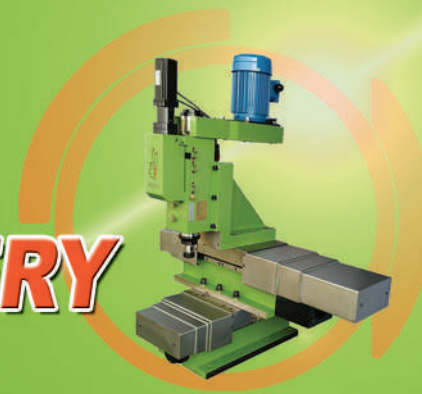
More than a century old, ball screw motion is still around and used in a broad set of applications

Source: ANCA Motion

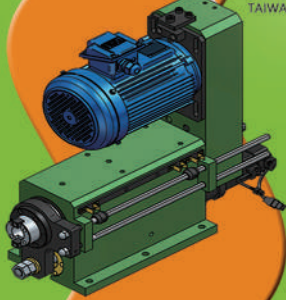


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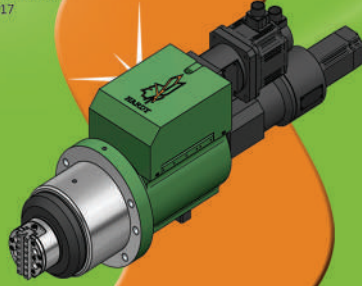
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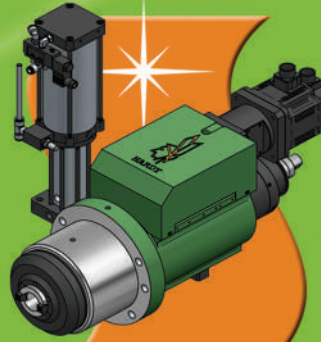
TAIWAN EXCELLENCE
2017



Servo Type Drilling / Tapping Spindle Head Unit.



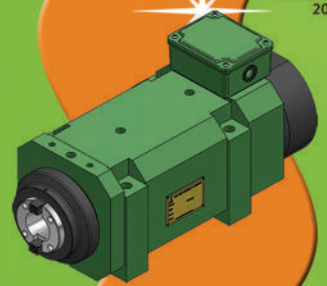
Built-in Motor Facing Head Unit - Flange Type



Built-in Motor Drilling/Tapping Spindle with ATC and Center Coolant



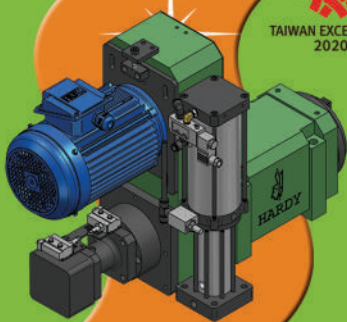
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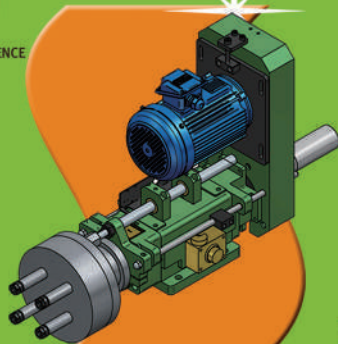
Built-in Motor Spindle Unit



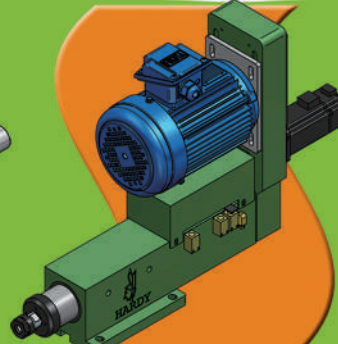
TAIWAN EXCELLENCE
2020



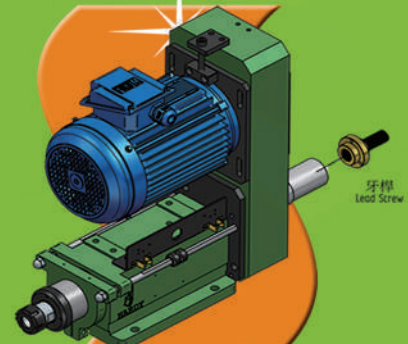
Boring/Milling Head Unit with ATC



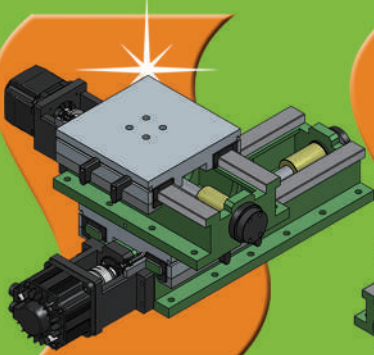
Multi-Spindle Head



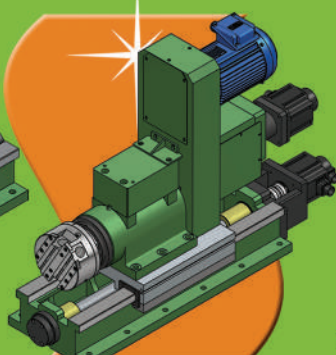
Servo Type Drilling / Tapping Spindle Head



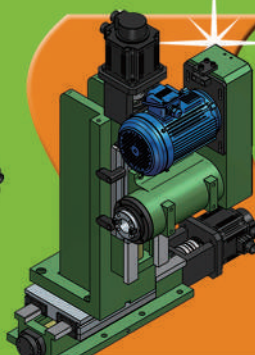
Tapping Spindle Head



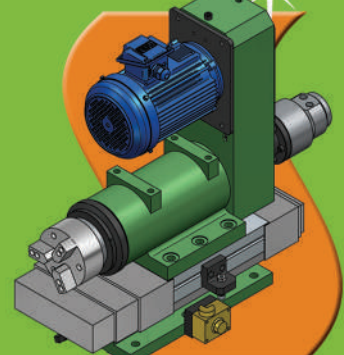
XY Servo Hardness Slide Unit



Servo Facing Head + Servo Ball Screw Slide Unit



XYZ Servo Slide Table + Milling Head



3-Jaw Chuck Spindle + Slide Unit



HARDY

HANN KUEN MACHINERY & HARDWARE CO., LTD.
NO. 22, Liou Shun Rd., East District, Taichung City 401, Taiwan
TEL:+886-4-2486-0602 FAX:+886-4-2486-0605
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LinX® motors are nimble, with no backlash due to their direct drive nature, resulting in zero friction between their forcer and shaft. The lack of friction means less wear, better longevity, and better quality for tools or whatever other product they are involved in making.

– from power steering to moving robotic arms. It is an indirect drive method, using nut and thread to turn rotational movement into linear movement.

Ball screw motion has its usefulness, proven by its longevity and also its shortcomings. It is unable to accelerate and decelerate quickly. The contact between moving parts creates wear and friction and requires lubricants, which can become a source of contamination. Wear also leads to increased maintenance costs and decreased performance over time. Another source of both is the backlash or lost motion caused by the necessary gap between the thread and nut.

LinX motors are much more nimble in comparison, with no backlash due to their direct drive nature, resulting in zero friction between their forcer (a sleeve with copper coils) and shaft (a sealed stainless steel tube containing magnets). The lack of friction means less wear, better longevity, and better quality for tools or whatever other product they are involved in making. They are also capable of achieving velocities as high as 10 m/sec, meaning a major boost for productivity.

Flatbed linear

Flatbed linear motors (simply called linear motors) are described as an unrolled version of a rotary electric motor, with the rotor (containing magnets) being the stationary part and the forcer (containing coils), the moving part.

Non-factory examples include maglev trains and railguns. Within industrial settings, such linear motors have found their high precision, velocity, and force abilities applied to material handling scenarios and machine tools.

Another way they improve the ball screw motion is by having no backlash or reversal error.

A downside to this kind of direct drive motor is its inability to be used in harsh environments. Mechanical stress and heat are generated due to the attractive forces between the rotor and forcer. This can require the use of a separate chiller to control, which in turn increases the total cost of ownership. The strong downforce causes extreme wear of the motor's railings, leading to their frequent replacement.

The answer to this is a tubular linear motor that makes full use of magnetic flux and has

greater thermal stability and an increased lifespan due to no contact between the forcer and shaft, with zero attractive forces due to the LinX motor's symmetrical design. These features make it suitable for use in harsh applications. This leads to a lower total cost of ownership and better precision.

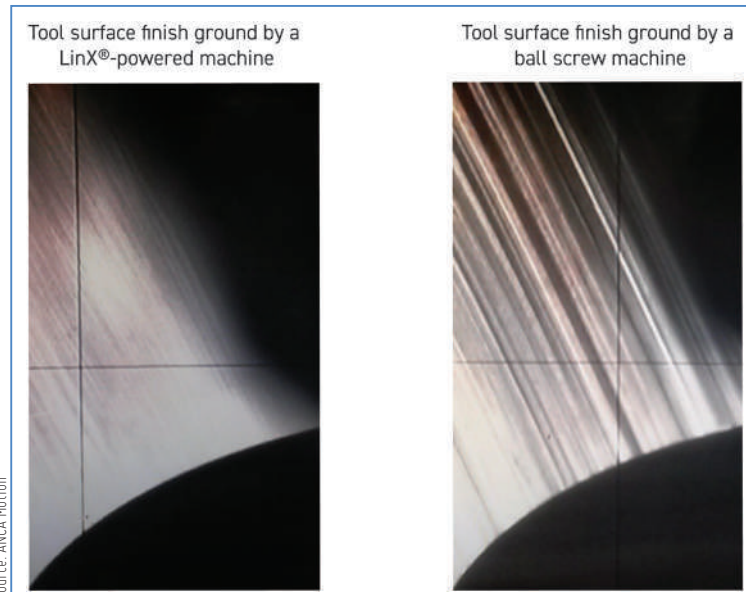
Knowing the company behind

ANCA Motion's linear motors were originally developed to give ANCA CNC Machines an edge in a highly-competitive global industry. ANCA is a world leader in CNC tool grinding technology, with a series of world firsts since 1974. It exports almost all of what it makes at its Melbourne headquarters.

The LinX series has a heritage in tool manufacture and has a growing list of customers the world over. They are used across various industries in diverse applications, including pick and place, labeling, pressing, reject sorting, stacking, transfer, line distribution, and many other material handling applications within automated warehousing. Besides LinX, the company offers a range of servo drives, human-machine interfaces, and control systems.

ANCA Motion has decades of experience developing motion control solutions and partners with customers to build custom solutions. This is supported by a local team of engineering, sales, and service experts ready to help expand Australia's sovereign manufacturing capability.

Along with custom motors, ANCA Motion supplies standard LinX linear motors in two ranges: M-Series (continuous force of 80 N to 287 N, peak force of 1200 N) with IP 66 rating and S-Series (continuous force of 335 N to 630 N and peak force of 4270 N) with IP 67 rating.



Source: ANCA Motion

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WAYS TO BUILD A LEAN CULTURE

A successful company culture is one that can be easily accepted or embraced by everyone, from the newest employee to the highest-ranking official. Here are a few essential, tried-and-tested tips to help one build a thriving Lean Culture...



Source: Magic Wand Media

Over time, every company develops a culture that may include strategy, goals, etc. But it is really about attitudes and practices that can answer the question, “What does it feel like to work in a particular company?”

When people ask me how I changed a traditional culture to Lean, it indicates their intent to change or transform from a traditional production company to a Just-in-Time (JIT) manufacturer or service provider. This transformation is not a casual thing, as a Lean company thinks exactly the opposite to that of a traditionally managed one when it comes to operational approaches, underlying attitudes, and practices. Tradi-

tional companies are structured into departments that make them produce in batches, while Lean companies are structured into value streams that enable a flow of value to the customer on demand.

Two traditionally managed companies might not have the same culture. Yet, because of their approach to marketing, production, and functional structure (batch production structure), they may have many similarities in them. The list of thinking or process examples could be endless and underscores the point that to become Lean, the traditional organization has to change. The challenge is enormous, and to build a Lean culture, you must first build a Lean company.

This massive change is not an overnight job. Building Lean culture is not a fly-by-night operation. It is not about fixing broken-down processes or doing some rejig. It is also not something that can be subcontracted to middle managers or below. It has to be led by the CEO or business owner from the front. Transforming to become Lean is not a mechanistic thing; it's more about people and, hence, it is more of a social transformation. It's about developing competence and behavior in people to reduce waste, solve problems, and make improvements. This is a new way of conduct and must be taught by demonstration until it takes root. So,

SANJEEV
BAITMANGALKAR
Stratmann Consulting
sanjeev@
leanmanufacturing.
consulting



the question is how to do it, and where should one begin?

Lead Lean from the top

My tryst with Lean started when I was reassigned from Business Development to head Operations, at a time when we knew nothing about Lean (we called it Just-in-Time (JIT) back then as the word Lean was not yet coined). I learned by practicing on the Gemba for the most part of two shifts every day. Understanding what doesn't work, sometimes failing, always teaching the workers and staff, leading the Kaizen, improvising, focusing heavily on the process and never on the monthly results, learning when to use which tool or technique, etc. Demonstrating by example helped me develop the next level of leaders and changed everybody's behavior and attitude towards work. Our new work-related mantra, behavior, and description of the job had quietly changed to:

- When any abnormality was observed, it had to be corrected and restored to standards.

We discarded accepting deviations. The drawing was the master, and compliance with it alone was mandatory.

- We solved problems every day (Kaizen). Solving problems meant preventing reoccurrence. We would exchange the number of problems identified and solved. Seeing me lead the Kaizen effort, the workers and staff dived deep into it, making it a daily habit. They stayed over beyond work hours without pay to solve problems. That high was the motivation level.
- Once a problem had been solved, we set new higher standards and went after achieving them, aligned to overall company goals.
- In short, everybody's (including mine) daily work was to comply with standards strictly, eradicate abnormalities, identify reasons that caused problems at their grassroots level, set higher standards and go after achieving them... and we were in a hurry!

Work starts with the leader, who does not have to be an expert but is committed to improving continually. He must know the principles, philosophy, tools, and techniques of Lean and be able to have conversations on the subject. Success or failure will depend on his involvement. Transformation or change cannot be managed or delegated. The leader needs to be hands-on and lead the change. Even if people follow the orders, it will not change the culture; instructions may be followed, but attitudes and behavior won't change if there is no ownership. An old Indian Vedic proverb says 'As the land, so the water. As the seed, so the sprout. As the region, so the language. As the King, so the people.'

How to communicate

It is necessary to tell every team member about why you intend to become Lean and how you plan to proceed on this journey. The goal of Lean is not to reduce the headcount, so it is important to tell them that to alleviate any fears of retrenchment. When

Transforming to become Lean is not a mechanistic thing; it's more about people and, hence, it is more of a social transformation. It's about developing competence and behavior in people to reduce waste, solve problems, and make improvements.



Source: Magic Wand Media

With all this work being done seamlessly and concurrently across all stages of the value stream, I had given my team five 'zero' goals even if they were inordinate – zero delays in deliveries, zero waste (defect included), zero lead time, zero inventory, and zero accidents to facilitate all goals.



we decided to implement the JIT system three decades ago, we had a reason why we wanted to become Lean. There must be a reason why any company wants to become Lean. Explain these reasons to the people; let them know why you are asking for a change. Tell them the broad strategy of how you intend to implement it, when you will start, what they can expect, and what is expected from them. The language must be 'let us do this' and not 'you do it'. This communication must come from the leader to the workers and staff and not be informed via a circular or by delegating the job down the line.

There is a subtle difference between showing and telling. Lean is different in values compared to traditional management. The new or different value systems need to be imbibed and exhibited in behavioral attitudes. Lead-

ing is by example. In the twelve to fourteen hours I spent on the Gemba every day, I taught them to respect the customer by demonstrating the respect necessary to be given to every subsequent process within the product manufacturing processes. By learning to respect the internal customer, they began delivering better value. When they saw me believing in their ability to solve problems and challenging them to do more, they cultivated the Kaizen habit and began to do more. They had understood the importance of the customer, Kaizen, and respect for people. The old blame game had vanished to collaborative and cooperative work. The workers felt they were a responsible part of the change. Trust had come into existence, and teamwork was built. There was nothing to fear, so the lies disappeared. They were not

afraid to experiment with new ideas. Truth, honesty, effort, and earnest work were encouraged and celebrated by all.

Dream, vision, and goals

A dream – a far-sighted vision – is necessary to fuel your Lean journey. The adage 'you will believe it when you see it' means you need to see the possibilities in your mind first. Only then can you achieve it. Then translate this broad picture of possibilities into the goals of the company. Break it down into smaller steps for teams to work on them. The CEO must set these aspirational goals for himself and the company. Stretched goals will be reasonable. Focus on the process and not the results. Remember, a good process will always get you good results. The result is the consequence of what and how you do, so focus on changing your processes, and



the results will follow. The CEO himself must speak to the workers and staff to set the goals and lead them in Kaizen.

When my Lean journey started, we faced many problems. One of them was that there were no orders despite having good products. This led to a temporary closure, necessitating a turnaround strategy to avoid an extended or

permanent closure. I began by setting goals for myself, such as becoming the market leader, cutting costs by half, and empowering workers to be responsible for and in charge of production without the intervention of management. To inculcate Lean or JIT behavior in all, give new products protection for 8-10 years, make competition redundant, develop new markets, become India's first actual Lean organization, etc. I had a timeline in mind, but we were basically in a hurry to outperform ourselves. With these guiding lights, I broke them down into daily Kaizen activities on the Gemba in every area - from marketing to product development to execution to supply chain. With all this work being done seamlessly and concurrently across all stages of the value stream, I had given my team five 'zero' goals even if they were inordinate - zero delays in deliveries, zero waste (defect included), zero lead time, zero inventory, and zero accidents to facilitate all goals.


Lean department or not?

My focus was on developing every person into a leader (however unreasonable or over-ambitious that might sound). This meant everyone had to learn and master all aspects of Lean by imbibing and adapting to

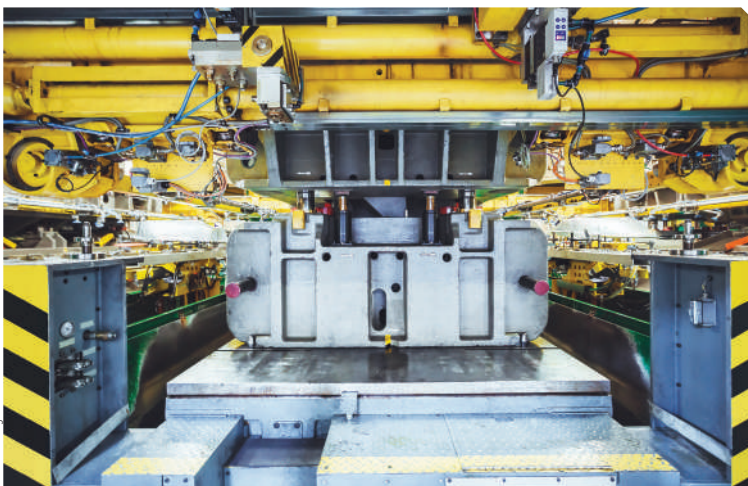
Lean behavior. I did not think it was necessary to set up a special Lean department and put them in charge of education and transformation. I made it everybody's responsibility in their area of work, taught by me initially and later by my value stream managers. This job was to be done every day on the Gemba and not from remote locations. We felt happy with every achievement, yet we were never satisfied as it taught us more was possible.

In hindsight, we were lucky not to have had people telling us various things to do. We followed JIT leads from Dr Schonberger's book 'World Class Manufacturing', which incidentally is still a good book. The fact that I was able to put my words into action helped to build trust. My team saw me addressing concerns on all fronts - marketing, product or process design, supplier development, problem-solving, people development, creating a happy, trustworthy environment, etc. I was always talking to them about the next goal and its benefits. My experience shows that one can transform without a special department or group being set up for the purpose.

Social and passion vs. mechanistic and intellect

Building a Lean culture is not a mechanistic thing. It's not that you can randomly cherry-pick some tools that will build you a Lean culture. It is more of a social thing, one that is part of people's development and transformation, one that teaches involvement, ownership, and responsible behavior. Passion, not intellect, is the driver for success here. Intellect here is useful in Kaizen and standardization, but success will come out of passion. Passion motivates involvement, intellect encourages delegation, and delegation, in the beginning, is ruinous for success. 

It is necessary to tell every member of the team about why you intend to become Lean and how you plan to proceed on this journey. The goal of Lean is not to reduce the headcount, so it is important to tell them that to alleviate any fears of re-trenchment.



Source: Magic Wand Media

NAVIGATING THE CRISIS

A deliberation on how the Indian manufacturing and logistics industries can counter the global supply chain crisis...

The global economy had been on a steady path to recovery following the advent of the second wave, but the new variant has cast concerns over global growth, which would decline further if the pandemic continues. Rampant disruptions have already been seen in the travel, education, and entertainment sectors, leading the World Bank to trim its forecast by 1-1.5 percent for 2022-23. The continued global supply chain and logistic crisis—sizeably engen-

dered by the pandemic—has forced supply chain operators to accelerate end-to-end automation. The current global and domestic trade and economic policies certainly haven't helped either. The shutting down of major international manufacturing hubs and ports has shored up the global price of raw materials and intermediate supplies for Indian manufacturers. Adding to the accelerating crisis was the restriction on the mobility of human capital involved in supply chain operations, resulting

in transportation disruption, cancellation of cargo, cramped freight capacity, and extensive manual customs clearance. Consequently, there were late deliveries, operating losses, cancellation of orders, and reputational damage. The factors that influence the performance of a supply chain company are facilities, inventory, sourcing and pricing, transportation, location, and information. The pandemic has impacted all these significant factors that ensure the smooth running of operations.

RUPAL SINHA
CEO, IFMS
Quest Corp



Source: Magic Wand Media

Adopting advanced technologies

The short-term effects of COVID-19 seem to be wearing down, but the strains on supply chain functioning have existed long before the pandemic and need a strong focus to bring artificial intelligence (AI) from the manufacturing floor to front door delivery. Retailers are increasingly using AI to predict customer demographics and their behavior patterns to forecast demand and supply. In warehouse management, facility managers assist warehouse managers in inventory planning, forecasting, and optimization based on real-time information on the products available. Thanks to AI, appropriate stocking and shelf man-

agement can be adopted based on the data generated from production, purchase orders, and supplier delivery challans.


The Internet of Things (IoT) is proving to be a path-breaking technology in supply chain operation management. The usage of IoT leads to the real-time exchange of information between all stakeholders. This, in turn, leads to greater speed, reduced operational costs, and improved decision-making on both the demand and supply side of the market. Building a robust Advanced Logistic System (ALS) with Transport Intelligence (TI) for supply chain disruption is the need of the hour, and an efficient IoT can serve many functions. It contributes to optimal route planning, fore-

casts the mechanical health of vehicles, maps their locations and driver performance, and ensures the security of goods while facilitating real-time tracking for logistics operators as well as the end customer.

Facility management systems

The role of facility management providers is to assist warehouses with a detailed analysis of how manpower and machine can collaborate to achieve the fastest and most efficient ways of loading and unloading, stacking, and placement of goods. Converting a conventional warehouse to a smart warehouse would need an IoT-enabled platform customized to the requirements, as there is no such thing as 'one size fits all'. Depending on the requirements, automation can be built to integrate a full-blown facility management system that incorporates security systems, safety, onsite facility management, and asset and building maintenance systems, backed by an intelligent command control center that can prevent, predict, and generate artificial intelligence for better onsite facility management of the warehouses.

Digitization is crucial

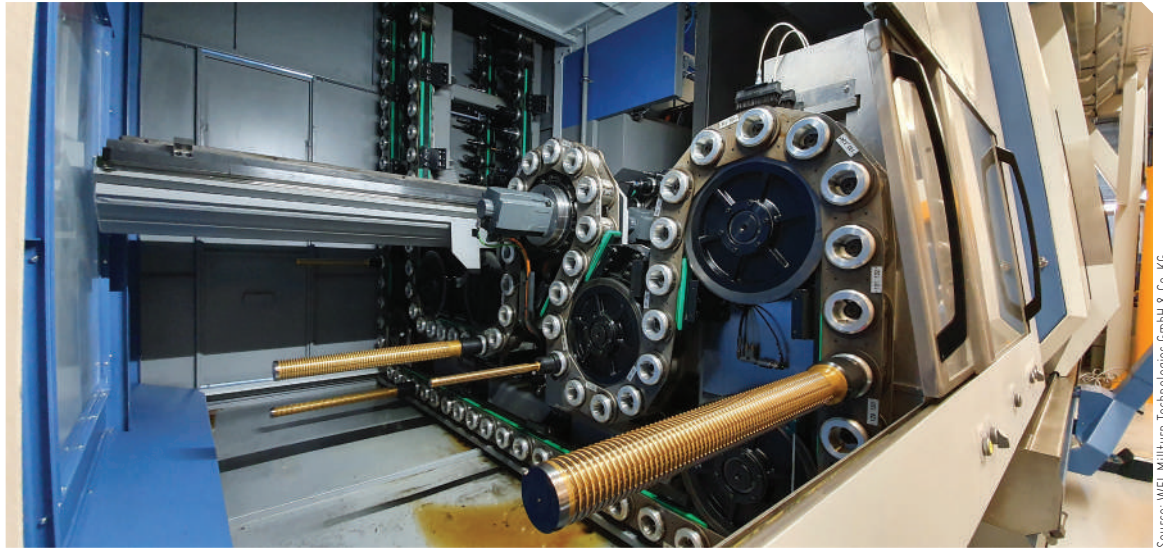
Except for the 'first and last mile' of the distribution network, where human interaction is inevitable, digitization of logistics and warehousing through the deployment of IoT, towards integrating all back-end processes, is crucial to maximizing value-added delivery with proper analysis and real-time tracking information. The sector is now at the brink of transformation, fostering an entirely new cycle of innovation within the Logistics sector and its ancillary industries. 

The Internet of Things (IoT) is proving to be a path-breaking technology in supply chain operation management. The usage of IoT leads to the real-time exchange of information between all stakeholders. This, in turn, leads to greater speed, reduced operational costs, and improved decision-making on both the demand and supply side of the market.



RETAINING COMPETITIVE EDGE

Here's how Bredel has brought flexibility to automated turning-milling processes and reduced its throughput time by more than half with an M65-G Millturn turning-milling center from WFL Millturn Technologies.



The chain magazine provides space for 200 tools, while taking up relatively little space. The long broaching tools can be seen in this photo.

Bredel, a manufacturer of industrial hose pumps in Delden, Netherlands, has invested in an M65-G Millturn turning-milling center from WFL. The machine tool is supplied by Oude Reimer from Hilversum. To make the best use of the capabilities of the turning-milling center, the WFL machine tool is equipped with a large tool magazine, an automation solution from Promot, and a jaw quick-change system from Schunk specially developed for this project. With the complete installation, Bredel can produce various parts for hose pumps unmanned and achieve short throughput times.

Bredel is part of the Watson-Marlow Fluid Technology Group and is the global market leader in the field of hose pumps. The pumps find their applications in a wide variety of industries, including Mining,

Medical, and Food. To maintain its competitive edge, Bredel is always looking for ways to improve productivity and optimize processes. The new automated WFL M65-G Millturn is an excellent example of the continuous investment strategy at Bredel. The new turning-milling center will eventually replace an older machining center from WFL. At the moment, all programs and components are gradually being optimized and transferred to the new M65-G.

Combining machining processes

Bredel has not only replaced the old CNC machining center from WFL due to its age and capabilities, but also because it wishes to use the new machine for production for 120 hours per week, with staff required for just one day shift. To achieve this, Bredel has opted for an automat-

ed production process. Bertus Groteboer, Senior Manufacturing Engineer, Bredel explains, "The decision to opt for a new turning-milling center was already on the cards. At the end of the 90s, we had already decided that we would only invest in machines that could perform both turning and milling operations. Although these machine types are much more expensive, the ROI is significantly better. This is because machining processes can be combined, which means that two separate machines are no longer necessary. Bredel can therefore fully machine pump parts with both turning and milling operations in one clamping."

Producing pump parts as a set

The new WFL M65-G has a nominal center distance of 2,000 mm. Both spindles have an output of 56 kW. The two

Challenges:

- Bredel wanted to invest in machines that could perform both turning and milling operations.
- It wanted to replace its old CNC machining center from WFL due to its age and capabilities and also needed to use the new machine for production for 120 hours per week, with staff required for just one day shift.
- The company was looking for a machining center with essential elements to allow for an unmanned production process and a high degree of flexibility.

Solution:

- The new M65-G Millturn. With the new automated turning-milling center that can machine small batches flexibly, Bredel has reduced the throughput time for a set of pump parts from three days to just one day.
- The manufacturer can respond much more quickly to urgent orders.
- Bredel now aims to achieve 5,500 spindle hours per year with the new M65-G Millturn.

spindles and milling spindle allow for complete machining of workpieces. “In this project, we actually focused on unmanned production. The production cell takes the material out of the storage and after machining, places the finished workpiece

back in the storage without any human intervention. Here, it is important that various workpieces can be produced interchangeably. In this way, we can produce the different parts of a pump as a set, with the advantage that we can sell

and paint faster. To make this possible, the machining center must have several important elements that not only allow for an unmanned production process but also has a high degree of flexibility.”

Optimization in small details

In order to machine a wide variety of parts automatically, Bredel has equipped the turning-milling center from WFL with a large chain magazine. The magazine has room for a total of 200 tools while taking up relatively little space of just a few square meters. The magazine’s special feature is that it can accommodate tools with a length of up to 900 mm. This was a particular requirement of Bredel to be able to store long broaching tools. “For this project, we took a critical look at the cutting tools. A working process can always be improved, and the tools play a crucial role. Take, for example,

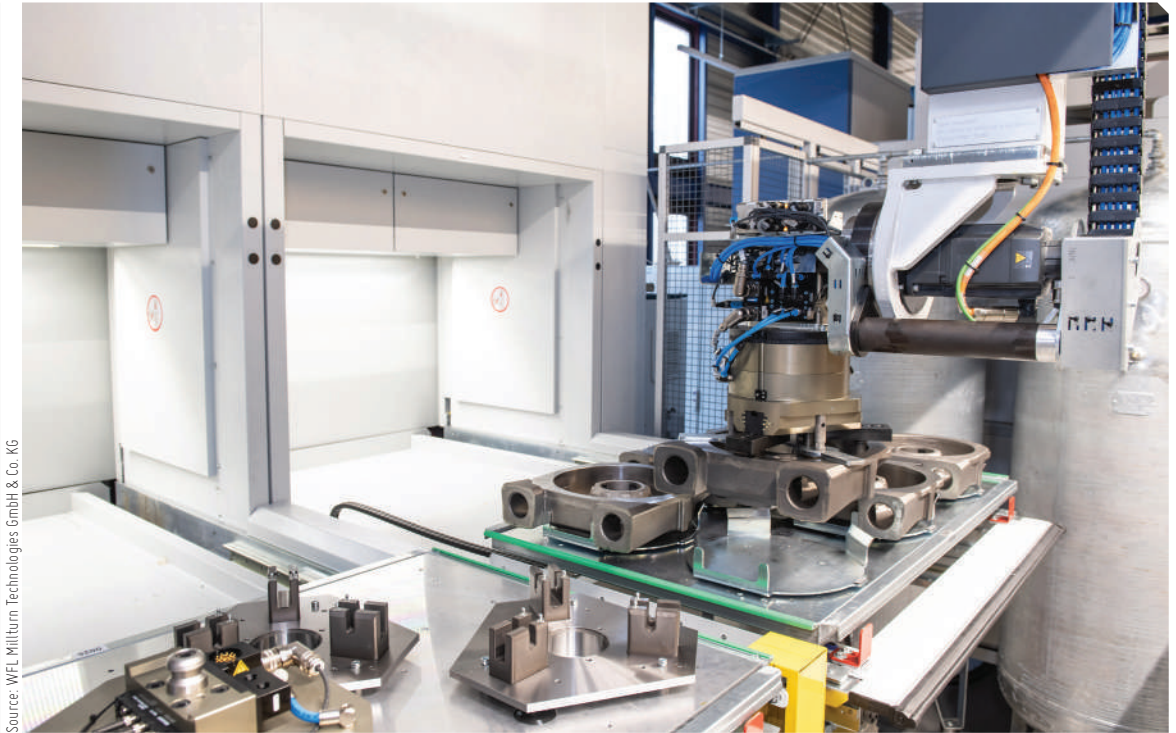
To make the best use of the capabilities of the turning-milling center, the WFL machine tool is equipped with a large tool magazine, an automation solution from Pro-mot, and a jaw quick-change system from Schunk specially developed for this project.



Source: WFL Millturn Technologies GmbH & Co. KG

Bredel has fully automated the WFL M65-G Millturn with a gantry loader and a jaw quick-change system. (Photos of Bredel and Tim Wentink)

Thanks to the new automated turning-milling center that can machine small batches flexibly, Bredel has reduced the throughput time for a set of pump parts from three days to just one day.



Source: WFL Millturn Technologies GmbH & Co. KG


The gantry loader can handle workpieces as well as jaws and grippers.

combined tools to reduce tool change times or special tools that can perform a process much faster. All these little things help reduce throughput time and lower the cost of the workpiece. This is the only way businesses in the Netherlands can continue to compete with the rest of the world," believes Groteboer. To machine gears and grooves, Bredel has developed a special broaching tool in consultation with WFL. Usual-

ly, the tool needs a feed force of 100 kN, which was not achievable even with the WFL machine. The adapted version has a feed force of just 30 kN. Previously, the shaping of gear teeth in a part took half an hour. The process now takes just 1.5 minutes using the adapted broaching tool.

Throughput time more than halved

Thanks to the new automat-

ed turning-milling center that can machine small batches flexibly, Bredel has reduced the throughput time for a set of pump parts from three days to just one day. What's more, the manufacturer can respond much more quickly to urgent orders. "We have optimized the design of many workpieces to make the best possible use of the machine's capacity. Parts for milling-turning operations have therefore become more complex. For this reason, we have created a digital twin of the machine together with Siemens and WFL for simulation in the Siemens NX CAD/CAM software. In addition, we have integrated some cycles from WFL, such as measurement cycles, process control, and engraving into Siemens NX. This means that we can program complex parts offline quickly and reliably." Bredel is aims to achieve 5,500 spindle hours per year with the new M65-G Millturn. 



Source: WFL Millturn Technologies GmbH & Co. KG

The Bredel team is delighted with the new turning-milling center.

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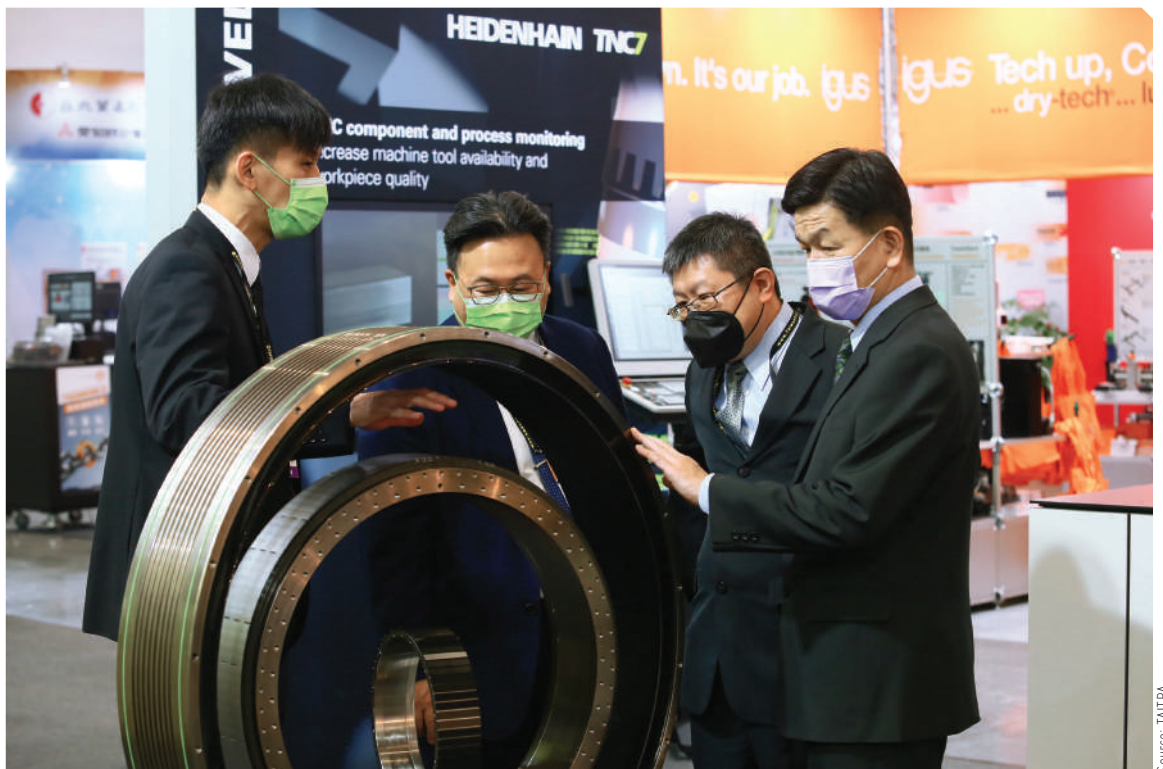


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Race Course Road, Bangalore - 560001
Ph: +91-80-22288841-43 E-mail: tmtp@kiadb.in

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WITH TWICE THE FORCE

The first co-branded machine tool mega show in Taiwan, TIMTOS x TMTS 2022, held from February 21-26 at Taipei Nangang Exhibition Halls 1 & 2, concluded successfully. Highlights...



Source: TAITRA

TIMTOS x TMTS is not only Taiwan's largest trade fair since the onset of the pandemic but also the world's first machine tool mega show in 2022, with 950 exhibitors in 5,100 booths. The event drew over 40,000 online and offline visitors from all over the world. The online exhibition, which continues until March 21, has attracted visitors from more than 20 countries and regions.

Online participation and offerings

In response to border controls, the show featured 'On-site Guide for Online Visitors', 'Sourcing Taiwan Machinery', 'On-site Guide for Media Tour',

'Live Tour @ Showground', 'Media Eye on TIMTOS x TMTS', 'Podcast Live', and 'TIMTOS x TMTS Online', among other online services for international visitors and media.

Daily live updates from the show floor were provided by 'Live Tour @ Showground', 'Media Eye on TIMTOS x TMTS', and 'Podcast Live'. More than 25,000 people have watched and listened to the videos and podcast episodes. Furthermore, high-profile attendees such as Mighty USA, EMIL Macchine, Faustino Pittori SRL, Hommel GmbH, and Siemens Turkey were directed to the showground where they developed real-time relationships with

selected exhibitors through 500 online sessions. Foreign buyers were particularly interested in processing equipment, multi-axis machining centers, and laser cutting machines.

Global response

Max Martinelli of Faustino Pittori, Italy, expressed gratitude to the organizer TAITRA, for offering the On-site Guide service, a video-guided tour, which provided an excellent opportunity to learn about the latest products from key suppliers and discuss future collaboration promptly. Bo Jean from Mighty USA appreciated the video-guided tour since it allowed him to get a 360-degree view of each piece

SOVAN TUDU
Sub-editor
Magic Wand Media Inc
sovan.tudu@
magicwandmedia.in





Source: TAITRA

of equipment while conversing with the exhibitors. International media were especially pleased by Taiwan's machine tool manufacturers' outstanding R&D skills. In addition, the 'On-site Guide for Media Tour' proved to be extremely useful in facilitating remote interviews throughout the pandemic.

Industry trends

The Machine Tool industry adapts to future trends and accelerates digital transformation and improvements. New business models and solutions have been developed for emerging

industries such as Semiconductors, Green Energy, Electric Vehicles, Health Care, and Aerospace. This year's TIMTOS x TMTS garnered a diverse range of attendees from a variety of businesses. TSMC, AIDC (Aerospace Industrial Development Corporation), Formosa Heavy Industries, Hon Hai Precision Industry, Chang Gung Medical Technology, Nan Ya Plastics, and CSMC (China Steel Machinery Corporation) were among the major domestic visitors.

Success stories

The show proved to be an


ideal platform for conducting business conversations, exploring networking opportunities, and striking deals. Exhibitors were elated with the on-site orders. Within the first three days of the show, KAO MING, the main Taiwanese vendor of hydraulic radial drills, sold out all the drills on exhibit at its booth. On-site orders were also received by RONG FU, a leading band saw provider; CASTEK, an expert in EDM drilling machines; MYLAS, a significant lathe maker; HEAKE, known for its 5-axis mills; and SUN FIRM, a leader in flatbed lathes.

Within the first three days of the show, KAO MING, the main Taiwanese vendor of hydraulic radial drills, sold out all the drills on exhibit at their booth.



Source: TAITRA

Extended online show

The TIMTOS x TMTS 2022 online exhibition remains open until March 21. HIWIN, VICTOR TAICHUNG, Hartford, FANUC, and SAN YUAN have been the most popular exhibitors at TIMTOS x TMTS Online. Overall, exhibitors at the event showcased their solutions from the last three years, both on-site and online. The next season of TIMTOS is set to premiere in March 2023. 

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