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"INDIA ENJOYS NATURAL ADVANTAGE IN THE NUTRACEUTICAL SECTOR"

Exclusive interaction with **Sanjaya Mariwala**, Executive Chairman and Managing Director, OmniActive Health Technologies and President of the Association of Herbal and Nutraceutical Manufacturers of India

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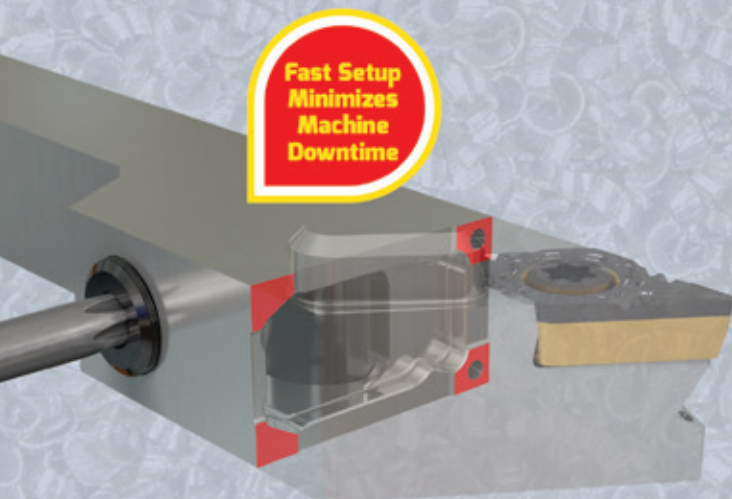
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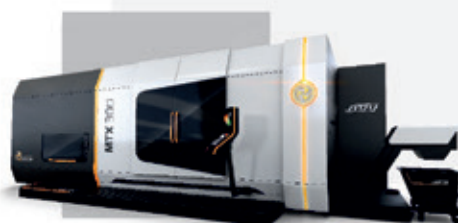
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INDIA'S CAPEX STORY

Investment plays a pivotal role in driving the economy. Overall Gross Fixed Capital Formation has risen to 34 per cent of the GDP in FY23, levels last seen in 2013. Capital Expenditure (capex) substantially augments the economy's productive capacity and exerts a more profound influence on long-term growth and productivity in contrast to revenue expenditure. This heightened impact can be attributed to capex's capacity to generate a more pronounced multiplier effect on the overall growth prospects.

When capex is allocated for new projects, expansion of existing ventures, or enhancement of technology and infrastructure, it fosters opportunities for economic growth through heightened productivity, increased demand for allied industries, and the creation of job opportunities. The budget announcements by the government reflect a concerted effort to reinvigorate the Keynesian animal spirit, with the expectation that heightened public capex will act as a catalyst for increased private sector investments.

Over the past few years, the public capex has remained strong mainly led by the centre. The Government's steadfast commitment to capex is reflected in its budgetary priorities. Notably, the share of capex within the total expenditure has undergone a substantial increase, rising from 12.1 per cent in FY21 to 22.2 per cent in the budget estimate for FY24.

Centre's capex witnessed a growth of 48.1 per cent YoY in the April-August FY24, with spending of 37.3 per cent of the budgeted value of Rs 10 trillion which is higher than the spending of 34.6 per cent of the budgeted value in the same period in FY23. Among the major ministries and departments, utilisation of the budgeted amount remains high for the Ministry of Railways, MoRTH, and Ministry of Communication with budgetary utilisation above 40 per cent till August. Ministry of Finance's higher capex is driven by an increase in transfer to states for capital expenditure. The government's focus on infrastructure development continues to remain high in the fields of connectivity, physical infrastructure, and energy.

That said, the state governments have also budgeted for strong capital expenditure, with the aggregate budgeted capex for 19 major states at Rs 7.8 trillion – 19.6 per cent higher than the budgeted capex of last year. However, unlike last year, the state capex has maintained its momentum with the April-August period witnessing a growth of ~45 per cent as compared to last year. The Centre's disbursement of conditional interest-free loans tied to actual capex spending has aided in the rebound of the capex cycle by states.

As far as the private sector is concerned, India Inc's investment shows a good recovery in FY23 with total capex rising above pre-pandemic level for the first time. However, project announcements show a moderation in capex in H1 FY24. Even though there are downside risks to domestic as well as external demand and higher cost of money which can lead to firms postponing their capex plans, the conditions continue to remain suitable for a strong uptick in private capex with improvement in capacity utilisation levels and a deleveraged balance sheet.

Even though the cost of money remains high, the global monetary policy cycle has neared its peak and the major central banks are expected to start their rate-cutting journey in the next calendar year. Thus, I remain hopeful that the private capex will gather momentum in the upcoming quarters.

R Kamat
Editor

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EPACK PREFAB concludes 12.3 million sq ft construction for cement and steel companies

EPACK PREFAB, the emerging leader in India's pre-engineered structure manufacturing sector, has concluded the construction of 12.3 million square feet of industrial facilities for cement and steel companies. The total project value amounts to approx. Rs 493 crore.

Amidst India's robust infrastructure growth, cement and steel enterprises are focusing on increasing their production capabilities. Responding to the rising need for infrastructure-related products, these firms are embracing cutting-edge construction solutions, with a shift towards adopting pre-engineered buildings for the expansion of their manufacturing facilities.

Sanjay Singhania, Managing Director of EPACK PREFAB, said, "The robust infrastructure development initiatives in India, including projects like highways, bridges, and real estate ventures, have spurred a heightened demand for construction materials involving cement and steel. Cement



manufacturers are actively pursuing construction approaches that provide speed, cost-efficiency, and sustainability to enhance their production capacities. Pre-engineered buildings are increasingly becoming the preferred choice for these companies."

The primary surge in construction demand is originating from the Northeast and Southern regions of the country. Prominent hubs, particularly Assam and Maharashtra, have witnessed a significant uptick in demand. In response, EPACK PREFAB has effectively executed projects for distinguished companies, including but

not limited to Dalmia Cement, Ultratech Cement, Calcom Cement, Ambuja Cement, Tata Steel, Jindal Steel, and others.

As cement companies throughout India endeavour to boost their production capacities, the adoption of pre-engineered buildings (PEBs) is set to continue its upward trend. Incorporating PEBs into construction can lead to time savings of up to 50

per cent, expediting project completion and enabling businesses to commence operations more swiftly. This approach helps foster a sustainable growth of the nation's infrastructure by reducing carbon emissions by as much as 60 per cent.

EPACK has witnessed an expansion of 100 per cent in its order book, comparing the fiscal years 2021-22 and 2022-23, the company envisions concluding the order book for FY 23-24 at a higher value of Rs 1,400 crore. Furthermore, EPACK anticipates securing an additional 25 per cent of its orders from cement and steel companies in the coming 12 months.

Sterling and Wilson constructing Angola's First Tier-III Data Centre for Raxio

STERLING AND WILSON PRIVATE LIMITED (STERLING AND WILSON/ SWPL), a Shapoorji Pallonji Group Company, and one of India's leading engineering, procurement, and construction (EPC) companies, has started the construction of its second data centre for Raxio. The company is Africa's premier platform of carrier neutral, colocation, Tier-III data centres, providing industry-standard, carrier-grade facilities and services that serve as the foundation of Africa's digital economies.

The facility will be the first independent and neutral Tier-III certified data centre in the country and will have a total IT load of 3 MW initially, with the capacity to scale up to 7 MW, and accommodate more than 1,600 racks. It features a cutting-edge design optimised for performance and energy efficiency. The project will be commissioned by second half of 2024.

Prasanna Sarambale, CEO, Data Centre Business, Sterling and Wilson Private Limited said, "The demand for digital services and connectivity solutions in Africa has been steadily increasing in recent years. With the growth of the digital economy and the increasing use of cloud-based services, businesses across the continent are recognising the need for reliable, secure, and scalable data centre solutions. Sterling and Wilson which has already executed multiple projects in Africa, is perfectly poised to make the most of this opportunity."

Robert Mullins, CEO, Raxio Data Centres said, "With the arrival of new connectivity solutions and the continued evolution of the digital ecosystem in the region, we will continue to build scalable, world-class facilities to meet the growing needs for connectivity, storage and data processing. This is a response



to the continuous increase in demand for digital services and the evolution of connectivity solutions in the region. In addition, Angola is geographically very well positioned to be a strategic connectivity hub for the region, making it an important market for our growing portfolio. As with all our facilities, Raxio Angola is being developed in strict compliance with our ESG standards, generating a positive impact through the direct and indirect creation of hundreds of jobs."



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SCAN FOR PRODUCT CATALOGUE 2023

Tata Elxsi and IISc to together develop automotive cyber security solutions

ADVANCES IN VEHICLE-TO-VEHICLE AND VEHICLE-TO-ANYTHING (V2X)

connectivity have presented more opportunities for theft, remote control, tampering, and siphoning of personal information.

Tata Elxsi, leading design and technology service providers across industries, announced the joint development of an Automotive Cyber Security Solution together with the Indian Institute of Science (IISc) under the framework of the existing Memorandum of Understanding (MoU).

The partnership aims to address the challenges in cybersecurity presented by complex in-vehicle networks of sensors and numerous advancements in software that define the modern driving experience.

The collaboration will also focus on security and threat detection in connected automotive vehicles, using AI & ML-based intrusion detection. The partnership will also work to prevent and detect potential security threats and



From Left to Right: T. Ravi Kiran, Principle Product Manager, CTO Group | Atul Vinayak Kulkarni, CTO, Tata Elxsi | Manoj Raghavan, CEO & MD, Tata Elxsi | Prof G Rangarajan, Director, IISc | Prof Rajesh Sundaresan, Dean EECS, IISc | Dr. Vaibhav Katewa, Assistant Professor, IISc

anomalies with preventive insights on future and potentially more advanced threats in the system.

This joint development will leverage Tata Elxsi's experience of artificial intelligence and machine learning skill set and the business foray towards software-defined vehicles (SDV) and EV solutions, coupled with the strength of advanced research at IISc, who are focusing on developing automotive vehicle technologies and network security, smart grids, and other critical systems.

Manoj Raghavan, CEO & MD, Tata Elxsi, said, "In the Connected vehicles space, we have made substantial

investments to improve our solution stacks for Autonomous vehicles via our ADAS programme, SDV architecture, and the like. As vehicles increasingly rely on digital technologies, ensuring cybersecurity is paramount. With IISc's partnership focusing on Cybersecurity solutions and products, we are sure our clients and automakers can build safer, more resilient vehicles while providing peace of mind to end customers."

"In today's digital and interconnected world, cybersecurity threats are growing with technological advances. At IISc, we are always keen on academia-industry partnerships that can help address such challenges," said G Rangarajan, Director, IISc.

Rajesh Sundaresan, Dean, Electrical, Electronics and Computer Sciences (EECS) Division, IISc, said, "A modern car easily has upwards of 3000 chips sensing and controlling the car's operation. The design complexity associated with enabling safe in-vehicle networking is enormous."

MIT Technology Review recognises Gogoro as a top climate tech company to watch

GOGORO INC., a prominent global technology company specialising in battery swapping ecosystems designed to facilitate sustainable mobility solutions in urban areas, has received recognition from MIT Technology

Review. This acknowledgment comes as part of MIT Technology Review's unveiling of its list featuring fifteen noteworthy climate tech companies. The announcement took place at the MIT Technology Review ClimateTech Conference held at the MIT Media Lab, situated on the campus of the



Massachusetts Institute of Technology in Cambridge, Massachusetts.

MIT Technology Review's newly unveiled '15 Climate Tech Companies to Watch' list aims to spotlight companies from across the globe that, in the eyes of its editors, hold the potential to significantly mitigate greenhouse gas

emissions or effectively address the challenges posed by global warming.

MIT Technology Review highlighted Gogoro saying, "Gogoro could make an immediate impact both by speeding up the move to electrified vehicles and by reducing the load on the grid to charge those vehicles through smart management of its power stations."

"Gogoro leverages innovation to address the urban transportation and energy challenges of the world's most densely populated cities. Today, with nearly 13,000 battery swapping stations and 400,000 daily battery swaps we've demonstrated that battery swapping provides a clear path to transforming urban two-wheel transportation to smart electric power," said Horace Luke, founder, and CEO, Gogoro.



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TAGMA announces its new leadership

THE TOOL AND GAUGE MANUFACTURERS ASSOCIATION OF INDIA (TAGMA)

has successfully concluded its 32nd Annual General Meeting (AGM), which featured a crucial election process for a new Executive Council. During this year's AGM, TAGMA members convened to deliberate on significant industry developments, exchange valuable insights, and unveil the 'Indian Tooling Report'.

The highlight of the AGM was the election of the new Executive Council of TAGMA. Devaraya Manjunath Sheregar, Managing Director and Chairman of Devu Tools Pvt. Ltd., assumed the role of the newly appointed President, while D Shanmugasundaram, Managing Director of S&T Group, was elected as its Vice President for the year 2023-2026.

Sheregar expressed, "Companies worldwide are actively considering investments in India, recognizing our



nation's potential as a hub for innovation and manufacturing. To harness this momentum, collaborative efforts are imperative, with a sharp focus on skill development and responding to the burgeoning demands of our industry. Together, we can shape a promising future for tool and gauge manufacturing in India."

Discussing the new initiatives, Shanmugasundaram stated, "During this term, our primary objective is to expand our horizons. We are committed to proactively extending our delegation to various countries, fostering global partnerships, and welcoming new

members into our continually expanding TAGMA family. Together, we will persistently elevate the Indian tool and gauge manufacturing sector to unprecedented heights."

TAGMA India is eagerly anticipating the new leadership under Sheregar's guidance and is confident that his tenure will usher in an era of advancement and prosperity for the association and its members.

The newly elected members for the term 2023-2026 are as follows:

- Akshay Kalyanpur, Sridevi Tool Engineers Pvt Ltd
- Devaraya Manjunath Sheregar, Devu Tools Pvt Ltd
- D Shanmugasundaram, S&T Engineers (P) Ltd
- T S Gopalakrishnan, Multiple Special Steel Pvt. Ltd.
- Raj Singh, Eqic Dies & Moulds Enggs. Pvt. Ltd
- Sachin S Netrabyle, Magna Plastic Corporation
- Shijesh Kokkodan, Macpro Technologies Pvt. Ltd

Inovance Technology India Debuts at Pack Mach Asia

INOVANCE TECHNOLOGY INDIA is making its inaugural appearance at the Pack Mach Asia exhibition, scheduled to take place from the 4th to the 6th of October. This event will be hosted at Pragati Maidan in New Delhi and serves as a distinguished international trade fair and conference, offering an unparalleled opportunity to witness the latest advancements in technology and solutions within the packaging and processing industry.

Located at Hall 12A, Booth D21, Inovance will present a diverse array of industrial automation products tailored to the packaging and processing sector. The featured products encompass the high-performance MD800 compact AC MultiDrive, alongside the MD290 and MD310 AC general-purpose drives. Additionally, visitors can explore the SV660N high dynamic performance servo drive, coupled with the MS1 high dynamic servo motor. Inovance will unveil the newly introduced Easy Series, a high-performance, compact, EtherCAT-enabled PLC, and introduce attendees to the compact GL20 and versatile GL10 I/O module families.

The exhibition will also feature demonstrations of two prominent PLC models: the H5U and the AC810. To provide a comprehensive view of their industrial automation packaging solutions, Inovance will showcase the IT7000 high-functionality HMI.

Anil Kumar, the Managing Director, Inovance Technology India, expresses his enthusiasm for the event, stating, "Our proficient technical team will be readily available to greet you at our exhibit during the Pack Mach Asia Expo. Whether you are an existing or prospective OEM client, a trade media journalist, or an aspiring engineering student seeking your initial career opportunity, we eagerly invite you to engage in conversation with us. Please do visit us at Hall 12A, Booth D21."

IMTMA announces new leadership for 2023-2024



ON THE 29TH OF SEPTEMBER 2023, the 77th Annual General Meeting (AGM) of the Indian Machine Tool Manufacturers' Association (IMTMA) took place in Bengaluru. During this event, Rajendra S. Rajamane, Managing Director of Rajamane Industries Private Limited, assumed the position of President for IMTMA for the year 2023 - 2024.

Likewise, Mohini Kelkar, Director of Business Development, Grind Master Machines Private Limited, was elected as the Vice President of IMTMA for the same term.

Furthermore, the new Executive Committee for IMTMA for the year 2023 - 2024 was formally established during this AGM.

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2 high-quality, ball-bearing fixed wheels Ø 150 mm and 2 castors with brake Ø 125 mm.



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- Absolutely necessary if LED lighting is installed.

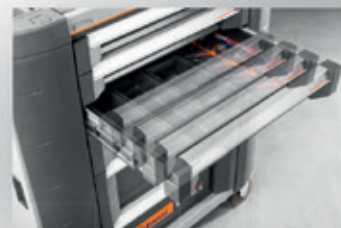


Perforated back panel

Optional, modular perforated back panel (3 different heights, perforated single-sided or double-sided) for insertion into the support columns.

Removable tray (accessories)

- Made of sheet steel with swivel arm.
- X-ABS tray, extra non-slip, does not damage surfaces.



- Optionally with GARANT ComfortClose: Self-closing and damping.



Storage with GARANT GridLine mat

- Storage of polyamide with compartments for small parts and bottle holders, scratch resistant, does not damage surfaces.
- GARANT GridLine mat of natural rubber to restrain easyPick small parts storage bins on the mat.
- With cable routing in the can holder.
- Easy exchange of tray with other worktops (for example, bamboo).



Optional

- Additional drawer for fitting under the roller cabinet - for tools that are particularly heavy or seldom used.



End cupboard

- With centrally locking sheet metal door.

Recessed end faces

- Increased shelf depth for storage of power tools, for example.
- Second wall protects against dust and dirt.
- Perforations 9 x 9 mm in 37 mm grid, for individual fitting with perforated panel accessories and Easyfix hooks and holders.

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RSOLEC to launch with 300-million-dollar investment

RENAISSANCE SOLAR AND ELECTRONIC MATERIALS (RSOLEC),

an innovative solar enterprise with operations in India and the USA, announced its official launch and establishment, accompanied by a significant planned investment of about 300 million dollars.

The launch of RSOLEC aligns with India's 'Atmanirbhar Bharat' mission, showcasing the country's capabilities in the state-of-the-art solar value chain. The company's primary focus for the next five years will be on Crystal Growth and Wafering in India. Over the long term, RSOLEC intends to expand its manufacturing over the entire solar value chain.

Investment and Job Creation:

RSOLEC's commitment to pioneering solar manufacturing with the lowest capital intensity ensures cost-competitive production on a global scale. The company's roadmap anticipates achieving a capital intensity below \$35 million per GW.

Furthermore, RSOLEC is dedicated to job creation, aiming to generate over 1,000 skilled jobs in the solar sector within the next three years, with more than 3,000 skilled job opportunities envisioned for the long term. This commitment to job growth aligns with economic development and skill enhancement objectives.



RSOLEC integrates continuous improvement on existing platforms with cutting-edge technologies. Based in Delaware, USA, RSOLEC operates through its Indian subsidiary located within the dynamic ecosystem of IIT Madras Research Park.

Milind Kulkarni, Chairman and CEO of RSOLEC, articulated, "RSOLEC is poised to contribute to the solar energy revolution and initiate the cultural transformation required for success in the dynamic solar manufacturing sector. Our differentiation lies in our technology-driven, low-risk innovations, positioning RSOLEC at the forefront of the solar industry."

"Padmashree" Professor Ashok Jhunjhunwala, President of IITM Research Park, stated, "It is strategically imperative for India to develop the entire solar ecosystem, encompassing solar manufacturing. RSOLEC brings the requisite expertise for technology-driven solar manufacturing, and we are pleased to support this critically significant endeavour at the IIT Madras Research Park."

Key Highlights:

Technology: The facility will utilize the state-of-the-art Recharge Czochralski (RCZ) process, which can be retrofitted to the emerging Continuous Czochralski (CCZ) process for Crystal Growth. Wafer production is based on the cutting-edge DCW platform, capable of producing thin wafers measuring below 100 micrometres in thickness.

RSOLEC's commitment to continuous technological advancement on existing platforms enables an 80 per cent improvement in productivity and a 40 per cent reduction in production costs over a short timeframe.

Product: The primary product is high-quality silicon wafers with low oxygen content, high lifetime, and controlled resistivity, compatible with all solar cell technologies.

Capacity: Initial production capacity is set at 5 GW, with plans for expansion to exceed 20 GW in the long term.

Timeline: Commissioning of the facility is planned in late 2025 and production in 2026. RSOLEC is currently evaluating several short-listed production sites offering attractive opportunities.

Innovative Leadership: The founding team of RSOLEC consists of four dedicated professionals with extensive experience in the solar value chain, supported by nine international Subject Matter Experts and accomplished Advisory Board members.

Delta Industrial Automation celebrates 15 Years of operations

DELTA INDUSTRIAL AUTOMATION,

a leader in the industrial automation sector, recently concluded its 10th Industrial Automation Channel Partner Meet. This event, not only marked a decade of commitment to its partners but also commemorated 15 years of operations in the Indian industrial automation landscape.

Delta Industrial Automation has consistently been at the forefront of innovation and excellence, offering solutions that have revolutionised manufacturing processes. Over the past 15 years, Delta's industrial automation business in India has shown remarkable growth, solidifying trust among

customers, suppliers, and channel partners alike.

"The Indian industrial automation market is experiencing rapid growth, and we are strategically positioned to harness this momentum," stated Manish Walia, Head of Automation at Delta Electronics India. "Our comprehensive range of products and solutions is tailored to meet our customers' evolving needs, and we remain committed to delivering unparalleled support to our channel partners," he added.

Beyond the festivities, the event



provided a platform for Delta to unveil its vision for the future, outlining plans for product diversification and expansion into new markets.

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FOR DETAILS



PEWIN AIMS TO TRIPLE ITS TURNOVER BY 2030

In a press briefing, company management reveals Panasonic's targets for India till 2030.

Panasonic Electric Works India (PEWIN), a subsidiary of Panasonic Life Solutions India Limited, has outlined its plans to increase its production capacity and enhance its manufacturing technology in the coming years.

Currently, the company is focusing on three primary markets: India, Vietnam, and Turkey, with a special emphasis on India, where it generates 9 per cent of its total sales, amounting to Rs 62,500 crore.

PEWIN aims to make India a global export center, serving the Middle East and Africa. Currently, exports contribute 2 per cent to the company's overall turnover, but PEWIN has ambitious plans to raise this to 10 per cent by 2030.

PEWIN Managing Director Yoshiyuki Kato shared that in the fiscal year 2022, PEWIN achieved a significant business turnover of Rs 5,100 crore and aims to triple this figure by 2030.

Rajesh Nandwani, Director of Power at PEWIN, emphasised the company's production goals, saying, "We currently make 650 million pieces a year, and we want to increase this to 1,000 million by 2030."

INVESTMENT FOR GROWTH

Over the next five years, from 2021 to 2025, PEWIN plans to invest Rs 600 crore to support its growth initiatives. A substantial part of this investment, Rs 300 crore, will be used to set up a modern facility in Andhra Pradesh. This move signifies PEWIN's expansion into the southern region of India, specifically in Sri City, Andhra Pradesh. The Sri City facility is primarily focused on manufacturing wiring devices products covering Roma, Penta Modular, and Roma Urban.

This shift aims to bring the company closer to its customers, resulting in a significant reduction in delivery time compared to their Haridwar and Daman Plants.

TECHNOLOGICAL ADVANCES IN OPERATIONS

The Andhra Pradesh facility features an Automated Guided Vehicle (AGV) system, eliminating the need for manual transportation of goods. Additionally, the facility uses synchronised lifts to optimise efficiency.

Remarkably, about half of PEWIN's product assembly processes are fully automated, reducing the



need for human involvement and allowing employees to focus on more valuable tasks. By 2022, the company had provided jobs to over 600 individuals.

To support its research and development efforts, PEWIN has set up a state-of-the-art R&D laboratory at its Daman factory, with an investment of Rs 8 crore. This facility conducts thorough tests for performance and reliability, demonstrating the company's commitment to maintaining high quality while increasing production quantity.


Nandwani also mentioned the company's commitment to environmental sustainability, stating, "Our Daman and Haridwar plants already run on solar energy, and we plan to extend this eco-friendly approach to our Sri City facility."

COMMUNITY ENGAGEMENT

PEWIN has also announced plans for its 'Sparkle Powai' initiative. This project, scheduled for November during Diwali, aims to improve the Powai's appearance by installing facade lighting.

Importantly, PEWIN intends to involve its customers in operating these lights, highlighting their shift toward being a "solution-centric" company, as Nandwani emphasised.

Additionally, PEWIN expanded its reach by introducing solar residential kits in Pune and Nashik in May. Amit Barwe, BU Head at PEWIN, shared, "We received positive feedback from Pune and Nashik, and we plan to expand this to four more cities in Maharashtra in the next 3-4 months."

With these comprehensive strategies, PEWIN is well-positioned for significant growth and innovation in the years ahead. 

“THE FUTURE OF BIG DATA ANALYTICS IN THE RAILWAY INDUSTRY PROMISES A REVOLUTIONARY TRANSFORMATION”

Mike Muralidharan, Chief Operating Officer, Bahwan CyberTek explains how leveraging big data analytics can assist railways in making informed, data-driven decisions, thereby enhancing its operational efficiency, sustainability, and safety in an interview with Nisha Shukla.

How has the adoption of big data analytics helped in transforming decision-making processes within the railway industry?

Indian Railways is the fourth largest in the world – it is an economic lifeline connecting the entire length and breadth of the country. While the sector has historically relied on legacy systems to maintain operations, there is a swift, discerning shift towards digitalisation. The Indian Railways has embraced digitalisation across spheres like operations, maintenance, and monitoring to enhance passenger experience and improve revenue.

The adoption of big data analytics has fundamentally reshaped decision-making within the railway sector. First, there's the modernisation of the signalling system designed to improve safety and line capacity. Second, we're able to monitor data using sensors in real-time, and identify and prevent issues - shifting from reactive to predictive maintenance. This is improving fleet reliability and availability, an important factor that influences revenue for railways. Lastly, big data is strengthening giant public corporations such as Indian Railways to maintain reliable schedules using real-time data, ultimately enhancing the experience, not just for passengers but also for all stakeholders.

How is Bahwan CyberTek (BCT) leveraging new technologies and methodologies used in big data analytics to reshape railway operations?

At BCT, we use our unique combination of IP products, services, and outcome-based business approach to deliver success to our clients. For the railways, specifically, we use our digital enterprise asset management (EAM) solutions to improve sustainability, safety, and cost in asset-intensive industries. Another important aspect of our offering is our proven and successful deployment of IBM Maximo, which is a leading asset management solution in the rail industry. BCT's knowledge capital,



Mike Muralidharan, Chief Operating Officer, Bahwan CyberTek

deep-domain expertise, and award-winning service capabilities perfectly complement the IBM Maximo solution, making us an ideal transformation partners.

BCT is one of the top 10 Global System Integrators for IBM Maximo. It has been transforming the infrastructure, transportation, roadways and railroad industries across India, The Middle East and far East, for over 15 years through integrated digital solutions for asset management, predictive maintenance, logistics and supply chain management. We've also partnered with the Mumbai Metro Rail Corporation Limited (MMRCL) in their pursuit to build a Common Assets Management System to optimise processes, perform lifecycle cost monitoring and improve efficiencies.

We understand that railway assets are complex. There are numerous coaches, several kilometres of tracks, unmanned territories, and many human operators at



AI will drive automation, optimising train schedules, route planning, and resource allocation, enhancing efficiency and cost-effectiveness. Energy efficiency will continue to be a focal point, identifying ways to reduce energy consumption without compromising operations.

various points. We leverage the power of AI and IoT for data-driven decision-making, thereby helping railways move from condition-based maintenance to predictive maintenance and convert siloed asset management approaches into a single integrated approach for easy collaboration and decision-making.

How big data analytics has improved maintenance schedules and equipment failure prediction in the railway industry. Elucidate with a detailed case study?

Let me give you the example of the work we did for the Mumbai Metro Rail Corporation Limited (MMRCL). BCT was awarded a contract to build the Common Asset Management System (CAMS) for Mumbai Metro Line-3 (MML-3), by MMRCL, the nodal agency responsible for the implementation of the MML-3 project in India. BCT was engaged to provide the end-to-end design, implementation, and support for CAMS, leveraging its expertise in delivering enterprise-class EAM solutions.

With our dedicated team of technology experts, enterprise solution architects, and integration and quality assurance experts, we built an integrated CAMS to optimise processes, perform lifecycle cost monitoring and improve cost efficiency of MMRCL.

The CAMS solution helped MMRCL manage different types of assets such as rolling stock, tracks, power supply systems, traction systems, signalling and control systems, platform screen doors, telecommunication systems, plants and equipment, automated fare collection systems, escalators, and lifts, tunnel ventilation systems, security systems, infrastructure, and related systems and electro-mechanical systems like fire alarms, domestic water, lightning, etc. through a single-window enterprise application.

How is Bahwan CyberTek leveraging big data in real-time monitoring of tracks, signals, and infrastructure to prevent accidents and unforeseen collisions?

Our comprehensive product and service offerings cater to the specific needs of the transportation industry, emphasising railway safety and efficiency. We can leverage big data analytics, IoT, AI, and ML driven predictive algorithms that gather data including the status and performance of equipment in real time and develop predictive models. This will also include data

from sensors placed on tracks, signals, and trains, as well as external factors like weather conditions and historical accident data.

These predictive models are designed to identify performance challenges, potential risks, equipment failures, and disruptive patterns. By processing vast datasets, we will be able to predict and enhance decision-making.

Using emerging technologies, BCT can assist railways in making informed, data-driven decisions. These decisions optimise resource allocation, streamline train scheduling, and improve route design, ultimately enhancing operational efficiency, sustainability, and safety.

What strategies can be employed using big data to identify potential security breaches or safety hazards?

While digitalisation optimises efficiency, eliminates errors, and enhances experience; on the other hand, it exposes vulnerabilities and makes systems susceptible to threat actors. And just like every other sector, the railways can also be hit by cyberattacks. This year, the Alaska Railroad Corporation (ARRC) was affected by unauthorised access, compromising critical infrastructure.

To build resilience, decision-makers must focus on building a strong security framework, proactive monitoring, and complete data protection to prioritise data privacy and security while using big data for safety. Leaders should embrace and foster a culture of training and awareness that will help employees comprehend data security and stay informed of the latest policies on data collection, usage, and sharing.

How might big data analytics contribute to reducing energy consumption by analysing train performance data and optimising energy usage?

Just like digitalisation, Environmental, Social, and Governance (ESG) goals have become a priority for the railways. As a leading contributor to the growth of smart cities worldwide, railways cannot ignore the benefits of optimised energy usage and their impact on a sustainable future.

By leveraging the capabilities of comprehensive data analysis and cutting-edge optimisation strategies, along with the relentless monitoring and scrutiny of train performance metrics such as speed, acceleration, braking, and energy consumption, a new era of

efficiency is dawning. This paradigm shift empowers railway operators to swiftly pinpoint and rectify inefficiency patterns, effectively curbing wasteful energy consumption.

Predictive maintenance, driven by the wealth of historical performance data, enables the anticipation of potential component failures, allowing for proactive maintenance actions that save both time and resources. Furthermore, big data takes energy-efficient driving to unprecedented heights, providing real-time feedback to train operators on their driving habits and fostering a culture of continuous improvement.

In the realm of scheduling, dynamic optimisation using big data considers dynamic variables like track conditions and weather, minimising delays and enhancing reliability. Data-driven load balancing strategies optimise train capacity and traction, further enhancing overall energy efficiency.

What strategies can be implemented to make train operations more environmentally friendly using big data insights?


According to the International Energy Agency, 55 per cent of the energy consumed by the global rail industry in 2020 was generated by diesel. For railways to be more environmentally friendly, we should shift towards renewable energy sources. Reports suggest that Indian Railways are on track to meet the target of 100 per cent electrification of broad-gauge network by December 2023.

Now, coming to big data analytics, they help the

railways at an asset level and at the overall ecosystem level. Analytics can identify performance issues before they happen, identify errors or mistakes, preventing accidents, and ensure optimum utilisation of rails, preventing loss or underutilisation.

Kindly shed light on the potential future developments or advancements in big data analytics that could further enhance the operations of the railway industry.

The future of big data analytics in the railway industry promises a revolutionary transformation. Real-time predictive analytics will lead the way in foreseeing equipment failures and reducing downtime and maintenance expenses. The integration of the IoT will expand data collection through a comprehensive network of sensors, resulting in more precise predictions and optimisations. AI will drive automation, optimising train schedules, route planning, and resource allocation, enhancing efficiency and cost-effectiveness. Energy efficiency will continue to be a focal point, identifying ways to reduce energy consumption without compromising operations.

Big data insights will also help to better understand customer preferences and behaviour, enabling personalised services and increased satisfaction. Cybersecurity measures are set to improve with enhanced integrity of railway operations. Big data analytics will help streamline regulatory compliance and contribute to reducing operational costs and the industry's environmental footprint. 

JEAN-MICHEL VERDIER NAMED NEW MD OF CONTINENTAL ENGINEERING SERVICES

On September 1, 2023, Jean-Michel Verdier assumed the role of Managing Director at Continental Engineering Services (CES), succeeding Christoph Falk-Gierlinger, who concluded his three-year tenure with Continental.

Verdier boasts a distinguished engineering background and an extensive track record in the automotive industry, complemented by demonstrated leadership acumen spanning over a period exceeding two decades. Prior to his affiliation with Continental in 2020, he held pivotal leadership roles at both Lear and Faurecia.

During his prior role at Continental, Verdier led the global Research and Development (R&D)



division for the Wheel Brake Solutions segment. In this capacity, he exhibited exceptional leadership skills by effectively spearheading projects and overseeing large, globally distributed teams operating within complex frameworks. His proficiency in advancing operational excellence and efficiency played a pivotal role in the attainment of the segment's objectives.

Gilles Mabire, CTO at Continental Automotive said, "His extensive experience, entrepreneurial mindset, and commitment to collaboration make him the ideal candidate to steer CES towards further success in the future, taking the excellent work of his predecessor Christoph Falk-Gierlinger to the next level."

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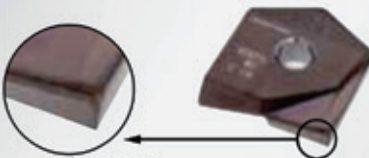


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SW type

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Application : Finishing

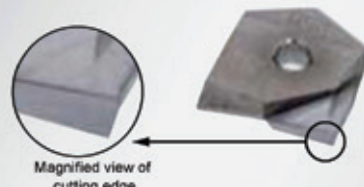


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THERE IS A NEED TO BREAK THE AGEIST STEREOTYPES AT WORK

In an ever-evolving business landscape, effective talent management is crucial for overall growth and success. **Shillpa S. Chabria**, Director of Human Resources, Occupational Health, Safety, Environment, Administration, and CSR at **thyssenkrupp Industries India**, openly discusses the key HR initiatives and strategies they are adopting to achieve and empower a diverse, inclusive, and equitable talent pool. Additionally, she delves into their unique policy, which involves bringing back 'superannuated' employees in a more adaptive work stream, in an interview with **Nisha Shukla**.

How does thyssenkrupp define diversity and empowerment within the context of engineering?

At thyssenkrupp, diversity means recognising and valuing the different backgrounds, perspectives, and

experiences that people bring to the table. We do not limit our recognition of diversity to gender, region, and race alone, rather, we extend it to include various outlooks and approaches. These diverse viewpoints open a world of possibilities. We firmly believe that a diverse team fosters innovation and enhances problem-solving, aligning with our approach to conducting business.

Historically, engineering was a gender-skewed domain. However, the landscape is evolving, albeit at different speeds in various segments, including the heavy engineering space in which we operate. While challenges persist, as an employer, we acknowledge our significant role in promoting change. We emphasise empowerment by providing our engineers with the autonomy, resources, and support they need to excel in their roles. To foster an inclusive and innovative work environment, it is important to address and include diverse voices through our policies and structures. True empowerment occurs when engineers adopt an 'I Can' attitude without any limitations. This mindset brings out genuine engineering marvel that we strive to provide to our customers and our nation.

What are some of the key benefits that a diverse workforce brings to the field of engineering and to a company like thyssenkrupp?

As I mentioned earlier, diversity brings various perspectives and fosters innovation. Our world has been predominantly shaped by men, but to effectively address contemporary challenges, it is essential to incorporate diverse viewpoints. The greater the diversity within the field of engineering, the better



Shillpa S Chabria, Director Human Resources, Occupational Health Safety and Environment, Administration & CSR, thyssenkrupp Industries India

prepared it will be to tackle modern-day problems. For any engineering company like thyssenkrupp, a diverse workforce means more creativity, efficiency, and comprehensive problem-solving abilities. Therefore, these factors play a significant role in retaining our valuable diverse talent.

The participation of women, especially in the engineering domain, is comparatively low, as against any other sector. What are the key steps thyssenkrupp is undertaking to increase their participation?

We are committed to addressing the gender imbalance in the engineering sector. At thyssenkrupp, we are actively promoting diversity and inclusion through targeted recruitment, mentorship, and leadership development programmes. Through these concerted efforts, our goal is to cultivate a supportive workplace culture that brings out the best in our employees. We are proud of the role models in our organisation who are paving the way for others and shattering the glass ceiling within heavy engineering enterprises such as ours.

Could you provide an overview of thyssenkrupp's initiatives or strategies aimed at promoting and empowering a diverse talent pool in the engineering sector?

While gender representation is a visible diversity index, we are working on regional, generational inclusion. This includes welcoming armed-forces veterans and older colleagues to harness their 'grey wisdom'. We have created an alternate path for colleagues approaching retirement age, allowing them to continue contributing their domain expertise to our business, while enjoying the ample free time that retirement brings. There is a need to break the ageist stereotypes at work, as doing so will create a more inclusive, equitable and diverse workforce. Personally, I take great pride in collaborating with colleagues' post-superannuation as their years of expertise and earnestness come through.

Kindly elaborate on thyssenkrupp Industries India's vision for achieving an inclusive workplace?

An inclusive workplace is one where everyone feels comfortable expressing themselves. It takes a lot of effort to create a culture that is sensitive, accepting, and safe. And we are taking small but significant steps towards this direction, starting with sensitivity training, initiating dialogues through focus group discussions, and creating forums for people to express themselves. We believe that deliberately initiating discussions on relevant topics, and finding solutions, is the way to open the world of possibilities for every organisation and our journey is no different.

How does thyssenkrupp foster an inclusive work environment that supports collaboration and innovation among engineers from various backgrounds?

This is where I take great pride in our leaders and managers at thyssenkrupp. In an era when HR leaders are striving to teach managers the importance of empowerment in managing their colleagues, we didn't encounter this challenge. Our leaders and managers consider talent agenda as their top priority, with HR serving as a strategic partner in this journey, more like a coach encouraging and guiding them. This culture, in turn, helps us to promote initiatives aimed at creating a more equitable and inclusive work environment.

Our annual cultural program, 'Catalyst', echoes a similar philosophy that revolves around our core business and talent. In this program, we encourage employees to gain a deeper understanding of our business, company history and talent landscape. This knowledge allows them to better resonate with the brand and its values.

In a diverse enterprise like ours, encompassing six major businesses — Cement, Mining, Energy, Services, Sugar, and Manufacturing—it becomes imperative to integrate the workforce across business verticals. Inclusion begins when every employee is empowered to contribute, not only to their own growth but also to their colleague's growth prospects. This eventually translates into elevating the company's growth curve, and 'Catalyst' contributes significantly to weaving these elements together.

Tell us in detail about your views on the non-traditional hiring approach and its significance for the VUCA world?

There is a befitting adage which says, 'it is a war out there for talent'. However, organisations are getting smarter by bringing in work streams that suit different genres, genders, and ethnicities. Some of the examples in this context are bringing women back from a life-changing event such as marriage, maternity, or even as a caregiver. I would like to reiterate the need for bringing back 'superannuated' employees in a more adaptive work stream, as the current business environment demands a change in the way we view talent and prepare them for the days ahead. I also foresee a trend where the talent may prefer working only on an hourly basis as per their convenient schedules and we must adapt to this change.

Are there any challenges or obstacles thyssenkrupp has faced while implementing diversity and empowerment initiatives in the engineering domain, and how were these challenges addressed?

Every change comes with its complex challenges.

Currently, our biggest challenge is the infrastructure improvement and enhancing work conditions of our people working in remote locations. We have noticed that deploying women and urban-college talent to some of our remote sites is challenging. This is not because the college students or women do not wish to work in remote areas, but such places may not offer a conducive work environment. We are undertaking relevant measures to revamp and improve the working conditions to empower and motivate our people for a brighter future for their families and themselves.


Are there mentorship or sponsorship programs in place at thyssenkrupp to help support individuals from underrepresented groups in their engineering careers?

Yes, we have a 'Tuition Assistance Programme' to help employees in achieving academic milestones while they are working within the organisation and contribute to the company's growth. Every employee is unique to us, and we pay special attention to their development and learning curve within the organisation by creating a customised approach. We believe that all our employees deserve growth opportunities, and we relentlessly work towards creating such platforms for them.

How does thyssenkrupp engage with educational institutions and organisations to encourage and support diverse talent entering the engineering field?

Campus integration exercises spell significant value for us and our leaders are passionate in implementing various measures for this. They invest their time in campus engagement, initiate corporate conversations, and coach and guide the students on frequent occasions. It makes me proud to see our organisation's efforts in developing young talent and contributing to the nation's growth.

Are there any long-term goals or aspirations that thyssenkrupp has set for furthering diversity and empowerment in engineering over the next few years?

Our vision is to become an organisation of engineering marvel that not only contributes to the nation's growth but also becomes a talent development academy. We are working towards building an equitable workforce that thrives in a collaborative environment. We aspire to break the glass ceiling in the heavy engineering domain by creating our own distinguished approach. I am confident of achieving this goal in the years ahead. 

GODREJ & BOYCE PAVES WAY FOR SUSTAINABLE INDUSTRIAL PRACTICES WITH ITS INNOVATIVE WASTE HEAT RECOVERY SYSTEM

Amidst rising energy costs and an urgent global imperative to reduce carbon emissions and enhance energy efficiency, industrial facilities are undergoing a remarkable transformation to maintain a competitive edge and achieve cost savings in the long run. In line with this, Godrej Electricals & Electronics, a business unit of Godrej & Boyce, is paving the way for sustainable industrial practices through the innovative technology of 'Godrej Waste Heat Recovery System' unit, recently installed at a leading beverage manufacturer's plant in India. With a resolute commitment to pioneer sustainable manufacturing practices, Godrej & Boyce aims to reduce CO2 Emissions by 100,000 tons from similar processes by the next 5 years.

Industrial processes often produce copious amounts of heat, which traditionally dissipates into the atmosphere. Waste Heat Recovery involves the process of capturing and repurposing heat energy from waste heat sources within industrial plants. Instead of allowing this valuable resource to dissipate into the environment, it is now transformed into additional heat or converted into electrical and mechanical power. By harnessing this surplus heat, industries can now dramatically improve their overall energy efficiency, resulting in reduced

energy costs and significantly lowered carbon emissions. Godrej Electricals & Electronics has successfully installed the Godrej Waste Heat Recovery System unit for a prominent global beverage manufacturer in India.

The outcomes of the innovative technology installed for the leading beverage manufacturer by Godrej Electricals & Electronics include achieving actual energy savings of 1750 kWh per day, the recovery of 370 MWh of energy since installation, a substantial reduction of 465 tons of CO2 emissions annually, and an impressive payback period of less than 1.5 years.

Commenting on this innovation by the business, Raghavendra Mirji, Senior Vice President & Business Head, Godrej Electricals & Electronics said, "Our commitment to sustainable industrial practices through innovative solutions like the Godrej Waste Heat Recovery System reflects our larger vision of pioneering environmental stewardship within the industrial landscape. By harnessing waste heat to enhance energy efficiency, we not only drive down operational costs but also set a powerful example for industries worldwide. Our mission is to lead the way towards a greener, more sustainable future, where reducing carbon emissions is not just a necessity but a shared responsibility, and where every watt of energy saved is a step towards a brighter tomorrow."

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By Rahul Kamat

“INDIA ENJOYS NATURAL ADVANTAGE IN THE NUTRACEUTICAL SECTOR”

In an exclusive interaction, **Sanjaya Mariwala**, Executive Chairman and Managing Director, OmniActive Health Technologies and President of the Association of Herbal and Nutraceutical Manufacturers of India delve deep into the world of health and nutraceuticals, exploring the innovative strategies behind OmniActive’s success in India and international markets. Edited excerpts...

Could you give an insight into your journey in the nutraceutical industry and the genesis of OmniActive Health Technologies?

That is an interesting question. I used to run a different company within my family called Mane Kancor Ingredients Limited. We dealt with food ingredients, such as spices, extracts, menthol, and essential oils, and exported them worldwide. However, I realised that this business wasn’t my creation; it was inherited. I wanted to establish my entrepreneurial legacy, something designed and envisioned by me.

Secondly, I observed that the food business, while

profitable, lacked innovation. It primarily focused on generating profits without addressing consumer needs or pursuing a visionary mission. So, I sought areas where my knowledge of natural products could be applied—personal care and healthcare. We chose healthcare because it represented a new-age industry with room for innovation, aligning with our vision. In contrast, personal care was traditionally dominated by French companies, making it difficult for newcomers like us.

Preventive care science was deep-rooted in India, however, like many other things, people remained





under Western influence and were more focused on research and innovations happening in synthetic chemistry. What was unfolding on the other side was the keen interest of the Western world in the Indian heritage of Yoga and Ayurveda. There was a steady rise in wellness tourism – people either coming for their treatments or coming to study the subjects. Together with this, the internet was picking up and millennials were becoming more global, better aware, and well-read about various options available worldwide. These were enough indicators to begin the journey in the nutraceutical space.

Thus, we embarked on our journey into healthcare, and the rest is history.

It seems the traits of entrepreneurship were always part of you, leading you to seek new paths...

Indeed. Entrepreneurship is about constantly seeking the next challenge and asking, “What’s next?” I spent around 20-24 years in the food ingredients business, making it successful. However, I felt the need to do something new and innovative.

What are the growth prospects for the international trade of nutraceutical products?

The nutraceutical sector is growing at roughly 9-10 per cent, which is one of the highest across the industries. Many countries are joining the nutraceutical bandwagon. Those who have evolved like India are growing at 15-17 per cent p.a. and other countries like Europe, and Japan, are growing at 7-8 per cent p.a. Given its ancient Ayurvedic wisdom, in-depth pharmaceuticals knowledge and favourable agriculture base, India enjoys a natural advantage in this sector.

Despite more than 50 per cent of the products currently getting exported from India, we are still at only 1-2 per cent of the global trade.

There are 4 different segments in which the industry can be divided. Cultivation of botanicals and raw materials, raw material processing, ingredient manufacturing (APIs), and OTC products and formulations for consumption. We are largely present in the first two, with a limited presence in the ingredient space and a negligible share in the final products. There is a need to add more value-added products to the export basket. Today 90 per cent of the API production is exported, however, the overall API segment itself is very small in India. If we expand just the API segment, there is tremendous potential to increase our share in the international market.

On the demand side, domestic demand itself is increasing steadily. I also expect populous markets like Indonesia, Vietnam, Bangladesh, and Malaysia to present new growth opportunities. The disposable income in these countries is growing steadily and people are likely to start adopting nutraceutical products as their daily fulfillment needs.

As the founder of OmniActive Health Technologies, what role does the company play in the nutraceutical industry? The nutraceutical industry in India is niche, and you have become a pioneer, expanding globally. How are you planning to grow within India?

OmniActive Health Technologies Ltd was established with a clear purpose “to improve lives by enhancing nutrition and wellness and leveraging the most innovative science and technology to meet consumers’ demands while adhering to the highest scientific

standards of quality”.

Our approach involves several facets. Firstly, the nutraceutical industry requires innovation in science and technology to meet consumer needs. We aim to bridge this gap by combining science and technology to create products that offer real value to consumers.

Regarding the idea of extracting medicinal compounds from flowers, we conducted extensive research before entering the business. We formed a team that scoured databases and global research for natural products with medicinal and nutritional properties. We observed that Japan and the US were at the forefront of natural product research for nutritional purposes. This led us to believe that this trend would shape the future of healthcare.

We decided to not only provide content to supplement makers but also manufacture supplements for the Indian market. We supply bulk ingredients to international companies, but we also focus on branded ingredients, a concept we introduced in the industry.

Currently, our products serve five categories – i) Active wellness and physical performance, ii) metabolic health and weight wellness, iii) vision, cognition, and mental wellness, iv) daily energy and productivity performance and v) specifications speciality extracts. Research & Development is the backbone of everything

we produce. Our global R&D centre leads product development, setting the standard for ingredient and extract excellence; focused on developing new products and methods of delivery, isolating new plant bioactive, and establishing novel analytical measures for differentiation and purity.

Today, OmniActive holds 38 patents, has applied for 60 more, and derives 99 per cent of its revenues from exports. In addition, it also boasts heavyweight customers like Pennsylvania-based health and nutrition-related product manufacturer such as GNC, direct-seller of dietary supplements Amway, specialised eye care company Bausch and Lomb, and mass market giants Costco and Sam's club and many other innovative companies that have launched interesting products and platforms in the nutritional space.

Setting up manufacturing units for extracting active compounds from flowers can be challenging. How did you start this process, and how did you manage initial investments and talent acquisition?

Starting something new is always challenging, but you must begin somewhere. We carefully planned the next three years, outlining what the company would look like, the necessary talent, and the processes. We began with a small team, doing everything ourselves.



We also investigated improving processes continually. The advantage of natural products is that you can enhance efficiency at every step. We focused on improving yields, active content, and processing conditions. We collaborated with farmers, creating clusters for more efficient production.

We have made substantial investments in expanding our capacities. Last year, we spent around \$150 million on plant and equipment. Additionally, we allocate about 8-9 per cent of our revenue to R&D, covering clinical studies and research.

Talent acquisition and skill development are crucial for growth. How do you address these challenges in your workforce?

Identifying and retaining skilled individuals is indeed a challenge. We needed both –pharmaceutical and natural product expertise. It took time to convince pharmaceutical experts to transition to the nutraceutical field. We had to sell them on the concept. Once we demonstrated success, more experts joined us. We believe in challenging, providing opportunities, and exposure to our employees, allowing them to grow and excel.

You are also the founder of AHNMI. What was the motivation behind establishing this association, and what role does it play in the industry?

The Association of Herbal and Nutraceutical Manufacturers of India (AHNMI) was formed to create an industry body similar to NASDAQ. We aimed to focus on policy advocacy, consumer

education, interfacing with regulators, and establishing self-imposed industry regulations. Currently, we are primarily engaged in lobbying with the government. The sector is not yet well-organised, but we are working to change that.


What is your international expansion strategy, and which markets are you targeting apart from the US?

Our primary focus has been the USA, but we are now looking at expanding in Asia, particularly Japan, Korea, Taiwan, China, Australia, and New Zealand. India has potential as well, and we aim to support Indian companies wanting to enter the global market.

Exporting to international markets involves meeting stringent standards and regulations. How do you ensure your products comply with these standards?

We have a robust regulatory practice that includes teams in both the US and India. Before entering any market, we thoroughly study and understand its standards and regulations. We design our products to meet these requirements and ensure compliance through rigorous processes.

Lastly, what drives you to excel in your professional role as a visionary leader?

Entrepreneurship is in my blood, and I believe in constantly seeking the next challenge. My purpose is to improve the lives of everyone connected with our company - whether it's our customers, employees, or the farming communities we work with. We aim to bring positive change to people's lives. 



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“WE AIM TO PRODUCE UP TO 300 TURBINES ANNUALLY BY 2040”

The Indian Steam Turbine Market has rebounded to 2019 Levels. In this interview, **Nikhil Sawhney**, VCMS, Triveni Turbines, discusses the company's Rs 12,476 million earnings in 2023, growth, and technological advancements. From trends to future insights, the interview provides a comprehensive view of the workings of the company and the market in general.

Could you provide an overview of the Indian steam turbine market and the demand it is witnessing from other industries?

In 2022, the Indian sub-100 MW Steam Turbine market experienced a 15 per cent growth in terms of megawatts when compared to the figures from 2021. This increase can be attributed to the increase in demand for combined heat and power (CHP) within the industrial sector, which saw the market bouncing back to 2019 levels. The concept of combined heat and power involves the efficient utilisation of surplus steam generated by the turbine in various industrial processes. Furthermore, power produced through this method boasts a cost reduction of 14-15 per cent in comparison to power generated by Independent Power Plants (IPPs).

The Bio-Power industry plays a crucial role in converting diverse potential feedstocks, such as biomass, wood pellets, bagasse, sugarcane residues, and palm oil residues, into solid fuels. CHP or cogeneration plants possess the capacity to harness sustainable thermal resources, such as bagasse-based biomass fuel, to produce low-pressure steam. This steam is generated through extraction steam turbines and serves the dual purpose of generating heat and electricity.

The drive to harness locally available biomass resources, including agricultural and forest residues, has facilitated the generation of power in closer proximity to the point of consumption. Consequently, this has paved the way for the establishment of power production facilities based on biomass resources.

For an environmentally sustainable approach, thermal waste treatment, also known as incineration with energy recovery, provides a viable alternative method. The Waste-to-Energy (WtE) industry encompasses a wide range of treatment technologies that transform waste into electricity, heat, fuel, or other usable materials, along with various residues.



Nikhil Sawhney, VCMS, Triveni Turbines

Triveni Turbines achieved its highest-ever earnings of Rs. 12,476 million in the last quarter of the fiscal year 2023. What factors contributed to this success?

Despite the uncertain global economic conditions, the company performed well in terms of securing orders throughout the fiscal year 2023. The increase in order bookings compared to the previous year can be attributed to completing orders from industrial clients first, followed by power producers, which also

expanded offerings. Additionally, there was a higher demand for API drive turbines.

Furthermore, the business unit responsible for servicing turbine equipment after purchase experienced strong growth due to a significant increase in new orders. This growth has further strengthened the unit's diverse sources of revenue, which are focused on maintaining and improving turbine performance worldwide.

Could you give an insight into your most successful innovations, which have helped the brand gain its reputation? And what new can the industry expect from Triveni Turbines now?

We have achieved advancements in research and development, particularly in impulse and reaction blading technologies and high-efficiency low-pressure stages.

Our company serves a wide range of drive applications and offers tailored solutions from our API product portfolio to meet specific customer needs. These solutions include customisation options for governors, lubrication systems, bearings, and supervisory instruments.

Further, we are involved in the development of subcritical and supercritical CO₂-based power generation systems. These technologies promise improved efficiency and more compact alternatives to traditional steam-Rankine cycles.

The global heat pump market is rapidly expanding due to the favourable properties of these systems. Triveni Turbines is collaborating with leading academic institutions to lead the way in developing next-generation Transcritical CO₂ heat pumps.

How are you incorporating digital solutions into products and services to align with the demands of today?

Our solutions include the latest versions of the SAP ERP system, Primavera for project management, Salesforce for customer relationship management, and a suite of design software tools such as PLM, PRO-E, Ansys, rotor dynamic software, CAD/CAM, and CFD packages.

On the shop floor, we have connected all CNC machines through a central programming unit, thereby eliminating the need for human intervention and minimising errors in machining program execution.

Further, all CNC machines have been equipped with IoT capabilities for real-time measurement and monitoring of manufacturing data, encompassing metrics such as Overall Equipment Efficiency (OEE) and productivity. TTL has embraced manufacturing technologies, including laser alignment for assemblies, 3D printing for prototype development, and CMM for steam path components.

Our learning centre features a Computer-Based

Training (CBT) module that offers comprehensive video-based training on our products.

Can you give an overview of your company's current production volume in terms of units manufactured and describe its evolution over the past few years?

We have consistently made investments in the expansion of our manufacturing capacity. Currently, we operate two manufacturing plants located in Bangalore. Further, we have initiated the establishment of an additional facility in South Africa with the intention of serving our customers in the African region.

At this juncture, our installed capacity allows us to produce 250 to 300 turbines on an annual basis.

Our turbine designs have evolved over the years in response to both market demands and advancements in technologies, such as boilers, cooling towers, condensers, and pumps. At present, our annual production volume stands at approximately 225 machines.


Furthermore, our capital expenditure (Capex) investments have been aligned to augment our manufacturing capacity, with a target of producing 250 to 300 turbines annually by the end of the fiscal year 2024.

What are the most notable trends in the industry that you are observing? Looking forward, what do you predict as the major trends that will shape the power generation industry over the next 5-10 years?

There has been an adoption of cleaner energy sources across various industries. Notably, nearly 80 per cent of our recent order bookings now originate from thermal renewable energy sources.

Customers are seeking ways to enhance energy efficiency, reduce carbon emissions, and cut operational costs. The competitive cost landscape and the changing demands of end-users have driven them to seek improvements in plant efficiency through the adoption of energy recovery technologies. In this context, the potential of API steam turbines offer efficient steam turbines suitable for both power generation and drive applications.

Looking ahead, after recording a 46 per cent revenue growth in the business, are there any expansions or collaborations of the country that we can expect to see?

We are dedicated to pushing the limits of turbine technology and fostering continuous product innovation. We achieve this by forging alliances with research institutions across the globe, participating in the creation of turbines that excel in terms of efficiency. These endeavours aid our customers as they confront the energy efficiency challenges within the global market. 

By Rony Banerjee

UNLOCKING POTENTIAL WITH THE PM VISHWAKARMA SCHEME: A GATEWAY FOR MAJOR INDUSTRIES

The article highlights the multitude of benefits the recently introduced PM Vishwakarma Scheme offers and delves into the plethora of collaboration opportunities it has in store for India's larger manufacturing firms and artisans alike.



India's economy is intricately woven with threads from the traditional 'Vishwakarma' artisans. These craftsmen, the heartbeats of our heritage, have embellished our culture for centuries. Recognising their invaluable contribution and the need to usher them into the contemporary business landscape, the government introduced the PM Vishwakarma Scheme on September 17, 2023. Besides being a beacon of hope for these artisans, this initiative has also unfurled a plethora of collaboration opportunities for India's larger manufacturing firms.

With a robust allocation of Rs 13,000 crore,



the PM Vishwakarma Scheme has a multidimensional approach. It envisions not only skill enhancement and tool modernisation for artisans but also provides avenues for financial empowerment through accessible loans and contemporary transaction methods like online payments. Additionally, it endeavours to broaden their horizons,

introducing their unparalleled crafts to expansive markets.

Shri Narendra Modi, our Honourable Prime Minister, has passionately endorsed this scheme, highlighting its potential to transform a myriad of



'Vishwakarma' artisans, spanning diverse domains like blacksmiths, potters, carpenters, and sculptors. Under the guardianship of the Ministry of Micro, Small & Medium Enterprises (MoMSME), and with the staunch support of Ministry of Skill Development and Entrepreneurship (MSDE) and the Department of Financial Services, the scheme is poised for a holistic impact.

BUT WHERE DO THE GIANTS OF MANUFACTURING FIT INTO THIS MOSAIC?

The strengths of these larger enterprises lie in their vast reservoirs of resources and expertise. By aligning with the Vishwakarma scheme, they can play an instrumental role in sculpting the artisans of tomorrow. These firms can harness their infrastructural capabilities to offer state-of-the-art training, refining artisanal skills to meet global benchmarks.

Moreover, with their technological prowess, major manufacturers have the potential to carve out digital realms specifically curated for artisans. This would entail deploying advanced technologies to foster efficient, secure, and streamlined operations, allowing artisans to navigate the digital world with ease.

One of the most significant boons larger corporations can offer is integration into their expansive supply chains. Such a collaboration would open floodgates of opportunities for artisans, magnifying their reach and thereby, their sales. Furthermore, given the marketing acumen of these large firms, they can architect campaigns that harmoniously blend the allure of tradition with contemporary appeal, making these crafts resonate with today's consumers.

Now visualise, in a remote Indian village, traditional blacksmiths create unique iron utensils and tools, but their reach is limited to local markets.


A global kitchenware conglomerate, seeking unique products, partners with these artisans, recognising the growing demand for rustic, hand-forged items. Integrating the blacksmiths' work into their supply chain, these handcrafted items are refined for modern kitchens and soon make their debut in elite stores across global cities. The conglomerate launches a campaign, "Forged with Tradition," merging the artistry of these traditional blacksmiths

with contemporary culinary scenes. This initiative not only takes the blacksmiths' craft to international audiences but also meets the modern consumer's desire for authentic, story-rich products.

Imagine, in the serene backwaters of Kerala, a group of skilled boat makers, using age-old methods, handcraft traditional wooden boats. Their craftsmanship, rich in cultural heritage, primarily attracts local fishers and tourists. However, a luxury resort chain, aiming to provide authentic experiences to its international guests, discovers these craftsmen. They collaborate, commissioning bespoke, larger versions of these boats, outfitted with modern comforts while preserving traditional aesthetics. Here is a collaboration.

The merger of age-old techniques with cutting-edge technology can be the touchstone of quality enhancement. Major businesses, by facilitating this amalgamation, can assist artisans in elevating the quality of their products while retaining the essence of tradition. In an era where sustainability is paramount, these businesses can also spotlight the eco-friendly characteristics inherent in artisanal products, augmenting their global desirability.

A goldmine of knowledge and expertise lies with these manufacturing giants. By initiating knowledge-sharing platforms, they can significantly bridge the knowledge gaps that artisans might grapple with.

In conclusion, the PM Vishwakarma Scheme is a monumental stride for India's artisans and a beckoning call for its manufacturing behemoths. The confluence of these two worlds promises to fortify India's manufacturing landscape, poised to etch India's name as a manufacturing titan on the global map. This partnership is a synergy of tradition and modernity, not just about commerce but the creation of a legacy. 

EMERGING SENSOR TECHNOLOGIES ARE CRUCIAL IN DEFINING THE FUTURE OF AUTONOMOUS DRIVING

Dr. Balaji Venkataraman, President of TVS Sensing Solutions, shares insights on how sensor technology is driving advancements in auto component performance, electric vehicles (EVs) and ADAS. He also delves into recent technological advancements and innovations in sensor technology, as well as future plans in an interview with **Nisha Shukla**.

How has sensor technology evolved to enhance the overall performance of auto components?

Sensors play an essential role in today's auto component industry. They monitor engine performance, emissions, and fuel usage. With this widespread sensor integration, manufacturers are now able to offer vehicles that prioritise safety, fuel efficiency and driving comfort. In future, vehicles will offer a real-time comprehension of both the external surroundings and the behaviour of their occupants. Therefore, the future of the automotive industry will be heavily influenced by sensor technologies.

How TVS Sensing Solutions are driving advancements in safety, performance, efficiency, and connectivity with advanced sensor technology?

The key driving factor is the rising demand for better safety and security in vehicles. Government regulations are promoting adoption of automotive sensors in various vehicle systems like body control, power steering, temperature regulation and anti-lock braking. These features are gradually becoming standard in vehicles, encouraging sensor manufacturers to include them as common options in their product offerings.



Dr. Balaji Venkataraman, President of TVS Sensing Solutions

For example, our Active Wheel Speed Sensor is a key auto component that monitors the speed of a vehicle's wheel. It is important for the anti-lock braking system, using the sensor to prevent skidding during sudden stops and thereby improving control and road safety.

What role do sensors play in optimising the fuel efficiency of various auto components, and what improvements have been observed?

Sensors for auto components keep an eye on things like engine temperature and fuel mix to make sure the vehicle runs efficiently. Our fluid level sensor helps improve fuel efficiency by monitoring the quantity of brake fluid in a vehicle's braking system ensuring safe and efficient brake performance.

What manufacturing processes do you employ to ensure the precision and consistency of your products, and how do these processes meet the specific requirements of the sensors, solenoids, switches, and electronic components industry?

Application engineering and customisation tailor components to specific vehicle needs and adapts parts for specific models. Auto component manufacturing incorporates several key processes, like cable harness manufacturing, vertical injection molding machines, horizontal and vertical injection molding, resistance welding machine utilisation, core riveting, crimping core tube assembly, coil winding, enamel removal, crimping, and automated assembly workstations. These processes guarantee that our products meet the safety, performance, and quality standards of the automotive industry.

Our manufacturing facilities are equipped with custom-built End-of-Line (EOL) testers, performance testing setups and leak testers to ensure the quality and reliability of our auto components. We also use advanced tooling technologies including Vertical Machining Centers (VMC), Wire EDM, Spark Erosion, Grinding, and Milling, to precision-engineer components to meet the highest standards.

In what ways is your company working towards enhancing the sustainability of its products, manufacturing processes, and operations, considering the global focus on environmental



impact reduction?

We are committed to incorporating sustainable principles seamlessly into our product development and solutions, while focusing on resource efficiency and life cycle assessment. We uphold supply chain sustainability, prioritising ethical practices and fair labour conditions. Our proactive initiatives aim for a net-zero impact, encompassing water conservation, energy-efficient LED lighting, and solar panel installations.

How has the growing demand for Electric Vehicles (EVs) impacted your business, particularly in terms of product demand and innovation?

EV sector is undergoing significant changes driven by industry trends, presenting promising growth opportunities and the potential for success. To address these trends, we're working on solutions specially designed for electric vehicles and those utilising standalone and connected series IIoT, focusing on sustainability needs.

Our offerings encompass ARAI-approved DC-DC converters, Tire Pressure Monitoring Sensors, Side stand sensors, Throttle Position Sensors, and Acoustic Vehicle Alert Systems. Furthermore, our commitment extends to expanding our product portfolio with upcoming additions, including Oxygen sensors, Integrated sensors, and Advanced Driver Assistance Systems (ADAS).

Are there any recent technological advancements or innovations in your sensor technology that you'd like to highlight?

We are dedicated to expanding our product portfolio further, with upcoming additions including Oxygen sensors and Integrated sensors. This also includes



the addition of the fully automated SMT line that fuels the capability to handle high volume electronic products. All our products are rigorously tested to ensure reliability, durability and reduce maintenance requirements enhancing the overall performance and efficiency of electric vehicles.

Can you highlight any unique features or technologies that set your products apart from competitors?

At TVS Sensing Solutions, we have mastered the manufacturing process in the insert molded space for sophisticated product assemblies. On the sensor domain, our focus is on combining several sensing elements into one unit for space saving and better pricing to customers.

How are environmental sensors being employed to ensure compliance with emission regulations and improve the performance of emissions control components?

Environmental sensors are critical in addressing environmental issues stemming from industrial growth and urban development. They can be adapted for various purposes, such as detecting vehicles with high emissions. These sensors monitor and manage the environmental conditions and fuel efficiency of vehicles. Currently, we supply sub-assemblies in turbochargers for emission controls in vehicles.

What impact have sensor innovations had on the development of advanced driver assistance systems (ADAS) and self-driving technologies?

Recent technological developments are bringing us closer to autonomous vehicles. Advanced Driver Assistance Systems (ADAS) make use of a wide range of sensors to smoothen capabilities playing a key role in this domain. These sensors aid in functions like lane-keeping, parking assistance, cruise control, avoiding collisions and recognising traffic signs. They also provide the awareness needed to operate safely and efficiently, making autonomous driving a reality.

What are some recent developments in sensor technology that have contributed to the evolution of

electric and hybrid vehicle components?

In recent years, the demand for electric vehicles has experienced rapid growth especially due to government regulations governing emissions. Several key drivers are fueling the expansion of the market which includes the growing necessity for sensors in electric and hybrid vehicles. The new developments include sensors that monitor battery health, environmental sensors that enhance battery performance and autonomous driving sensors improving safety and navigation, to state a few.

What is the potential future trajectory of sensor technology in the automotive industry, and how might it further transform auto component performance, specifically with reference to connected components?

Sensor technology in the automotive industry is poised for continued advancement, with a focus on connected components. Emerging sensor technologies are crucial in defining the future of autonomous driving.

These advanced sensors act as vigilant observers, constantly monitoring and interpreting the environment, making it safer for vehicles to navigate. This evolution is set to further enhance auto component performance by enabling real-time data exchange and intelligent decision-making.

What is your company's vision for the future, especially in terms of product development and market expansion?

We are proactively looking for growth opportunities to meet the rising industry demands. Our focus is to excel in emerging technology sectors like the EV industry by aligning our resources and expanding our product range through international partnerships. TVS Sensing Solutions marked a significant milestone by establishing an export unit in 2005. Our reputation for delivering products of the highest quality has enabled our expansion into international markets, including the United States, Germany, and China. We are dedicated to fostering innovation, design, and application engineering, which strengthens our capability to meet customer requirements. By leveraging our expertise in these domains, our goal is to establish a significant position in the marketplace. 

By Tony Saldanha, Cofounder and CEO of Inixia and Former VP, Global Business Services & IT at P&G

IT'S TIME TO GO BEYOND END-TO-END PROCESS EFFICIENCY

The article highlights the dire need to look beyond End-to-end (E2E) process “designs” and illustrates why E2E unified “accountability” is the way forward.

End-to-end (E2E) process design is all the rage in supply chain management and beyond these days. E2E process design delivers efficiency across a work process. So, for instance E2E process design in Order to Cash (O2C), eliminates siloes that create inefficiencies between order management (in the Sales function) and accounts receivables (in the Finance function). Or take an E2E

streamlined process that goes from molecule to shelf. That would cut across siloes in R&D (molecule stage), Manufacturing, Planning, and Logistics, and Sales (at the shelf stage). It would result in a super-efficient streamlined work process that ensures information from customers flows backwards not just for supply chain planning and execution, but also to R&D. Such streamlining would cut down the cost of supply chain execution, manufacturing, and out-of-stock losses.

What's not to like about it? I would argue that while there's nothing wrong with this vision, it is good, but not sufficient. It's possible to go even further. In real life execution, we must go beyond E2E “designs” and into E2E unified “accountability”.

Unified accountability provides even more business benefits than E2E process design. How? By ensuring that when things unexpectedly go wrong on a day-to-day basis during execution, there is a human who takes responsibility to address the issue, and to ensure that the overall objective is met. This concept is built into the design of how the aviation industry operates.

Let's study the aviation industry for lessons on unified accountability.

LEARNING ABOUT E2E UNIFIED ACCOUNTABILITY FROM THE AVIATION INDUSTRY

If you think that the business processes in your own company are complex, try running an operation that moves 5 billion passengers every year, in roughly 25,000



commercial aircraft, via 15,000 airports located in 195 countries. And do that with over 99.999999 per cent reliability. And just to make things interesting, do it in a decentralised organisational construct where laws, standards, and procedures are not as tightly controllable as within a single company. There is no single CEO-like entity and no hierarchy for single accountability. Yet this is the industry that provides the benchmark for operational reliability. It can teach us

important lessons about business process excellence given its decentralised and complex setup.

How has it minimised the defects that occur in handoffs from one team to another? And how does it address the organisation issues of functional silos across thousands of companies?

To help us learn, it might be useful to look at an example of a failure. A postmortem of a problem, however painful, can often be useful.

LESSONS FROM THE MALAYSIAN AIRLINES MG370 DISASTER

MH370 took off from Kuala Lumpur for Beijing at 12:42 on March 8, 2014. Fariq Hamid, the first officer, was flying the airplane while the pilot Zaharie Ahmad Shah handled the radios.

Thirty-seven minutes into the journey, the flight approached the border of jurisdiction between the Air Traffic Controllers (ATC) in Malaysia and Vietnam. At such borders, control is passed from one ATC to the next via a prescribed handoff process. In line with this, the controller at Kuala Lumpur Center radioed the pilot the coordinates of the Vietnamese ATC: “Malaysian three-seven-zero, contact Ho Chi Minh one-two-zero-decimal-nine. Good night.” Zaharie responded with a laconic, “Good night. Malaysian three-seven-zero.”

Interestingly, the pilot did not read back the coordinates as required. This is pertinent and was likely related to Zaharie's frame of mind. It was the last word heard from MH370.

The airplane disappeared from the ATC radar a few seconds later. It vanished precisely at the seam of responsibility between the two ATCs, during the handoff process. The next step in ATC handoff would have been for Zaharie to call Vietnam ATC, or, failing that, for the controller to follow up and raise the alarm. These procedures were not followed.

The disappearance of an airplane from ATC radar is extremely unusual. As it happened, the ATC at Kuala Lumpur was busy dealing with other traffic and did not notice it. When he did check later, he assumed that the airplane was out of his range and being safely managed by Ho Chi Minh ATC.

Meanwhile, the Vietnamese ATC, who should have heard from the pilot, tried to contact the airplane, without success. They failed to follow a guideline that requires them to inform the sending ATC if a pilot does not check in within five minutes of being handed off. By the time they contacted the controller at Kuala Lumpur, the plane had been off the radar for 18 minutes.

Further, many of the failsafe processes that should have kicked in, were not followed. Malaysian Aeronautical Rescue Coordination Centre should have been notified within an hour of the disappearance. It was not. It would be four hours before they were notified, by then, it was just too late to help the aircraft.

The key lesson for us in E2E process design is that handoffs are major weak links. The aviation industry builds human accountability (like having the receiving ATC follow-up if the pilot does not check in within 5 minutes). E2E process designs usually don't do that.

LEARNING ABOUT E2E PROCESS ACCOUNTABILITY FROM THE AVIATION INDUSTRY

The MH370 crash is thankfully an outlier when it comes to operational process breakdown. To understand how aviation has achieved process excellence, we need to back up a bit. It's helpful to first understand the various stages involved in improving business processes.

In general, business processes in supply chain and elsewhere achieve excellence via five discrete layers of action:

1. **Fix non-standard processes:** This is the starting point. Imagine what might happen if there were different steps for each country, or each airline, when it came to handling ATC control transfers. That's the first step in improving processes.
2. **Synchronise siloed processes:** Imagine if ATCs were standard but siloed off from other aviation processes, such as airport gate management. Handoff errors would result. This step addresses that.
3. **Execute E2E processes consistently:** Assume that


terminal check-in to gate management to ATC processes have been synchronised but executional discipline is spotty. That can occur because it takes time to stabilise processes. Handoff errors may still occur.

4. **Add robust fail-safe designs to E2E process execution:** Assume that processes from terminal check-in all the way to ATC are well executed. However, if no fail-safe procedures have been designed for the rare situations where problems occur, there will be occasional blowups. That's because while processes are efficient E2E, there is no Unified Accountability for an employee to circumvent or fix perfect-storm-type issues.
5. **Design roles for Unified Accountability of outcomes:** At this stage employees are empowered both to achieve near-zero defects and to constantly evolve processes to keep up process excellence.

Applying these layers to our work on business process maturity, we can see that all five items could cause handoff errors in real life day-to-day execution. The usual E2E process designs address handoff issues for the first three – i.e., Standardisation, E2E process management, and disciplined execution. It is the final two—further reducing handoffs and designing roles for Unified Accountability of outcomes—that are less developed.

Here are tips I would offer to further manage handoff errors to ensure E2E unified accountability:

TIPS TO DELIVER E2E UNIFIED ACCOUNTABILITY IN A WORK PROCESS

1. **Create global process owner (GPO)** for each E2E process. And more importantly design their roles to include E2E accountability for day-to-day operational outcomes. Most often, GPO's accountability includes only process design and quarterly or annual business outcomes.
2. **Streamline** the organisational design between the GPOs and functional operations. In today's world, when a process extends through multiple areas or functions, different people are responsible for each single part. Significant handoff issues and losses occur.
3. **Work backwards** from key customer outcomes to design E2E key performance metrics. This helps in going beyond siloed process efficiency and drives E2E outcomes deep within the organisation.
4. **Eliminate conflicting reward systems** that are based purely on siloed or functional cost reductions and reliability, as opposed to E2E company or E2E customer. The reason for organisational silos is usually driven by functional reward systems.
5. **Re-engineer IT systems** for E2E standardisation and automation. They must eliminate system touches between siloed processes or functions. 

“CONSUMERS ARE NOW REPLACING AC UNITS WITHIN 5-7 YEARS, COMPARED TO THE NORM OF 13-15 YEARS”

With quicker replacement cycles, rising demands and changing lifestyles, the white goods industry is undergoing rapid change. In this interview, **Sukrit Bharati**, MD of Virtuoso Optoelectronics Limited (VOEPL), discusses how a dedication to localization in the midst of these rapid changes can lead to positive outcomes.



Sukrit Bharati, MD of Virtuoso Optoelectronics Limited (VOEPL)

VOEPL was established in 2015. Can you give an overview of the company and tell us how you managed to achieve such significant expansion in merely 8 years?

Virtuoso Optoelectronics Limited (VOEPL) started as a private company in September 2015 and became a public company listed on the BSE SME in September 2022. Its expansion in eight years can be attributed to several key factors.

Firstly, we benefited from a positive geopolitical environment due to stable government played who

ensured a conducive business environment with policy continuity and support for economic development.

Secondly, we found ourselves in the correct market, customer and product mix during the period of expansion. The timing & effort clicked, and we entered the commercial production of EMS (Electronics manufacturing services) and LED Lighting products. We then expanded our range to add white goods manufacturing, with the primary product segment being air conditioners and recently added water dispensers.

We had a vision for localisation in India, and

worked towards it since 2019, this was complimentary to the environment of domestic manufacturing being fostered by the government.

Enjoying support from both investors and customers, we received growth in the form of financial backing, partnerships, and an increase in demand. The developing interest of investors in manufacturing further helped us in our expansion.

What were some of the major challenges you faced during the initial stages of manufacturing in the company, and how did you overcome them?

The foremost challenge was selecting the correct segment of the manufacturing industry to venture into. We opted for Electronics Manufacturing Services (EMS), as there was limited presence of EMS providers in Nashik. We saw a demand and decided to supply.

Another challenge was securing financing. At that time, investors were not keen on funding manufacturing ventures in the SME space, making the initial investment a daunting obstacle.

Additionally, assembling a skilled workforce posed its own set of challenges. Finding individuals with the required skill set and meeting their compensation expectations proved to be a hurdle.

What is the company's current manufacturing capacity, and what are your expansion goals?

Currently, we make around 800,000 indoor air conditioner units and about 400,000 outdoor units in Nashik, Maharashtra. We also have three production lines for electronics and LED products. We're getting ready to make water dispensers, with a capacity of more than 150,000 units per year, and we'll start selling them in the last quarter of 2024.

In the next three years, we plan to start making commercial refrigeration products. We hope to launch these new products in the commercial refrigeration market by the first half of 2025. This will help us offer more products to our customers.

To support our growth, we will build a new manufacturing unit and two smaller manufacturing units in Nashik by the end of this financial year. This will help us increase our manufacturing capacity.

Can you provide insights into specific market trends that you believe will significantly influence the white goods manufacturing sector's growth? How do you foresee the sector evolving in the next 5-10 years?

Several key trends are expected to influence the sector's growth in the coming years:

Shortened Replacement Cycles: This is true particularly for air conditioners. Consumers are now replacing AC units within 5-7 years, compared to the previous norm of 13-15 years. This shift is driven by the demand for

higher efficiency products and changing lifestyles. They are looking for energy-efficient appliances that not only provide comfort but also help reduce energy consumption and utility bills.

Rise in Multiple ACs per Household: Households are no longer limited to just one AC per home; now, multiple ACs are often installed in various rooms. This trend is a testament to ACs becoming a basic necessity in today's urban households, contributing to higher sales volumes.

Environmental Considerations: Consumers are seeking eco-friendly and energy-efficient appliances that have a lower environmental impact. Manufacturers are responding by developing ACs and other white goods with improved energy efficiency and environmentally friendly refrigerants.

Urbanisation and High-Rise Living: High-rise apartments and offices often require room conditioning systems to maintain comfortable indoor environments, further boosting the demand for white goods.

Continued Growth Projections: Year-on-year growth projections indicate an average Compound Annual Growth Rate (CAGR) of 10-12 per cent. This signifies a sustained expansion in the segment, driven by factors such as increasing urbanisation, changing consumer preferences, and the need for more efficient appliances.

How does VOEPL plan to leverage the Production-Linked Incentive (PLI) Scheme for the white goods manufacturing sector in India?

One of our main strategies is to make more parts of air conditioners ourselves. This helps us build things in our own country and rely less on imports. By doing this, we want to make the process of building air conditioners better and add more value to our products made here.

In the PLI scheme for White Goods & LED Lighting, companies get money incentives, usually for selling a certain amount of products that they make in their own facilities. These incentives are tied to selling more products because they can make more parts themselves. This way, we create more jobs and learn more about the products we make in our country.

What upcoming projects, expansion plans, and new product lines can we expect from VOEPL in the near future?

We are actively expanding our manufacturing capacities for Indoor Units (IDUs), Outdoor Units (ODUs), and Electronics Manufacturing Services (EMS). For FY23-24, the company has set targets to produce between 500,000 to 600,000 IDUs and 150,000 ODUs.

We aim to have six manufacturing plants in Nashik by the end of the current year against the two units it had in the beginning of 2022.

VOEPL is also diversifying its product portfolio

with the introduction of water dispensers. This new product is slated for launch during FY24, offering consumers an additional choice in the water cooling and dispensing segment.

We further aim to achieve an annual revenue growth rate of more than 60 per cent in FY24. The company is also exploring opportunities in the process capabilities of materials such as aluminium pressure die casting, brass casting & CNC etc.

How does VOEPL plan to address the evolving consumer preferences for eco-friendly and energy-efficient white goods?

We are committed to reducing our carbon footprint by integrating solar power into our operations. Within the next year, we plan to incorporate solar energy into our manufacturing processes, further contributing to our production of eco-friendly white goods.

We understand that consumer preferences and industry standards are continually evolving. To remain at the forefront, we continually invest in our Research and Development capabilities. We also engage with our customers to gain insights into their changing preferences and requirements. This ongoing dialogue allows us to tailor our product offerings to meet the demand for growing emphasis on eco-friendly and energy-efficient appliances.

What advice would you give to aspiring

entrepreneurs interested in entering the white goods manufacturing industry in India?

For aspiring entrepreneurs looking to enter the white goods manufacturing industry in India, here is some advice:

First and foremost, take the time to identify the right gap in the market. Carefully assess the demands and preferences of consumers to pinpoint areas where your products can fulfil unmet needs. Localised manufacturing can be a strategic advantage, so choose your niche wisely.

Consider focusing on areas with high potential for value addition. The white goods industry often involves products with low margins, so identifying opportunities for enhancing the value of your offerings can be a key differentiator.

Building a strong manufacturing setup is crucial. Ensure that your Return on Investment (ROI) and Return on Capital Employed (ROCE) are robust, as this will form the foundation of your business's sustainability and growth.

Additionally, explore opportunities to integrate technology into your manufacturing processes and products. Technological advancements can enhance efficiency, quality, and competitiveness.

Lastly, consider passing on cost benefits to your customers whenever possible. This not only makes your products more attractive but also fosters customer loyalty. 🏆

JK TYRE SECURES 'BEST-IN-CLASS' ESG GRADING FOR 2ND CONSECUTIVE YEAR

JK Tyre & Industries, a leading tyre manufacturer and the pioneer of radial technology in India, has been graded "Very Good" yet again for the second consecutive year by CareEdge Research as a part of their ESG assessment study. According to the study, the company has been consistently demonstrating exemplary performance across all themes of environment, social and governance. With an overall ESG score of 78 out of 100, JK Tyre has been regarded as the best among peers.

Dr. Raghupati Singhania, Chairman & Managing Director, JK Tyre & Industries, said, "It's a matter of great pride that JK Tyre's strong commitment to become an environmental



conscious organisation has resulted in a noteworthy recognition, which is driven by strong ESG performance across all metrics.

This endorses our utmost intent and reinforces our vision of being the "Green and Trusted Mobility Partners". Our philosophy of adopting and advocating green manufacturing is paving path towards achieving excellence in the era of sustainable development. Our continuous efforts and investments on ESG front are fostering environment and societal development as a whole".

"We are committed to ensure that our processes, products and caring for people as key drivers for ESG performance," he added.

By Jay Shah, Global COE Head - Data Science at Tata Technologies

HOW AI CAN BE LEVERAGED IN MANUFACTURING VALUE CHAIN?

The article closely looks at the immense potential Artificial Intelligence (AI) holds in revolutionising the entire manufacturing value chain, including product design, production, supply chain management, and customer service.

In recent years, the manufacturing industry has undergone remarkable transformations, driven by the adoption of Industry 4.0 and the integration of Artificial Intelligence (AI) as pivotal game-changers. Just half a decade ago, we were still heavily reliant on manual or semi-automated product quality inspection processes. However, today, these tasks can be effortlessly automated, thanks to cutting-edge computer vision systems powered by AI.

Presently, AI holds the potential to revolutionise the entire manufacturing value chain, encompassing product design, production, supply chain management, and customer service. Its momentum has been significantly accelerated by the recent evolution of generative AI technology, marking a profound shift in how we approach manufacturing processes and innovation.

DESIGN AND PROTOTYPING

AI-powered design tools have revolutionised product development in the manufacturing industry. These cutting-edge tools leverage generative design algorithms to generate multiple design iterations based on specified parameters. This not only accelerates the design phase but also optimises products for enhanced performance, reduced costs, and improved manufacturability. As a result, manufacturers not only save time but also minimise material waste, leading to more cost-effective production processes.

PREDICTIVE MAINTENANCE

The adoption of AI-driven predictive maintenance has brought a paradigm shift in equipment management for manufacturers. By meticulously analysing data from sensors and IoT devices, AI algorithms can accurately forecast - when machinery is likely to experience failures and schedule maintenance proactively. This



proactive approach significantly reduces downtime, extends the lifespan of equipment, and slashes overall maintenance costs. Manufacturers can now operate with heightened efficiency and reliability.

QUALITY CONTROL

In the domain of quality control, AI-based computer vision systems have emerged as an indispensable tool.

These systems meticulously inspect products for defects, ensuring not only higher quality but also unmatched consistency throughout the manufacturing process. By harnessing AI's capabilities, manufacturers can maintain rigorous quality standards and meet customer expectations with precision.

SUPPLY CHAIN MANAGEMENT

AI plays a crucial role in the optimisation of supply chain operations. AI-driven inventory management systems employ demand forecasting and real-time data analysis to finely tune stock levels. This ensures that manufacturers always maintain the ideal balance of raw materials and finished goods, effectively minimising storage costs, while sidestepping the pitfalls of stockouts or overstock situations.

Furthermore, AI contributes significantly to route optimisation, resulting in reduced transportation expenses and a decreased environmental footprint. This dual benefit not only improves cost-efficiency, but also aligns with sustainability goals.

CUSTOMISATION EXPERIENCE AND PERSONALISATION

AI's transformative impact extends to enabling mass customisation, enabling efficient production of highly personalised products. The customer experience receives a substantial boost from AI by facilitating product customisation and personalisation. Chatbots and virtual assistants, powered by generative AI,

deliver instant and responsive customer support, while recommendation engines draw on individual preferences to suggest tailored products.

ENERGY EFFICIENCY

The manufacturing industry's growing commitment to sustainability finds a reliable ally in AI. AI-driven systems excel in monitoring and optimising energy consumption by analysing data gleaned from sensors and smart meters. This dual-pronged approach not only trims energy costs but also significantly reduces the

environmental footprint of manufacturing operations.

Artificial Intelligence is unquestionably reshaping the manufacturing landscape, driving process optimisation, elevating product quality, curbing expenses, and bolstering overall competitiveness. Manufacturers that harness AI across their value chain gain a substantial edge in today's dynamic marketplace. As AI technologies continue to evolve, it remains imperative for manufacturers to adapt and wholeheartedly embrace these innovations to maintain their leadership position in the industry.

UPDATE

HARYANA STATE GOVERNMENT CONFERS DELTA ELECTRONICS INDIA WITH "BEST FACTORY" AND "BEST ENVIRONMENT" AWARDS

Delta Electronics India, a leading provider of power and thermal management solutions, announced its recent recognition by the Haryana State Government, which has awarded the prestigious "Best Factory" Award, an annual honour presented to only one organisation in the entire state of Haryana. Additionally, Delta Electronics India has been declared the winner of the "Best Environment in Factory Premises" Award. The "Best Factory" Award recognises excellence in manufacturing and operational efficiency. Both accolades serve as a testament to Delta Electronics India's unwavering commitment to quality, innovation, and best practices in the industry.

Niranajan Nayak, Managing Director of Delta Electronics India, expressed his gratitude, stating, "Receiving these esteemed awards is a remarkable achievement for us. It is a testament to our unwavering commitment to excellence and our dedication to providing a safe and environmentally responsible workplace."

Delta Electronics India's dedication to maintaining a safe, healthy, and environmentally friendly



workplace has earned the organisation the "Best Environment in Factory Premises" Award. This accolade underscores the company's commitment to environmental responsibility and employee well-being. These prestigious awards were conferred by the Haryana State Government through the Department of Labour, as part of their recognition of outstanding achievements in Safety, Health, and Working Environment for the year 2022.

The awards were presented during an official ceremony attended by the honourable Chief Minister of Haryana, Shri Manohar Lal Khattar. Delta Electronics India's commitment to maintaining these high standards was further exemplified by a thorough verification process. After the submission of the award entry, officials from the Department of Labour visited Delta Electronics India's Gurugram campus to verify the information provided, ensuring the utmost integrity and credibility of the awards.

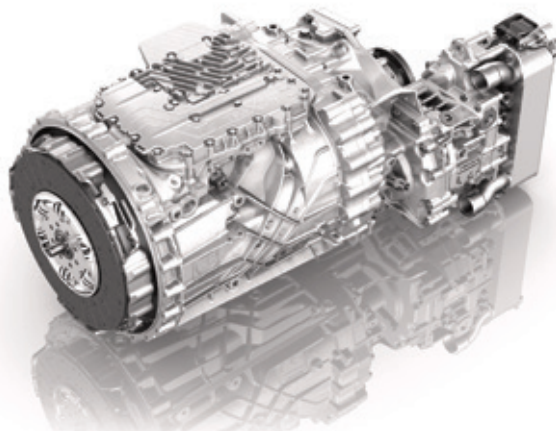
Dilip Banskota, DGM, Delta Electronics India, added, "These awards reflect our collective effort in upholding the highest standards of safety and environmental responsibility. We are proud to have our hard work and dedication acknowledged."



ZF PRODUCES MILLIONTH TRAXON UNIT, SAYS TRAXON 2 IN MAKING

The Commercial Vehicle Solutions (CVS) division of ZF has reached a significant production milestone for its TraXon transmission system. The 1 millionth unit was recently manufactured at the Friedrichshafen assembly line.

Winfried Gründler, who leads the driveline systems product line for ZF's Commercial Vehicle Solutions division, highlighted TraXon's industry-leading status due to its exceptional design, reliability, and ability to enhance energy efficiency. This makes TraXon an invaluable solution for commercial vehicle owners in terms of Total Cost of Ownership (TCO).



Notably, just a year ago, TraXon reached the 500,000-unit milestone, primarily produced at the Friedrichshafen main plant. However, global

expansion led to production at ZF's facilities in Jiaying (China) and Sorocaba (Brazil). In a mere 18 months, production doubled to meet the increasing demand for efficient systems worldwide.

Building upon the technological excellence of the TraXon system, ZF is preparing for the launch of its successor, TraXon 2, set for series production in 2024. TraXon 2 will feature further innovations, including ZF's in-house mechatronics and a new electronic control unit. The latter will enable new software functions with remarkable computing power, such as cybersecurity measures and over-the-air updates via mobile communications and WLAN.

HEXAGON LAUNCHES MOULD AND DIE SUITE

Hexagon's Manufacturing Intelligence division has released the HxGN Mould & Die, an integrated suite of specialised CAD/CAM, engineering, and automation tools. This suite is designed to enhance operational efficiency, reduce costs, and deliver high-quality tools across various industries, such as automotive and aerospace.

The primary goal of the HxGN Mould & Die suite is to enable mould designers and makers to achieve excellence in designing and manufacturing plastic injection moulds, progressive dies, forming dies, and similar tools.

It encompasses a wide array of capabilities, including CAD/CAE for plastic injection mould design, CAD/CAE for progressive die design, CAD for manufacturing preparation, CAM for CNC machine-tool programming, process simulation, G-code verification and optimisation, shop-floor production intelligence, and automation features driven by Hexagon's Nexus digital-reality platform.

Chuck Mathews, the General Manager of Production Software at Hexagon highlighted Nexus, which enhances automation and collaboration, streamlining 3D model sharing and providing access to libraries for tooling, fixtures, and materials.

Parth Joshi, Chief Product & Technology Officer at Hexagon, noted, "The HxGN Mould and Die suite represents an exciting development, combining our customers' challenges with our deep domain knowledge to achieve more."

For plastic injection mould manufacturers, the suite offers tools for design and engineering, flow simulation, reverse engineering, automated electrode design, and

CNC machining. It builds upon Hexagon's renowned VISI and WORKNC software, providing comprehensive multi-axis CAM programming capabilities, direct modelling of solids and surfaces, and support for constructing, editing, and repairing complex 3D geometry. Reverse engineering tools allow efficient creation of solid models from scanned data, essential for mould repair and redesign when CAD files are unavailable.

Additionally, the suite includes plastic flow analysis tools to aid shop-floor teams in producing cost-effective and reliable moulds. These user-friendly simulation capabilities ensure that even non-engineers or less experienced employees achieve optimal results. The suite further simplifies intricate injection mould feature creation with automated design and simulation of EDM electrodes and their holders.

For progressive die manufacturers, HxGN Mould and Die provides a connected workflow

with tools for design, engineering, simulation, and production. It enables step-by-step unfolding of surface and solid models, granting designers greater control over each forming stage. Flexible layout capabilities and the ability to simulate strip performance at any stage simplify the analysis of design changes. The software assists manufacturers in predicting spring back and offers compensation strategies when material performance issues arise.

Moreover, the suite supports shops in fully utilising advanced machine tools, utilising Hexagon VISI and WORKNC software to optimise machining cycles and specialised cutting strategies specific to mould production. Prior to machining, CNC programs can be simulated and verified using NCSIMUL, the suite's G-code simulation software, which replicates the entire machining environment for an accurate digital representation of machinery, parts, and processes.

NEW UNIVERSAL LOADING SYSTEM: INSERTLOAD

The new insertLoad automation solution supports the loading and unloading of S33 and S31 universal cylindrical grinding machines and can load workpieces between centres and into the chuck.

Where customised solutions were previously necessary, the new universal loading system from STUDER now enables standardised automation for loading and unloading the S33 and S31. insertLoad can be used for centre distances of up to 1,000 millimetres (39.4 inches), thus closing a gap in standardised automation systems. The workpieces can be up to 100 mm (3.94 inches) long and weigh 1.5 kg (3.3 lbs) in alternating mode or 5 kg (11 lbs) in a single mode. The sophisticated design and the ease of use with the digital setup wizard allow users to configure this themselves for centres and chucks - no programming knowledge is required. And insertLoad can handle workpieces that are stored either vertically or horizontally.

The Best Combination of Standardisation and Flexibility

The new STUDER loader combines the advantages of a standardized system with great flexibility. It handles a wide variety of parts in terms of geometry, weight,



and size; even the capacity of the drawers and the degree of autonomy can be adapted based on the needs and requirements. Loading and unloading is handled by a Fanuc robot, which moves independently on a linear axis between the loader and the machine's work area. Typically, the time without human operator intervention is between thirty and sixty minutes.

STUDER placed particular emphasis on safety during development. For example, a loading hatch separates the loading area of the insertLoad from the working area of the machine to prevent

flame flashback during machining processes using grinding oil. In addition, the software and a safety switch ensure that grinding technicians are not endangered in the event of a deflagration.

Availability for Additional Machines Planned

The insertload will be presented to the international trade public for the first time at the world's leading trade show for metalworking, EMO, in Hannover, Germany (September 18 to 23, 2023). Initially, it will only be available for the S33 and S31 CNC universal cylindrical grinding machines, but the availability for other models is in preparation. The S33 and S31 are ideal grinding solutions for small to large workpieces in single, small batches and volume production. Both machines feature distances between centres of 400 to 1,600 millimetres (15.75 to 63 inches) and a centre height of 175 millimetres (6.9 inches).

INTERNATIONAL TRACTORS LIMITED (ITL) LAUNCHES 5 NEW TRACTOR SERIES, AIMS TO DOUBLE ITS GLOBAL SALES IN NEXT 3 YEARS

International Tractors Limited (ITL), India's number one exporter of tractors, recently launched 5 tractors, including their electric model – Solis SV Series, with cutting-edge technology to transform the world farming landscape. These revolutionary farm machines offer a superior blend of advanced technology, power, and versatility to enhance productivity and efficiency for farming communities worldwide. The new product launch happened concurrently with ITL's global conference 'Global Partners Summit (GPS) 200' in Gurugram, India which saw participation of over 200 channel partners members from various countries of the world.

The new line-up of tractor comprises Series S, Series C, Series H, and Series N, along with the SV series, and all products are power packed with world-class technology and advanced emission control system. Leveraging its strengths of a strong manufacturing base in India and superior worldwide network of 3,000 dealers, ITL offers highest quality products at a very competitive cost to farmers across the globe.



While Series H, Series S, and Solis SV models are launched globally, Series C will be available for European markets and Series N will cater to markets including Europe, USA, Africa and South America Regions.

The EV variant in particular guarantees superior torque availability at all the times and can be charged from 0-100 per cent in 3-3.5 hours using a fast charger and in 8 hours using a regular charger.

Sharing his thoughts on the exciting launch, Rahul Mittal, Executive Director of ITL said, "We have found a winning formula by combining European styling and Japanese quality at Indian manufacturing costs. The special ingredient in this formula is our constant growth mindset with biggest network of channel partners who dream big, are willing to take up new challenges and are ready to reinvent. This formula is shaking up the global tractor industry. Our aim is to help farmers all across the globe to increase their productivity and make a difference in their life. We aim to achieve that through innovation."

SWARAJ TRACTORS LAUNCHES 5 NEW PRODUCTS

Swaraj Tractors has launched five new tractors in the 40-50 HP range with a total investment of Rs 200 crore. According to Harish Chavan, CEO - Swaraj Division, M&M Ltd, these tractors align with the regional demand. He further said, "We can create multiple variants with different specifics for various regions be it South, North, East or West."

"With this new tractor range, we're steering the brand into the future, by enhancing its core of power and reliability and making it ready for future agriculture mechanisation needs. Beyond performance, this new range emphasizes comfort, versatility for emerging applications and broader customer appeal with its contemporary but authentic styling," he said.

With an unwavering commitment to empowering farmers and boosting agricultural productivity, this range sets new performance standards in this fast-growing segment. The new tractors seamlessly blend power, reliability, and style to conquer even the most challenging conditions with the latest features and technology.

Designed to handle heavy and modern implements with ease, the new range redefines agricultural operations, effortlessly meeting the demands of modern-day agriculture, delivering exceptional power and increased productivity in both existing and emerging applications.

Hemant Sikka, President – Farm Equipment Sector, M&M Ltd., commented, "Through this new Tractor range, we're offering the latest features and technology to elevate mechanisation in Indian agriculture and empower farmers to achieve higher yields and reduce effort, fostering growth and prosperity." He further added, "As far as fuel efficiency is concerned, these tractors are 7-8% fuel efficient than our previous ones."

The new Swaraj range is now available at all Swaraj Dealerships across India, offering excellent value for money. Prices start at Rs 6.9 lakh for 42 HP (31.3 kW) for the base variant and go up to Rs 9.95 lakh for 50 HP (37.2 kW) for the top-end model. To sup-



port farmers, Swaraj Tractors will also provide attractive financing options, ensuring easy access to the latest Swaraj tractor range.

Furthermore, these tractors come with a six-year warranty, highlighting Swaraj Tractors' unwavering commitment to quality and customer satisfaction, assuring reliability and peace of mind for the farming community.

That said, to enhance the brand's appeal to a wider customer base, Swaraj has also roped in its own satisfied customer cricketer MS Dhoni to endorse the brand.

IGUS-POWERED AUTOMATIC BEER TAP DELIVERS RAPID, FOAM-FREE POURING

One Two Beer GmbH has introduced an automatic beer tap. This state-of-the-art device features a mobile tap head that can swiftly and precisely fill beer cups in just five seconds, eliminating the age-old issue of foam overflow.

The idea is the integration of igus drylin linear guide technology, characterised by hygienic standards, lubrication-free operation, and durability.

Automatic Beer Tap System

The One Two Beer automatic beer tap system is engineered to cater to large crowds efficiently. The system consists of two plastic cups placed side by side, resembling the setup of a coffee machine. With a simple press of a button, the dispensing heads facilitate a flawless beer pour.

This bottom-up filling approach eliminates the problem of foam overflow, allowing beer enthusiasts to enjoy their beverages without any delay.

Engineering Challenges

Developing the automatic beer tap posed a unique set of technical challenges, as said by Tamás Kozma, Chief Information Officer at One Two Beer GmbH. Kozma, "To achieve rapid beer dispensing, a high-speed linear



guide with minimal friction was essential." Furthermore, the system needed to maintain a precision level of up to one-tenth of a millimetre.

Hygienic and Lubrication-Free Linear Guide

The linchpin of the system's efficiency lies in the operation of the linear guide. The tap is affixed to a flange lead screw nut sourced from the igus dryspin JFRM series.

The lead screw nut is constructed from FDA-compliant high-performance plastic, an inherently self-lubricating material that ensures smooth and low-friction dry operation. Moreover, this polymer nut resists the accumulation of dirt, simplifying the cleaning process with water or high-pressure methods.

Enhanced Efficiency

Furthermore, the design of the lead screw incorporates enlarged thread flanks, which increase the surface area for power transmission.

This asymmetrical thread design extends the service life by approximately 30 per cent compared to symmetrical trapezoidal threads. Additionally, the flattening of the flank angles of the lead screw nut and lead screw itself contributes to an efficiency rate of 82 per cent, surpassing industry standards.

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