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Navigating the Cutting Edge of Industry News

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Engineering the Intelligent **Future of Manufacturing**

As global manufacturing enters a new phase of digital maturity, the convergence of intelligent technologies, sustainable practices, and data-driven decision-making is no longer optional—it is imperative. The April edition of Machine Edge Global brings into focus the innovations and ideas shaping this transition, offering readers a comprehensive look at how industries are evolving to meet the demands of a smarter, faster, and more resilient future.

The manufacturing sector today stands at a defining crossroads. The promise of Industry 4.0 is no longer a distant vision—it is actively reshaping factories, supply chains, and business models across the globe. At the heart of this transformation lies a powerful enabler: smart sensors. As highlighted in our cover story, "The Role of Smart Sensors in the Future of Industry 4.0: WIKA at the Forefront," these devices are revolutionizing how industries operate. No longer limited to passive data collection, smart sensors now serve as intelligent nodes within connected ecosystems—processing, analyzing, and communicating data in real time. This evolution is driving unprecedented levels of efficiency, safety, and predictive capability across manufacturing environments.

But the transformation extends far beyond the factory floor. In this edition, we explore how mobility and logistics are undergoing a similar reinvention. In our exclusive interview with Akash Gupta, Co-Founder & CEO of Zypp Electric, we delve into how electric vehicle fleets and rapid delivery platforms are redefining urban logistics. His insights into battery swapping infrastructure, AI-powered fleet optimization, and expansion into Tier 2 and Tier 3 cities highlight a broader shift towards scalable and sustainable transportation solutions in India. Equally compelling is the growing role of artificial intelligence in enhancing reliability across the transportation lifecycle. Our feature on Predictive Vehicle Health underscores how vehicles are evolving into software-defined systems capable of continuous self-assessment. With the exponential growth in data generated by connected vehicles, predictive analytics is unlocking new possibilities—minimizing downtime, improving safety, and extending asset life.

In parallel, the materials and infrastructure supporting industrial growth are also undergoing significant innovation. Our interaction with Mohammed Hafeez of Garware Technical Fibres Ltd. sheds light on how advanced materials, stringent testing protocols, and sustained R&D efforts are redefining industrial safety standards. Meanwhile, our article on domestic manufacturing of basic monolithics examines its transformative impact on steel industry supply chains, especially in the context of India's rising production capabilities and the need for operational resilience. Sustainability, too, remains a central theme in this issue. As urbanization accelerates, the focus is shifting toward building smarter and greener environments. Our feature on green elevators explores how even seemingly small components of infrastructure can contribute meaningfully to energy efficiency, environmental responsibility, and occupant well-being.

Together, these stories paint a clear picture: the future of manufacturing is interconnected, intelligent, and increasingly sustainable. Success in this new era will depend on how effectively organizations can integrate technology with strategy, innovation with execution, and growth with responsibility.

As you navigate this edition of Machine Edge Global, we invite you to reflect on the opportunities and challenges that lie ahead. The pace of change may be rapid, but so too is the potential for innovation and impact. By embracing intelligent technologies, fostering collaboration, and prioritizing sustainability, the manufacturing industry is well-positioned to lead the way into a smarter, more resilient future.

Sanjay Jadhav

Sanjay Jadhav
Founder & Editor, editor@machineedgeglobal.com

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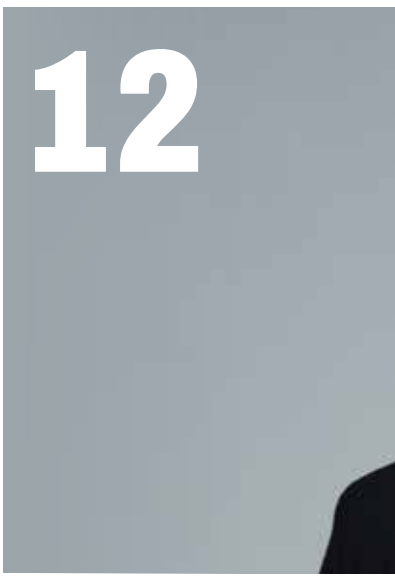

MR. GAURAV BAWA,
Senior Vice President,
WIKA India

The Role of Smart Sensors in the Future of Industry 4.0: WIKA at the Forefront

Industry 4.0 is reshaping the global manufacturing landscape by merging physical operations with digital intelligence. At the core of this transformation are smart sensors, devices that not only measure but also process and communicate data - enabling smarter, safer, and more efficient industrial ecosystems.

As industries evolve, WIKA continues to play a pivotal role by delivering high precision instrumentation, advanced transmitters, and IIoT-enabled solutions that support fully connected, automated operations.

Smart Sensors: The Foundation of Industry 4.0

Smart sensors combine measurement accuracy with digital communication and embedded intelligence. Their growing importance stems from their ability to:

- **Enable Real-Time Process Insight:** Smart sensors provide continuous, accurate data that feeds into SCADA, PLC, or cloud platforms, allowing instant, informed decision-making.
- **Support Predictive Maintenance:** With built-in diagnostics, sensors monitor equipment health and detect early deviations. This helps industries shift from reactive to predictive maintenance, reducing downtime and improving asset lifespan.
- **Improve Connectivity Across the Plant:** Industry 4.0 requires interoperability. Smart sensors support protocols like HART, IO-Link, PROFIBUS and wireless IIoT, ensuring seamless communication across systems.
- **Enhance Safety and Compliance:** By monitoring critical parameters in real time, smart sensors help maintain regulatory standards and avoid hazardous situations.

WIKA's Role in Accelerating Industrial Digitalization

Advanced Transmitters for Smart Automation

WIKA's pressure, temperature, level, flow, force sensors are engineered with digital capabilities that align perfectly with Industry 4.0 needs. Instruments such as the S-20 pressure

transmitter or TR34/35 temperature transmitters with IO-Link offer:

- High accuracy and signal stability
- Intelligent diagnostics
- Remote parameterization
- Seamless integration with automation platforms

IIoT-Enabled Solutions

WIKA's IIoT-ready portfolio includes wireless sensors enables the following benefits:


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- Reduce wiring costs
- Enable remote monitoring
- Improve accessibility in hazardous or hard-to-reach areas
- Support cloud-based data analysis

"At WIKA, we believe that smart sensors are not just instruments - they are the digital pulse of modern industry. As manufacturers accelerate toward Industry 4.0, our mission is to empower them with intelligent, connected, and highly reliable measurement technologies. By integrating advanced transmitters, IIoT-enabled solutions, and data-driven insights, we are helping our customers build operations that are safer, more efficient, and future-ready. The industries of tomorrow will be shaped by precision and connectivity, and WIKA is committed to leading that transformation."

Smart Sensors in Action: Real Impact Across Industries

WIKA's smart sensing technologies are already transforming sectors such as:

- Oil & Gas: Wireless monitoring and explosion-proof transmitters enhance safety and uptime.
- Pharmaceuticals: High-precision sensors enable strict compliance and batch consistency.
- Food & Beverage: Hygienic smart sensors ensure transparency across production lines.
- Power & Energy: Smart transmitters monitor critical temperature and pressure parameters for optimized plant performance.

Conclusion

Smart sensors are the backbone of Industry 4.0, enabling real-time intelligence, predictive maintenance, and seamless connectivity. With its strong legacy in precision measurement and its forward-looking innovations in IIoT and digital instrumentation, WIKA is not just adapting to Industry 4.0 - it is shaping it.

"How Zypp Electric is Redefining Last-Mile Logistics with EVs"

As India accelerates its transition toward sustainable mobility, electric vehicles are rapidly becoming central to the future of urban logistics. At the forefront of this transformation is **Akash Gupta, Co-Founder & CEO of Zypp Electric,** a company that has emerged as a key player in enabling electric last-mile delivery solutions for India's booming quick commerce ecosystem. In this interview with **Sanjay Jadhav, Editor, Machine Edge Global**, Gupta shares insights on how the convergence of EV fleets and rapid delivery platforms is reshaping city logistics, the role of battery-swapping infrastructure and AI-driven fleet management, and how Zypp is building a scalable, sustainable model for India's evolving mobility landscape. He also discusses the company's expansion strategy across Tier 2 and Tier 3 cities and the broader vision of creating cleaner, more efficient urban transportation networks.

AKASH GUPTA,

CO-FOUNDER & CEO OF ZYPP ELECTRIC,

Q. Zypp Electric operates at the intersection of EV mobility and last-mile logistics. How do you see the convergence of quick commerce and electric fleets shaping India's urban transportation ecosystem over the next five years?

The quick commerce boom expected to reach ₹2,500-5,500 crore by 2030 will make electric vehicles the backbone of urban deliveries across India. We're already seeing this shift happen: in metros like Delhi-NCR, Zypp handles 15-20% of delivery volumes, and we expect EVs to power over 50% of all urban last-mile deliveries by 2031.

This convergence is creating smarter, cleaner logistics networks. Our AI-powered routing, combined with 30-second battery swapping, enables delivery partners to meet aggressive 10-15 minute SLAs without compromising on sustainability. We've already completed 110 million deliveries, cutting 60 million kg of emissions in the process proving green logistics can be both fast and profitable.

Cities are shifting to "electric-first" delivery ecosystems, and Zypp is leading this transformation by scaling to 100,000 EVs across 25 cities by 2030. Our fleet achieves 87% utilization compared to the industry average of 60%, showing that sustainable operations can actually be more efficient and economical. As quick commerce grows, electric fleets won't just be an alternative they'll become the standard for how India moves goods in its cities, creating cleaner air, lower costs, and better livelihoods for delivery partners.

Q. Battery lifecycle management is becoming a crucial factor in scaling EV fleets. What innovations or partnerships is Zypp Electric exploring to optimize battery performance, swapping efficiency, and end-of-life sustainability?

Zypp optimises battery performance through our strategic partnership with

Indofast Energy, which enables rapid 30-second battery swaps at stations located every 5 km in key tier 1, 2 cities like Delhi NCR and Bengaluru. This eliminates charging downtime entirely, giving riders unlimited range and keeping delivery partners productive throughout their shifts.

On the technology front, our FleetEase AI platform uses predictive maintenance alerts and real-time battery health monitoring to extend battery lifespan by 20-30%. The system analyses battery performance data continuously, flagging potential issues before they

cause failures helping us maintain 90% fleet uptime while reducing replacement costs.

For end-of-life management, we're building a comprehensive recycling ecosystem. Technicians trained through the Zypp Academy handle efficient repair and refurbishment services, ensuring batteries are used to their fullest potential. Looking ahead, our partners focus on R&D on modular battery designs that can be repurposed for stationary energy storage after 5+ years of vehicle use, creating true circular economy value. This means batteries don't just get discarded, they get a second life powering homes or businesses before final recycling, maximising both environmental and economic returns.

Q. With increasing focus on ESG compliance and carbon accounting, how is Zypp enabling enterprise clients to measure and transparently report their emission reductions through your fleet solutions?

Zypp makes it simple for enterprise clients to measure and report their environmental impact through our custom dashboards, which provide real-time tracking for every delivery and follow industry standards for carbon calculations. We've eliminated over 60 million kg of emissions fleet-wide with verifiable data through API integration for their Scope 3 reporting.

The dashboard goes beyond carbon metrics to show tangible benefits: each delivery partner saves approximately ₹5,000 monthly on fuel costs, while cities benefit from reduced noise and air pollution. All data is audit-ready and exportable, making compliance reporting straightforward rather than burdensome.

Critically, our clients don't have to choose between sustainability and performance; we maintain strict SLAs while delivering greener logistics. Our achievement of positive EBITDA since July 2025 demonstrates that sustainable operations are financially viable at scale, not just an idealistic goal. This proves that ESG compliance and business growth can go hand-in-hand, making it easier for enterprises to commit to zero-emission logistics without compromising on speed or reliability

Q. India's EV adoption story differs significantly from global markets. What unique challenges and opportunities does Zypp encounter in Tier 2 and Tier 3 cities, and how are you adapting your business model for these regions?

Expanding beyond metros presents unique challenges and exciting opportunities. In cities like Jaipur and Hyderabad, we face underdeveloped charging infrastructure and inconsistent state policies, but these markets offer strong demand from gig workers and significantly lower operating costs.

Zypp adapts through a hub-centric approach, we establish large operational hubs (5,000+ sq ft) in strategic locations like Gachibowli and Jaipur that serve as onboarding and service centres. Partnership with existing BaaS partners enables us to rapidly deploy 1,000 EVs within a month without waiting for public infrastructure. We leverage local subsidies and policy incentives wherever available, keeping our asset-light rental model accessible.

Our B2C rental program specifically targets youths, professionals and gig economy workers in these cities, helping them with low cost mobility and earn ₹25,000-35,000 monthly, about 20% higher than traditional delivery jobs through ICE Vehicles without vehicle ownership burdens. The playbook we perfected in metro battery swapping networks, driver training, and quick deployment translates effectively to smaller cities, just adapted for local conditions and purchasing power.

This approach turns infrastructure gaps into competitive advantages, as we build the ecosystem ourselves rather than waiting for it to materialise.

Q. As competition intensifies in the EV logistics space, what will differentiate Zypp Electric in the long term—technology integration, fleet economics, driver welfare programs, or strategic partnerships?

Zypp's competitive edge comes from combining smart technology, people-first programs, and strong partnerships. Our FleetEase AI achieves 87% fleet utilisation through dynamic allocation, ensuring vehicles are always productively deployed while meeting strict SLAs for partners like Swiggy, Zepto, and Sun Mobility.

We invest heavily in driver welfare. The Zypp Academy trains delivery partners, while our rental model helps them earn sustainable livelihoods without upfront vehicle costs.

Beyond logistics, we're diversifying revenue through Zypp Ads partnerships with Rapido and Paytm, creating additional value streams.

Our purpose-built high-speed logistics EVs and battery swapping infrastructure create operational advantages competitors can't easily replicate. As we scale toward 100,000 vehicles and prepare for an eventual IPO, this holistic approach—technology that works, people who thrive, and partnerships that deliver- positions Zypp for sustained market leadership in India's EV logistics revolution.

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SUNDAR GANAPATHI,
Chief Technology Officer for Automotive, Tata Elxsi

Predictive Vehicle Health:

AI-Enabled Reliability Across the Transportation Lifecycle

Today's vehicles are no longer just mechanical machine with few sensors and electronics control units. Over the last ten years or so, developments in vehicle connectivity, software, and data analytics have gradually transformed vehicles to software intensive intelligent devices capable of continuously assessing their own condition and performance. With the growing software content of vehicles, the volume of vehicle operation-related data has grown substantially, opening new doors to improving vehicle reliability in the transportation sector.

This transformation has altered the approach of the transportation sector toward vehicle maintenance and design validation. Traditionally, vehicle manufacturers have counted on reactive approaches to vehicle reliability and maintenance. However, with the help of artificial intelligence and digital simulation technology, vehicle manufacturers are now able to use predictive analysis to identify vehicle complications and optimize vehicle performance.

Predictive Maintenance Models: Anticipating Failures Before They Occur

Modern automobiles use a vast network of sensors to monitor performance and environmental factors. In many circumstances, a single car may have 70 to 100 sensors that continually collect data on engine performance, temperature changes, braking patterns, vibration levels, battery health, and exterior driving conditions.

Meanwhile, car links have exploded. More than 400 million automobiles around the world now have some form of connectivity and more than 60% of the vehicles sold today are linked. The growing web of connected cars is generating huge amounts of data on how vehicles actually perform in the real world.

The influx of data has arrived alongside major advancements in artificial intelligence and machine learning technology. Sophisticated AI algorithms can now sift through large amounts of data and identify patterns that traditional analytic methods might miss.

Predictive maintenance models use this skill to monitor vehicle performance data and operating signals. Over time, they learn to recognize early warning signs of component wear or abnormal behavior. For instance, slight changes in vibration, heat distribution, electrical load or energy consumption may suggest that a component is close to failure.

By recognizing these signals early, predictive systems can predict the remaining service life of certain components. Rather than waiting for an engine to fail, maintenance crews or vehicle owners can pre-empt possible failures before they happen. The shift to predictive, rather than reactive service, improves reliability and saves on costly and wasteful maintenance.

Digital Twin Analytics: Closing the Loop Between Design and Operations

In addition to predictive maintenance, the creation of digital twins is transforming the way that automobiles, and their parts, are designed and tested. The digital twin is a virtual representation of a physical part or system that an engineer can use to assess how it behaves in various operating environments. Simulation techniques have long been used to determine mechanical component structural strength, endurance, and stress levels. These simulations help engineers

to understand how components may behave in real-life scenarios.

Recent developments in simulation technology have expanded the range of digital twins. Now, engineers can develop accurate digital models of complex components, such as electric motors, battery systems, integrated circuits, and electronic control modules. These models can simulate electrical, thermal, mechanical, and even chemical properties.

However, simulations cannot capture every real-life scenario. Driving conditions differ dramatically depending on how often a vehicle is used, the environment it is operating in, and the driving patterns of its occupants. Real-life data gathered from connected vehicles is extremely valuable in these conditions.

Engineers can use operational data and digital twin models to improve and increase the precision of simulations. Machine learning algorithms can analyze data and predict how components will behave over time.

This creates an ongoing feedback loop between design and real-life operations. Engineers can assess whether components behave as intended once vehicles are in operation and make better-informed decisions in subsequent iterations of the design. In some cases, this data can also be used to make changes while the vehicle is in operation.

Operational Efficiencies: Minimizing Downtime Through Intelligent Diagnostics

Greater availability of real-time vehicle data increases diagnosis and maintenance management.

Predictive diagnostics in passenger vehicles can enhance the whole ownership experience. Drivers can receive alerts of probable trouble in advance, instead of experiencing sudden failures. This

allows them to plan for repairs in advance and avoid unnecessary interruptions on a road trip.

The benefits of predictive diagnostics are more evident when it comes to commercial transportation. Fleet depend heavily on vehicle availability and performance. Unplanned downtime will upset logistics, delay shipping and lead to loss of money.

Connected vehicle data and predictive analytics enable fleet operators to continually monitor their truck's health. That means if a truck part is wearing down, they can plan maintenance to happen at the most convenient time for them – during normal logistics planning or a scheduled break.

This proactive planning reduces unscheduled repairs, boosts fleet availability and enhances operational efficiency. The prospect of being able to forecast maintenance across large transportation networks could bring about huge gains in reliability and cost savings.

Sustainability Outcomes: Optimizing Performance Across the Lifecycle

Aiming for larger sustainability goals, predictive vehicle health solutions are moving beyond operational benefits.

An increasing trend is the use of predictive information for optimizing software-assisted automotive systems. With the number of software-assisted features in automotive increasing, performance parameters can be altered based on the operating data. Such modifications can help to increase energy efficiency, reduce wear-out of components, and improve overall system performance.

Digital twin technologies can also provide more accurate estimates of the remaining useful life of vehicle components, with components being replaced according to maintenance schedules designed to avoid unexpected failures.

Predictive analytics can support maintenance decision-making based on the condition of components rather than calendar time. This means that components can often be used for longer durations without compromising safety or performance. Therefore, fewer components are prematurely rejected, which results in less material waste and more efficient use of resources.

This functionality is especially critical in the era of electrification of vehicles. High-value components such as battery systems and power electronics are large capital expenditures in both material and energy investment. Knowledge of the degradation of these systems over time can enhance their longevity and lead to vehicle operation that is more sustainable.

Toward a More Intelligent Mobility Ecosystem

The transportation industry is rapidly moving toward a future in which cars are constantly monitoring their own performance. Combining sensor data, connectivity, artificial intelligence, and digital twin technology is the key to unlock smarter vehicle health management.

Predictive maintenance models that predict likely failure modes years in advance, digital twins that better explain component performance, and advanced diagnostics that minimize downtime in both passenger and commercial vehicles, improving the sustainability initiatives of OEMs.

The shift to more networked and software-based vehicles will require a greater ability to understand and apply operational data. Predictive vehicle health is a critical component of a more dependable, efficient, effective and sustainable transportation system.

With Sustainability as a strong focus, artificial intelligence becomes the anchor to achieve this goal and enhance the transportation lifecycle.

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Vice President & Business Head – IPD and Agri at Garware Technical Fibres Ltd,

Engineering Safety:

How Advanced Polymers Are Transforming Industrial Protection

As industries increasingly demand safer, lighter, and more durable materials, polymer engineering is emerging as a key enabler of modern industrial safety solutions. From high-rise construction and infrastructure projects to manufacturing environments, engineered polymer fibres are redefining how safety systems are designed, tested, and deployed. In this conversation with Machine Edge Global, **Mohammed Hafeez,** Vice President & Business Head – IPD and Agri at Garware Technical Fibres Ltd, shares insights on how advanced materials, rigorous testing standards, and continuous R&D are shaping the future of industrial safety. In discussion with **Sanjay Jadhav, Editor, Machine Edge Global,** he highlights the growing shift toward high-performance polymer solutions, the challenges of scaling advanced materials in India, and the opportunities that innovation presents for strengthening the country's position in the global industrial materials ecosystem.

Q. How is polymer engineering evolving to meet modern industrial safety requirements across sectors like construction, infrastructure, and manufacturing?

Materials are increasingly being created for certain performance needs including high tensile strength, impact absorption, corrosion resistance, and UV stability due to substantial advancements in polymer engineering in recent years. These characteristics are especially important in industries like infrastructure and construction, where materials are subjected to dynamic pressures and extreme climatic conditions. Because they combine strength, flexibility, and reduced weight, engineered polymer fibers are being employed more in architectural safety systems, safety nets, harnesses, and geosynthetics. This development enables industry to enhance durability and lifetime performance while meeting increased safety criteria.

What benchmarks or global standards are most relevant today for evaluating high-strength industrial safety materials?

National and international safety and performance standards that measure tensile strength, dynamic impact resistance, load-bearing capacity, and environmental durability are commonly used to evaluate high-strength industrial safety materials. To ensure continuous performance in tough industrial environments, certification processes frequently require items to be evaluated for compliance with fire safety rules, fall prevention criteria, and long-term durability specifications.

Q. How has testing methodology for industrial safety products changed in recent years?

Methodologies for testing have grown increasingly thorough and data driven. In along with static loads, dynamic impact situations and environmental stress models including UV exposure, humidity, and temperature changes are also used to test modern safety goods. To make sure that goods function dependably in real-world operational environments, field testing, design validation, and controlled laboratory testing are being combined increasingly.

Q. Why are industries slowly shifting from traditional materials like metal to engineered polymers for certain safety applications?

Industries are turning to specific polymers because they have superior strength-to-weight ratios, corrosion resistance, and a longer service life than many conventional substances. Unlike metals, polymer-based systems are resistant to corrosion, fatigue, and environmental deterioration, lowering maintenance costs and boosting long-term dependability. Their lightweight nature also makes installation easier and minimizes structural load.

What challenges do Indian manufacturers face when adopting advanced materials at scale?

In India, there are still several obstacles to the widespread use of sophisticated materials. Project stakeholders' lack of understanding, procurement procedures that favor conventional materials, and tender conventions that frequently give precedence to generic requirements over performance-based solutions are a few examples. Furthermore, local geological and climatic circumstances necessitate localized testing and field validation, which lengthens development schedules but is necessary for long-term dependability.

Q. What core engineering principles are most critical when designing polymer-based safety solutions for industrial usage?

Tensile strength, load distribution, fatigue resistance, impact absorption, and environmental stability are important engineering concepts. Particularly in fall-protection or high-rise safety systems, anchoring integrity, installation accuracy,

and ergonomic design concerns are equally crucial. Another essential component of system design is guaranteeing adherence to safety standards and laws.

Q. What role does R&D play in improving performance attributes like load-bearing strength, UV resistance, and long-term durability?

R&D plays a central role in advancing polymer chemistry, fibre technology, and coatings that enhance durability and performance. The creation of materials that can endure harsh climatic conditions, retain their structural integrity over time, and function consistently under stress is made possible by ongoing innovation. Enhancing product dependability also involves investments in automated production, precise weaving, and material testing.

Q. Which emerging applications of engineered polymer fibres are expected to gain momentum in the next 5–10 years?

Geosynthetics for erosion management and slope stabilization, textile-based reinforcement systems in transportation infrastructure, and smart safety systems with sensors for load and stress monitoring

are just a few of the applications that are anticipated to increase dramatically. The use of lightweight reinforcing systems and safety-integrated architectural solutions is also anticipated to grow in urban and construction settings.

Q. How can material innovation contribute to safer, lighter, and more cost-efficient industrial equipment and structures?

Innovation in materials allows for the development of systems that are strong and long-lasting but lightweight, making them easier to carry and install. Improved load distribution and resistance to environmental degradation reduce maintenance and lifecycle costs. Such advances can help lower the carbon footprint, installation time, and material consumption in infrastructure projects, making them more cost-effective and beneficial to the environment.

Q. How can India strengthen its position as a global supplier of advanced industrial materials and safety solutions?

By supporting performance-based procurement, investing in domestic R&D, and fostering cooperation between manufacturers, engineers, and politicians, India may improve its standing internationally. In addition to programs supporting production and innovation, localizing testing, certification, and design support to Indian circumstances may further increase a product's credibility in global markets.

Q. What types of strength, durability, and environmental tests are essential before deploying polymer safety systems in industrial settings?

Tensile strength testing, dynamic impact resistance testing, load-bearing capacity testing, and fatigue testing are all important tests. To ensure consistent performance in a variety of industrial settings, environmental assessments including UV exposure, moisture resistance, corrosion resistance, and temperature tolerance are also essential.

Q. How closely does India align with global certification standards for industrial-grade polymer materials?

India has become more in line with international certification norms, especially in fields like geosynthetics and building safety. Nowadays, many sophisticated safety systems are developed and evaluated to satisfy both domestic and global performance standards. To help make broader use of sophisticated materials, efforts are being made to update technical guides and better unify local requirements.

Q. How is R&D driving the next phase of material innovation in safety products, especially in terms of improving lifecycle performance and sustainability?

R&D is making it possible to generate materials with less of an impact on the environment, longer-lasting safety systems, and recyclable polymers. Through improved coatings, sophisticated fiber engineering, and modular systems that cut waste and increase product life, manufacturers are concentrating on enhancing lifetime performance. Both environmental sustainability and operational efficiency are enhanced by these improvements.

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How Domestic Manufacturing of basic Monolithics Transforms Steel Industry Supply Chains

Steelmaking today is happening at an extraordinary scale. Global crude steel production reached about 1,849 million tonnes in 2025, and while China continues to dominate volumes, India's production is growing at a healthy pace. In December 2025 alone, India produced around 14.8 million tonnes of crude steel, up over 10 percent year on year. This steady rise reflects not just capacity expansion, but the growing importance of reliable, resilient operations in Indian steel plants.

MR. ISH MOHAN GARG,
Senior Vice President,
Calderys APAC Region

At the same time, steel producers across India and the wider APAC region have been dealing with repeated supply chain disruptions. Global shipping delays, container shortages, currency volatility, and geopolitical uncertainties have made the sourcing of critical refractory materials far less predictable than it used to be. When these materials arrive late, the impact goes well beyond logistics. It affects shutdown planning, furnace availability, working capital tied up in safety stock, and the ability to respond quickly to unplanned outages.

Basic monolithics are a backbone of modern steelmaking, used in some of the most demanding zones of furnaces and vessels. Relying heavily on imports for such mission critical materials forces steel plants into reactive sourcing. Domestic manufacturing of basic monolithics marks a shift toward more deliberate, strategic supply chain planning.

From import dependence to supply chain resilience

Local manufacturing fundamentally changes how steel plants manage their supply chains. When basic monolithics are produced closer to the point of use, lead times shrink dramatically. What used to take several weeks, including shipping and customs clearance, can now be planned in days. This makes just in time supply much more feasible, and the need for large safety stocks at the site is eliminated.

Lower levels of inventory directly alleviate the working capital burden. Steel manufacturers can free up funds that would otherwise be tied up in inventory as buffer stock. Local sourcing also mitigates risks associated with global disruptions in shipping, unexpected increases in freight costs, and exchange rate fluctuations that could unpredictably drive procurement budgets up. One clear sign of this shift is the commissioning of Calderys' basic monolithics line at its CAPES plant in Odisha, which is bringing large-scale domestic production of critical refractories closer to Indian steelmakers and easing reliance on imports.

In addition, local availability makes maintenance planning more manageable. Furnace relining schedules, shutdown periods, and hot repairs become more manageable when materials can be supplied on a reliable and shorter notice basis. This, in turn, helps to build actual supply chain resilience over time. Steel plants move from constantly firefighting supply risks to planning operations with greater confidence and stability, which is especially important as production volumes continue to grow in markets like India.

Engineering basic monolithics for high-performance steelmaking

Basic monolithics play a critical role in steelmaking operations such as electric arc furnaces, energy optimizing furnaces, ladles, tundishes, and degassing units. These areas face intense thermal cycling, aggressive slags, and constant mechanical stress. Performance in such conditions depends on more than just having material available. It depends on how well the refractory is engineered for the specific application.

High-performance basic monolithics must balance several properties at once. Thermal shock resistance is essential for zones with frequent temperature changes. Slag corrosion resistance protects linings from chemical attack. Good sinterability and coating adhesion help create dense, protective working layers that extend campaign life. Tailored raw material selection and binder systems are what make these properties consistent in real operating conditions.

When the manufacturing is localized, the formulation can be further refined based on the feedback from the steel plants operating under similar conditions. This helps refractory solutions evolve in sync with the changing furnace practices, scrap composition, and productivity requirements. In critical steel plants, the consistency of performance is as important as availability. A refractory that works well can minimize downtime and ensure consistency in production, which in turn helps in maximizing productivity, and ultimately supports

throughput and cost control.

Manufacturing excellence as a supply chain differentiator

Manufacturing quality is a silent but powerful part of the supply chain. Advanced local manufacturing setups allow tighter quality control, better traceability of raw materials, and more consistent batch to batch performance. In-house raw material processing, automated batching systems, and specialized mixing technologies reduce human error and improve reproducibility.

Manufacturing closer to the end user also makes it easier to adapt production volumes and packaging formats to customer needs. Routine consumption can be facilitated by having fixed production planning, whereas surge in demand during major shutdowns or unexpected outages can be handled by having quicker response times. This agility is a true gamechanger in sectors where time is of the essence and any delay can easily mean lost production.

Over time, consistent manufacturing excellence builds confidence in the supply chain. Steel producers gain trust that what they order will perform as expected, when they need it. That confidence reduces risk in maintenance planning and encourages longer-term partnerships rather than purely transactional sourcing decisions.

Beyond products: The role of technical partnership in supply chains

Modern supply chains in the steel industry are no longer just about moving materials from factory to site. They depend heavily on technical partnership. Local manufacturing makes it easier to provide

on-site application support, troubleshooting, and performance monitoring. Engineers can work closely with operations teams during installations, dry-outs, and campaign reviews.

Continuous feedback loops are essential. When performance data from furnaces flows back into product development, formulations can be refined to suit specific operating conditions. This kind of collaboration improves lining life and hot repair efficiency over time. It also helps steel plants adapt refractories to new operating practices, higher productivity targets, or changes in raw material quality.

Trust, transparency, and collaboration sit at the heart of this relationship. When suppliers and steel producers work as partners, downtime risks reduce and asset life cycle management improves. The supply chain becomes a shared responsibility, not just a procurement function.

Conclusion: Building a stronger, smarter steel supply chain from within

The domestic production of basic monolithics improves the steel industry's supply chains in three basic ways. It increases reliability by shortening lead times and making the industry less vulnerable to global disruptions. It improves cost efficiency by reducing inventory burdens and stabilizing procurement economics. And it increases operational agility by enabling faster response to both planned and unplanned maintenance needs.

Import substitution is only part of the story. The bigger shift is in supply chain quality. Local production, backed by strong manufacturing practices and technical partnership, upgrades how steel plants secure performance assurance over the long term. It supports resilience, consistency, and strategic autonomy in a sector where downtime is costly and predictability is valuable.

As steelmakers look to future-proof their operations in a world where production volumes are rising and supply chains remain uncertain, building from within becomes more than a tactical choice. It becomes a foundational strategy for competitiveness, reliability, and sustained performance.

How Green Elevators Contribute to **Healthier Buildings**

Buildings shape more than the skylines of our cities—they influence how we live and work every day. As urban spaces expand and high-rise developments become more common, attention is increasingly shifting to how buildings operate and the environmental impact they create.

MR. UMANG BANSAL,
Chairman, Polo Elevators

In India, for instance, buildings already account for 25 percent of total emissions, and therefore, the need for energy efficiency in building infrastructure is of utmost importance. While the debate on building sustainability often centres on solar power, insulation, and air-conditioning, the elevator often remains out of the spotlight.

Yet elevators are among the most frequently used systems in modern buildings. In office spaces, for example, they can account for 3-8 percent of total energy consumption. As buildings become taller, supporting more occupants, so does the demand for vertical transportation, as does the energy needed for such transportation.

But now, green elevators are making their presence felt, thanks to advanced technology, smart control, and environmentally friendly materials, which are helping elevators move beyond their traditional function as transportation machines to become part of the solution for healthier, more energy-efficient buildings.

Why Elevators Matter in Sustainable Building Design

Elevators run throughout the day, moving people, goods, and equipment across multiple floors. Every trip demands power for motors, doors and lighting, ventilation, and control panels.

Elevator systems in older buildings may not have been designed for energy efficiency. They operate at a constant speed regardless of passenger loads and continue to consume power even when not in use. Eventually, these systems contribute substantially to power consumption in a building.

As cities grow upwards, it has become increasingly important to improve the efficiency of elevators in buildings. Today, it has become clear to all concerned with building design and operation that elevators are not simply a luxury but have a direct effect on the environment.

Green elevators are designed to improve upon this by using advanced engineering techniques to improve energy management in buildings. The basic concept behind it is to avoid any form of energy wastage while at the same time ensuring movement within the building.

Regenerative Technology: Turning Motion into Energy

Among the most impactful innovations made on modern elevator systems is regenerative braking technology.

In a conventional elevator, energy generated during braking or moving downwards is normally lost as heat. This heat has to be dissipated by a cooling system, and this increases energy consumption as well as energy costs.

Regenerative systems take a different approach. If the elevator is moving downward with a heavy load or upward with a light load, the motor behaves as if it were a generator. Instead of letting the extra power go to waste, it can actually use it for other purposes.

The power can then be used for other operations such as lighting or ventilation. Regenerative drives can save up to 30 to 50 percent of the power that is normally consumed by traditional systems.

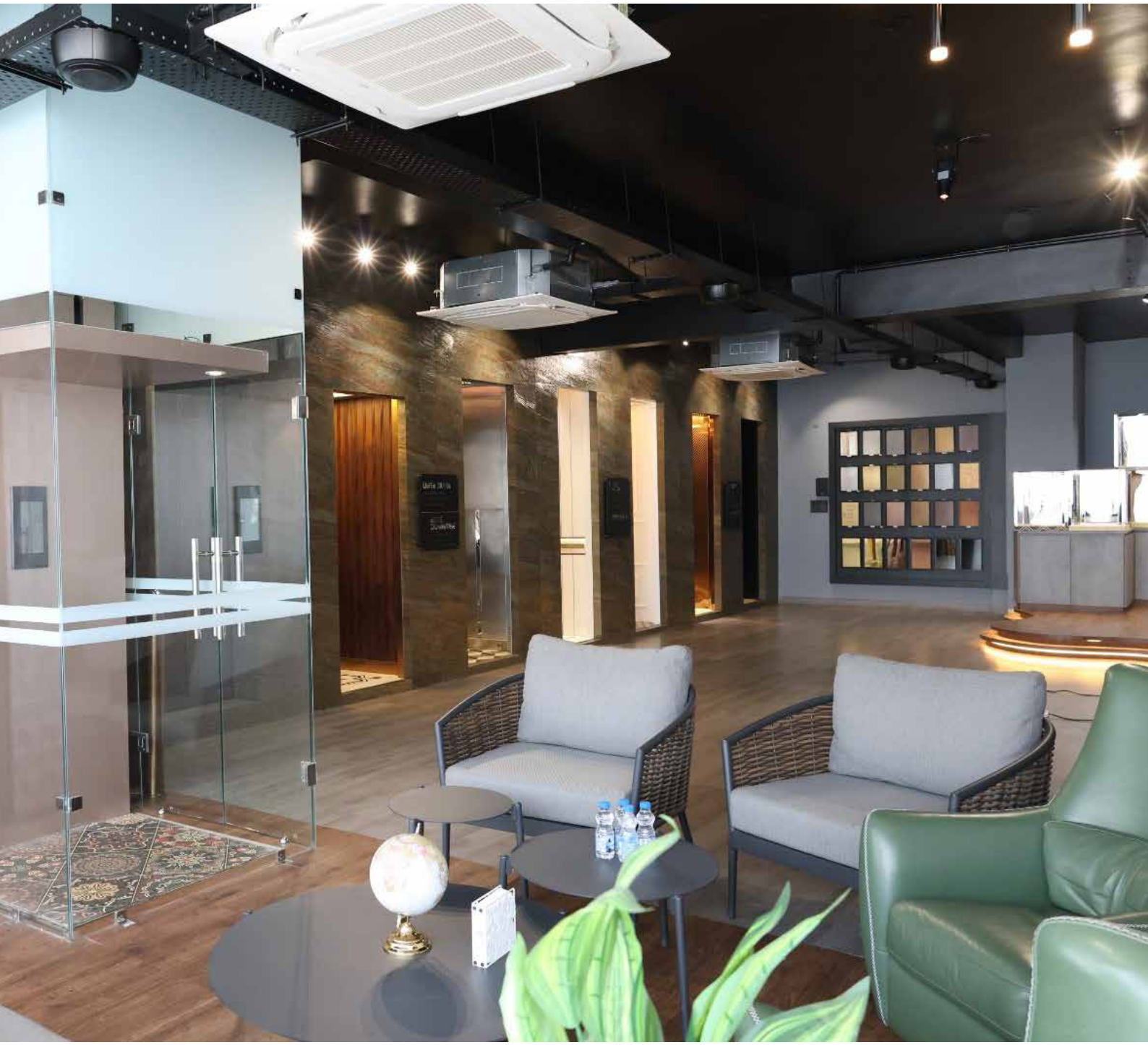
Another benefit is reduced heat in machine rooms, which helps lower cooling requirements and improves indoor conditions.

Smarter Motors and Intelligent Control Systems

In modern green elevators, motors that save energy are also utilized to enhance efficiency.

In contrast to older elevators

that run at constant speeds, modern elevators utilize Variable Frequency Drives (VFDs) to control the speed of the motors according to the load and the distance to be covered by the



elevators to save the required energy.

Destination control systems further improve efficiency. Rather than passengers pressing buttons for floors inside the cabin, they will be required to enter their floors prior to boarding. The passengers will then be grouped according to their destinations in the same elevator.

This minimizes the number of movements, improves the flow of passengers, and reduces energy consumption. The systems can, in the long run, be able to recognize the usage of the building and make adjustments

during peak and off-peak times.

Reducing Energy Waste through Smart Standby Features

The consumption of energy does not stop when an elevator is not in use. Lighting systems, display screens, and ventilation systems are active even when no one is in the cabin.

The green elevators have been able to reduce energy consumption when an elevator is in standby mode.

Modern systems include LED lighting, which can consume up to 80 percent less energy than conventional lighting and can have a far longer life. Motion sensors are used to turn off lights when the elevator is not in use, and the ventilation systems can be put on low power mode.

These small improvements may seem minor individually, but over hundreds of daily elevator cycles they result in meaningful energy savings without affecting passenger comfort.

Sustainable Materials and Cleaner Operation

Sustainability in terms of elevator systems is also applicable to the materials used in their construction.

Elevator manufacturers are using recycled materials in the interior of elevators. Low VOC paints and adhesives are used in elevator systems to minimize harmful emissions in a closed environment.

Another major change is the elimination of hydraulic elevators, which require large amounts of oil and can pose a threat to the environment if oil leakage occurs.

Today, traction elevators utilize electric motors instead of oil, making it a more efficient and environmentally safe solution by excluding the possibility of oil contamination, thus promoting a healthier indoor environment.

Conclusion

As cities continue to grow vertically, the systems that support modern buildings must evolve alongside them.

Elevators, once viewed simply as transportation within buildings, are now becoming an important part of sustainable building design. Technologies like regenerative drives, smart motors, intelligent controls, and eco-friendly materials are helping to reduce energy consumption and improve building performance.

In an era when buildings contribute to a large portion of India's carbon footprint, advancements in day-to-day infrastructure have the potential to make a real difference to the environment. Green elevators are a fine example of how building performance can be improved for a greener environment.

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KRISHNA KHANDELWAL,
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India's Growing Strength in Precision **Manufacturing and Assembly**

India's manufacturing sector is undergoing a structural shift. For decades, the country was recognized primarily for scale and cost competitiveness. Today, it is steadily earning global recognition for precision, reliability, and advanced assembly capabilities. This transformation is not accidental. It is driven by policy support, private sector investments, technology adoption, and a maturing supplier ecosystem.

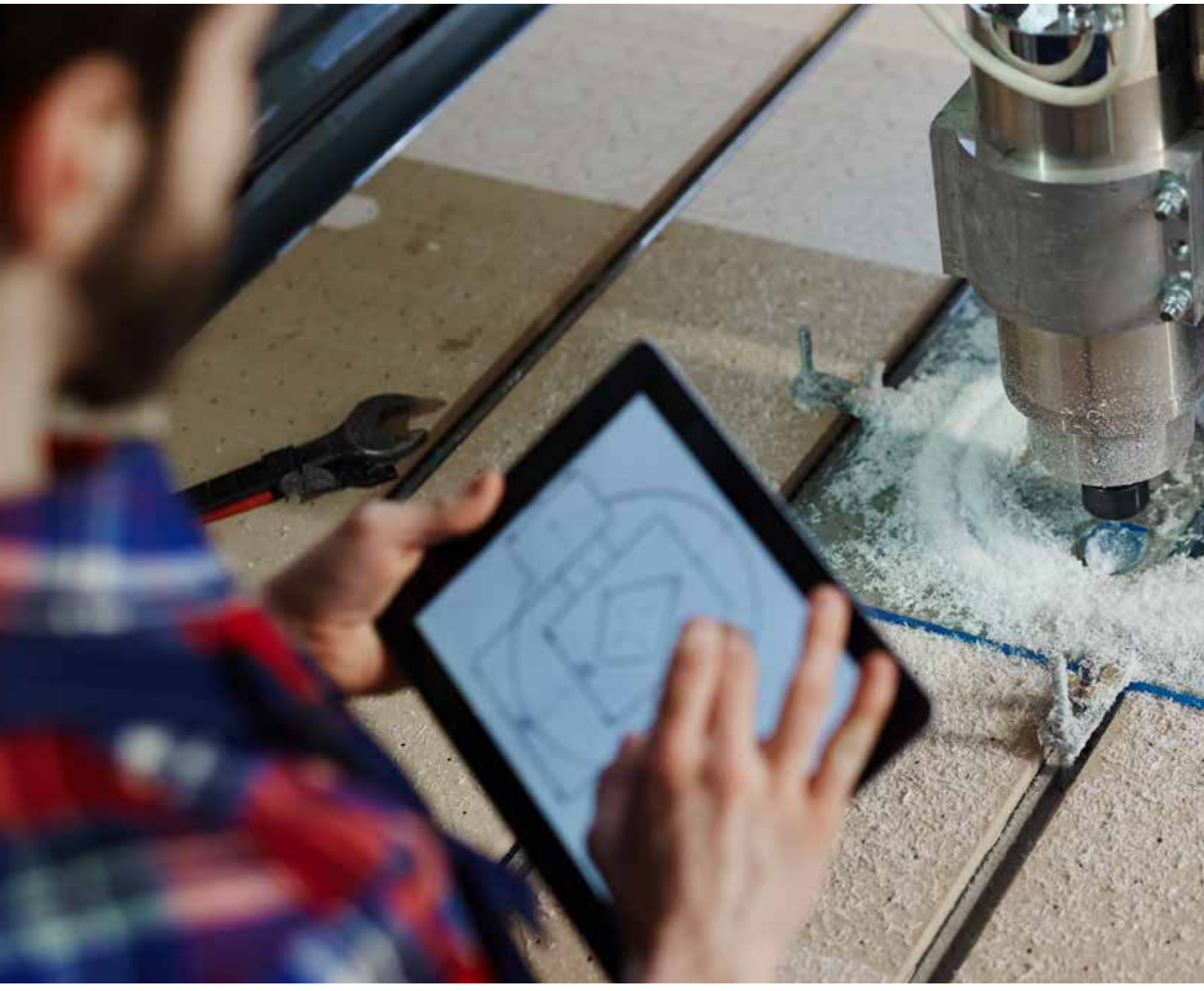
Precision manufacturing is no longer limited to a few high-end industries. It is becoming central to automotive, electronics, aerospace, medical devices, renewable energy, and semiconductor value chains. As global supply chains diversify and companies seek trusted partners, India is positioning itself as a dependable destination for high-quality, high-accuracy manufacturing.

The Shift from Scale to Precision

Traditionally, manufacturing success was measured by output volumes. While scale remains important, global customers now demand consistency, traceability, and micron-level accuracy. Components must fit perfectly, perform reliably, and meet international certifications.

Indian manufacturers are responding to this shift in several ways:

- Investing in advanced machine tools and automated production lines
- Strengthening quality control systems and inspection processes
- Building in-house design and



engineering capabilities
- Training workforce in specialized skills

This shift is visible across sectors. In automotive manufacturing, for example, tighter emission norms and the rise of electric vehicles require extremely accurate parts and assemblies. In electronics, miniaturization demands high-precision components. Even in renewable energy, wind and solar systems require carefully engineered assemblies to ensure long-term durability.

Policy Support and Industry Momentum

India's policy environment has also played an important role. Production-linked incentive (PLI) schemes, infrastructure investments, and ease-of-doing-business reforms are encouraging companies to expand manufacturing capacity. Industry surveys indicate strong optimism, with manufacturers planning capacity expansion, technology upgrades, and new product lines.

More importantly, the focus is no longer just on "Make in India," but

on "Make in India for the World." Export-oriented growth demands strict adherence to global standards. This naturally pushes companies toward precision-driven processes.

The government's emphasis on sectors such as semiconductors, electronics manufacturing, defence production, and medical devices is further accelerating the need for high-accuracy manufacturing and assembly ecosystems.

Technology as a Key Enabler

Technology adoption is central to India's precision manufacturing journey. Digital tools are helping manufacturers improve both speed and accuracy.

Some of the most impactful developments include:

- Computer-aided design and simulation to reduce errors before production
- Automated inspection systems for real-time quality checks
- Robotics in assembly lines for repeatable accuracy
- Data analytics to monitor process stability

Digitalization ensures that deviations are detected early and corrected quickly. It also enables traceability an essential requirement for industries such as aerospace and medical devices.

Importantly, technology is not replacing people; it is enhancing their capabilities. Skilled technicians and engineers are working alongside automated systems to maintain quality and improve productivity.

The Rise of Advanced Manufacturing Clusters

India is witnessing the growth of specialized manufacturing clusters. These clusters bring together suppliers, component manufacturers, logistics providers, and research institutions within a focused ecosystem. Such integration improves coordination, reduces lead times, and enhances overall precision.

Electronics clusters, automotive hubs, and emerging semiconductor zones are examples of how ecosystem thinking is strengthening India's manufacturing capabilities. When suppliers operate in close proximity, collaboration improves, and quality benchmarks rise collectively.

This ecosystem-based approach is particularly important for precision assembly, where multiple components must align perfectly. Any variation in one part can affect the entire system. A strong supplier network reduces such risks.

Workforce: The Human Advantage

India's demographic advantage continues to be one of its strongest

assets. However, precision manufacturing demands specialized skills. Recognizing this, companies are investing in training programs focused on metrology, advanced machining, assembly techniques, and quality assurance.

Technical institutes and industry partnerships are also evolving. Apprenticeship models, on-the-job training, and certification programs are helping bridge skill gaps.

A key trend is the growing emphasis on continuous learning. As machines become more advanced, operators must understand both mechanical systems and digital interfaces. The modern manufacturing professional is as comfortable reading data dashboards as operating equipment.

Quality as a Competitive Differentiator

Global customers evaluate suppliers not only on cost but also on consistency. Precision manufacturing requires strict process control, calibrated measurement systems, and adherence to international standards.

Indian companies are increasingly adopting globally recognized quality frameworks. Regular audits, supplier assessments, and standardized inspection protocols are becoming common practice.

In many sectors, customers now demand complete transparency from raw material sourcing to final assembly. Indian manufacturers are responding by strengthening documentation, traceability systems, and compliance practices.

This focus on quality is gradually shifting global perception. India is no longer viewed solely as a cost-driven destination, but as a reliable partner capable of delivering high-precision components and assemblies.

Assembly Capabilities: From Components to Systems

Precision is not limited to manufacturing individual parts. Assembly plays an equally critical role. Modern products whether electric vehicles, medical equipment, or electronic devices involve complex sub-systems that must integrate seamlessly.

Indian companies are moving up the value chain from part suppliers to system integrators. This requires:

- Controlled assembly environments
- Accurate alignment tools
- Skilled assembly technicians
- Rigorous testing protocols

By strengthening assembly capabilities, India is capturing greater value within global supply chains. Instead of exporting only components, companies are delivering complete modules and finished systems.

Sustainability and Responsible Manufacturing

Another important dimension of precision manufacturing is sustainability. Efficient processes reduce material wastage. Accurate machining lowers rejection rates. Smart assembly methods minimize rework.

Energy-efficient machinery, renewable power usage, and waste reduction initiatives are becoming more common across industrial facilities. Sustainability is increasingly linked with precision because better process control often leads to lower environmental impact.

Global buyers are paying close attention to environmental and social standards. Indian manufacturers who combine precision with responsible practices gain a strong competitive advantage.

Challenges That Need Continued Focus

While progress is evident, there are areas that require sustained attention:

- Upgrading legacy equipment in small and medium enterprises
- Ensuring consistent skill development across regions
- Strengthening supply chain resilience
- Enhancing research and development investments

Precision manufacturing demands long-term commitment. Continuous calibration, maintenance, and process improvement are essential. As global competition intensifies, complacency is not an option.

The Road Ahead

India stands at a significant moment in its industrial journey. The convergence of policy support, technological advancement, skilled talent, and global demand is creating strong momentum for precision manufacturing and assembly.

To sustain this growth, collaboration will be key between industry, government, academia, and technology partners. Investments in measurement, quality systems, automation, and workforce development must continue.

The country has demonstrated that it can compete on cost and scale. The next chapter is about competing on accuracy, reliability, and innovation. The foundations are already in place. With sustained effort, India can establish itself as a global hub for precision-driven manufacturing and advanced assembly.

As operations leaders, we see this transformation on the ground every day in upgraded shop floors, in skilled technicians mastering new technologies, and in customers placing greater confidence in Indian capabilities. The journey is ongoing, but the direction is clear, precision is no longer a niche capability in India. It is becoming a defining strength.

Why India's Copper Manufacturers Must Prioritise Integrity of **Process over Industrial Scale**

In the race to position India as a global manufacturing hub, scale has become the industry's favourite buzzword. We speak frequently in terms of million-tonne capacities and expansive industrial parks, yet in the high-precision world of copper manufacturing, where the metal serves as the literal nervous system of our modern infrastructure, scale is a secondary virtue.

MR. PRAMOD C,
Director, Gopalan Metals

The real frontier of Indian manufacturing excellence is not defined by how much we produce, but rather by the narrowing of the margin of error. As global supply chains decouple and seek higher reliability, the industry must pivot its focus toward three non-negotiables, which are unwavering standards, absolute consistency and granular process control.

Avoiding the Volume Trap in High-End Applications

For decades, the standard playbook for industrial growth was to increase volume and to lower unit costs. While this works for commodities, copper is rarely just a commodity in high-end applications. Whether it is for electric vehicle motors, renewable energy inverters or aerospace components, the cost of a component failure far outweighs the savings of a cheaper, mass-produced ingot. When a manufacturer prioritises scale over process integrity, micro-variations creep in. A slight fluctuation in oxygen content or a trace impurity might go unnoticed in a high-volume run, but it manifests as catastrophic failure during a wire-drawing process or perhaps as a reduction in conductivity that plagues an electrical grid for decades.

Establishing Global Standards as a Minimum Baseline

In the Indian context, meeting the standard is often viewed as the finish line, yet to truly raise the bar, we must treat international standards like ASTM (American Society for Testing and Materials) or DIN (Deutsches Institut für Normung) as the absolute baseline. We believe that true thought leadership in manufacturing involves over-spec engineering. This means achieving purity beyond 99.9 per cent, because in an era of high-frequency electronics, even the fourth decimal point of purity matters. Furthermore, it requires total traceability, ensuring that every kilogram of copper can be traced back to its thermal history. By adhering to rigorous standards even when the client does not explicitly demand them, manufacturers build brand equity in reliability, which is a commodity far rarer than the copper itself.

Solving the Challenge of Absolute Repeatability

Consistency is the most difficult metric to maintain in manufacturing, as it is relatively easy to produce a golden sample, which serves as a perfect specimen for a trade show. It is infinitely harder to ensure that the ten-thousandth unit produced at three in the morning on a Tuesday is identical to that first sample. For instance, if a copper strip's mechanical properties vary even slightly, it can jam a high-speed stamping press or result in uneven winding in a transformer. For Indian manufacturers to compete with the best of Germany or Japan, we must move away from acceptable ranges toward absolute repeatability. This shift requires a cultural change, moving from a mindset of fixing errors to a mindset of eliminating variables entirely.

Leveraging Process Control as a Competitive Advantage

If scale is about physical hardware, larger furnaces and more land, then process control represents the industrial software and the intelligence embedded within the production line. This advanced control works by monitoring metal physics at every stage, using precise thermal management to regulate cooling rates during casting and dictate grain structure. From there, deformation monitoring manages tension and speed during drawing to prevent internal stresses, while real-time analytics use sensor data to adjust parameters before any product drifts out of specification. Ultimately, investing in such sophisticated equipment and skilled workforce often yields better returns than simply adding another production line. Such control reduces waste, lowers energy consumption and, most importantly, builds a reputation for flawless delivery.

A philosophy rooted in process excellence is already shaping the next generation of Indian manufacturers. At Gopalan Metals, this translates into a focused portfolio spanning high-purity copper rods, busbars, PVC cables and a wide range of engineered wires, including bare, tinned, fine, and

superfine variants, designed to meet the exacting demands of modern electrical and industrial applications. By aligning product development with stringent quality benchmarks and controlled manufacturing environments, such players are quietly reinforcing India's shift from volume-driven output to precision-led value creation.

Elevating the Reputation of Indian Engineering

As India pushes the Make in India initiative toward a goal of making for the world, we are no longer just competing with local neighbours, we are competing with global benchmarks. The world is looking for a China-plus-one strategy, but international partners do not settle for products that are merely good enough. By focusing on standards and control over raw scale, the Indian copper industry can move up this value chain. Instead of exporting raw materials or low-grade products, we can become the preferred partners for high-tech industries. This is not just about business growth for metal companies in India, it is about elevating the Made in India tag to a hallmark of precision.

Measuring Industrial Success

The future of Indian copper manufacturing is not found in the size of our factories, but rather in the precision of our output. As we look toward 2030, the leaders in this space will be those who embrace the quiet work of tightening tolerances, perfecting thermal cycles and auditing every inch of the production line. We have realised that mastering the process, allows scale to follow naturally. However, when you chase scale at the expense of the process, you build a foundation on sand. It is time to stop measuring success by the tonne and start measuring it by the micron. In this new era, true industrial power will be defined not by how much we produce, but by how perfectly we craft it.

R V RAGHU,
ISACA India ambassador & director,
Versatilist Consulting India Pvt Ltd

Unleashing the AI Shadow Workforce:

How Summit-Hyped Tools Are Bypassing IT and Igniting Data Breach Nightmares

AI is on everyone's mind, driven primarily by fear of missing out (FOMO). Top management in organizations are bombarded by messages telling them that if their organization is not using AI, then they will be left behind, biting the dust as industry peers use AI to pull ahead.

Seventy-six percent of Indian respondents from ISACA's 2025 AI Pulse Poll believe employees within their organization use AI, whether it is permitted or not. The key here is whether it is permitted or not. Without clear guidelines on what can and cannot be done with technology, shadow IT often rises. This was the case when cloud services rose on the horizon and employees and business units started adopting cloud solutions like SaaS at the click of a button from their browsers, right under the noses of cybersecurity professionals. The same is now happening with AI, leading to the rise of what is called shadow AI.

The proliferation of AI is making this easier, with AI being integrated into office tools seamlessly, apps and browsers providing easy AI access, and AI serving as sidecars to any business solution you can think of. On one front, this may seem like a good thing. Traditionally technology curves have been steep, with deep-seated reluctance often requiring a hard push from management. With AI it is a different story. Employees and business units are using AI and management is also complicit in what is going on—or at least until things turn sour. Seventy percent of India-based respondents to ISACA's 2025 AI Pulse Poll say that the use of AI has resulted in time savings for them and their organization, and more than half (59%) believe that AI will have a positive impact on their career in the next year.

This may sound heartening, but the same survey also highlighted that only 32 percent of organizations in India have a formal, comprehensive policy in place for AI. If this does not make you pause, nothing will; because without a policy, there is a governance gap that is akin to setting off into a desert without so much as a compass, let alone a map. The risks abound. Sixty percent of India-based respondents to ISACA's latest AI Pulse Poll are very or extremely worried that generative AI will be exploited by bad actors. This is the beginning of the proverbial avalanche. In the hands of bad actors, AI can be used to fashion weapons that can have far reaching impact, all while not even as appearing as such. For example, data shows AI-powered phishing and social engineering attacks are now more difficult to detect. Deepfakes are being created with such potency, it is chilling. Other risks such as privacy violations, social engineering, loss of IP, and more are on the horizon. AI is proving to the ultimate double edged sword.

But all is not lost. Enterprises should fall back on first principles thinking and approach AI adoption systematically.

Education is going to be key. This may seem counterintuitive, but without understanding the animal, it may not be possible to deal with it. Education and skilling will be required across the board, starting at the top. Boards and senior management need to understand what AI is, how opaque it can be and how data hungry it is. With other tools there may seem to be some semblance of control; However, with AI, all you may see in many cases is a window to prompt the tool to do something and then get the results. But

unless boards and senior management understand what lies under the hood, they will not be able manage and drive the tool. Comprehension also enables an understanding of the risks that may arise which can drive safe adoption.

Skilling is also required across the rank and file so that employees understand not just the tool but also the risks that can arise from the tool itself. Education, skilling, training and awareness will also need to be role specific; for example, so that cybersecurity personnel understand what they are dealing with. The same also applies to business users who need to understand the nuances of data that is an input the tool and what the outputs might mean.

Next is governance. Armed with education, boards and senior management will be in a better position to simply articulate a policy on what can and cannot be done with AI. Governance will also help address critical underlying aspects that need to be managed, such as AI related risks and ethics. Policies are key because they are the guidepost that can help translate the organization's stance on AI into actionable tools for use by the rest of the organization, including when deciding if AI should be used for a specific purpose. Articulating policies will also help look at everything from the lens of risk—leading to risk-based decision making. Governance can also ensure that appropriate checks and balance are put in place across the AI value chain, and also enable periodic audits in AI usage in the enterprise to ensure transparency.

Among the many actions that can be taken for the safe and secure integration of AI into enterprise, establishing robust AI governance and accelerating up-skilling and re-skilling will go a long way in ensuring that risks are mitigated and in minimizing data breaches from the unbridled use of AI.

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