

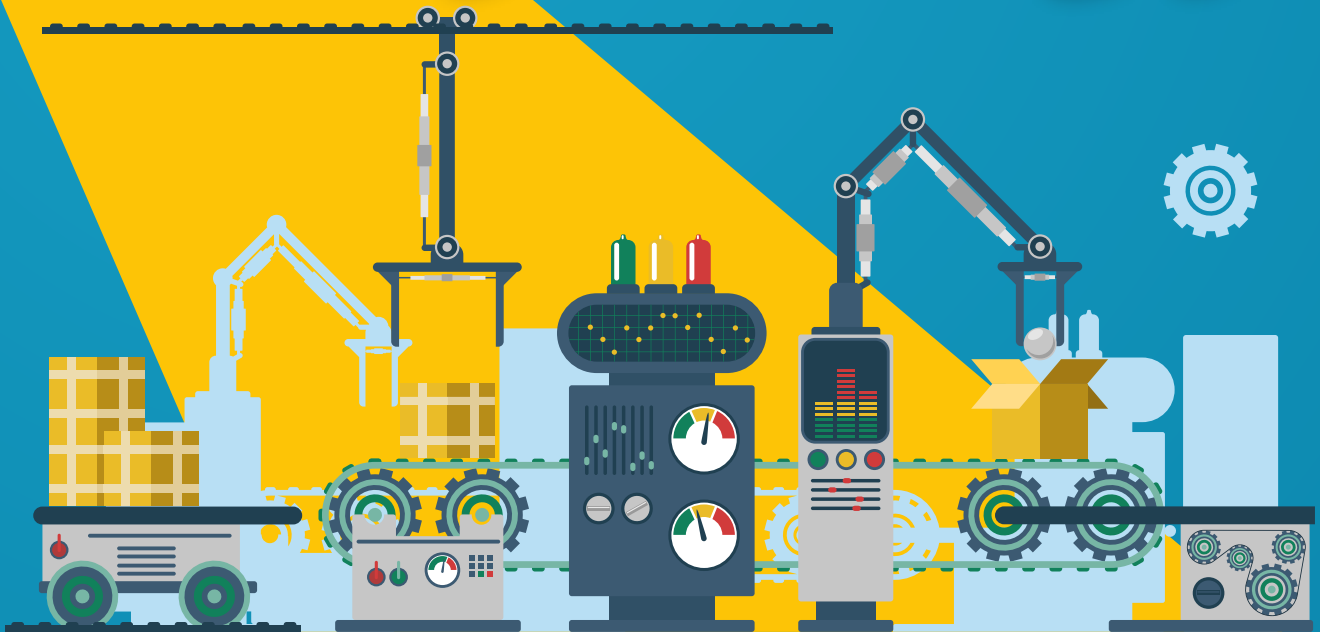
Special
Edition



BANGALORE CHAMBER OF INDUSTRY AND COMMERCE

e-Synergy

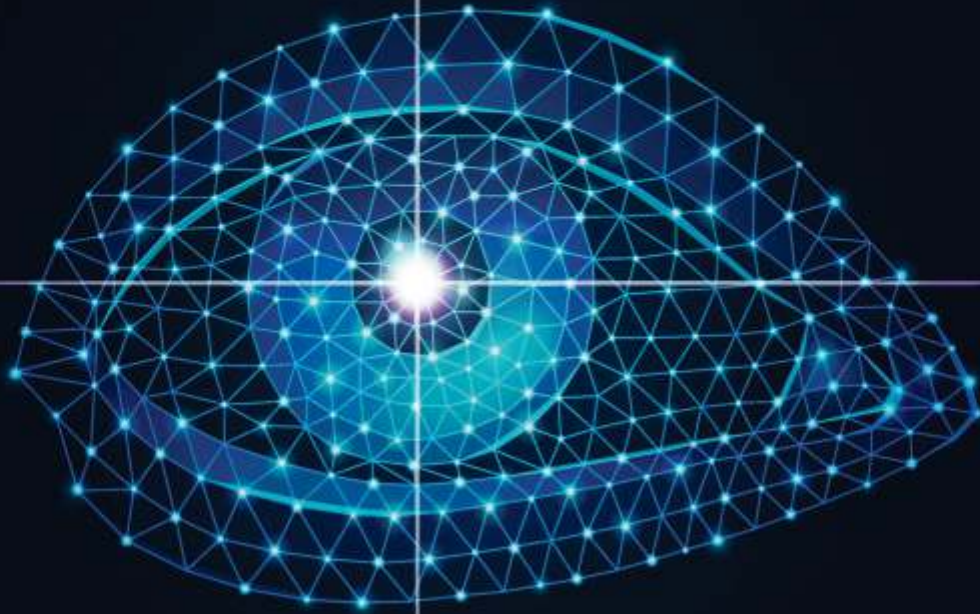
FEBRUARY 2024



MANUFACTURING CONCLAVE

December 8, 2023

Journey of Excellence
Continues 2023-2024



MISSION

Namma Karnataka-
Gateway to Future India

VISION

Look Beyond

Together We Should

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Dr. S Devarajan
President - BCIC and
Sr. Vice President
TVS Motor Co. Ltd.

Paradigm shift for Manufacturing as “Growth Engine” of India

Paradigm shift in Manufacturing as Growth Engine for future taking India among top three in GDP

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For couple of decades, India has been the destination for outsourcing software services as well as knowledge processes, but it is now all geared up to grab the center position as the global manufacturing hub. Manufacturing industry can contribute and play a vital role in the 5 trillion dollar aspirational growth plan of India. Currently, manufacturing sector contributes to around 13 % of India's total GDP and aspire to increase to 20 %. This is supported well by right conditions of young demographics, with more than 65 % of India's population under the age of 35, increasing urbanisation and middle class driving excellent domestic demand.



To harness the opportunity: adoption of SET frame work will be beneficial.

Strategy (S): such as AtmaNirbhar Bharat, Production linked incentives (PLI) to be further enhanced with an end to end planning including targets and ecosystem.

Enablers (E): including focus towards well educated workforce through skilling, Captive demand and for logistics - streamlined GST

Transparency (T): increasing agilitly, accountability and predictability through Digitalisation and low cost automation in direct and indirect areas

Manufacturing is the core for all business: automobile, aeronautical, civil, chemical, agricultural, machine tool etc and also software processes,if we consider coding / simulation as a essential part of manufacturing. When Manufacturing succeeds, all other areas in company grows.



This enables " Purposeful growth with WINNING PORTFOLIO - organisation focuses on creating value for all stakeholders with new winning framework of Accelerating INNOVATIONS to add customer value, Boost sustainability and giving back to society (Circular economy), transform DIGITAL into customer value add, OPERATING MODELS - to be lean, simple, fast across the enterprise and accelerate "CULTURAL JOURNEY" of people development.

Focussing on manufacturing in all areas of 7 M conditions would enable sustainable results. 7 M conditions are Men - skills, Method - process of manufacture, Material - Flow of material, lean thinking at

From the Desk of President



Suppliers, OEMs, Material handling, Money - optimising manufacturing cost and total cost, Measurement - consistency of measurement and Quality, and Mother nature - Environment and Energy.

MSMEs are extended partners for the growth of Oes and the Economy. Challenge of MSMEs to work with OEM in the "Proactive manner" from the product design, design for manufacturing, Sensorisation of old machines, capturing the data on Quality, Maintenance, Automation based

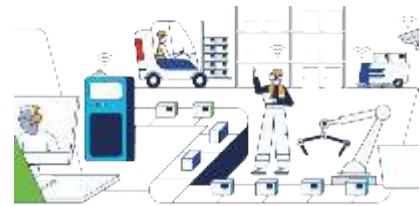


on essentials areas, Proof of concepts, ROI on end to end working and "Risk of not doing" in case of any "Recall".

Key input to Manufacturing is the skilling and resourcing .

Supplier development: both tier1, tier 2 is the core to support all OEMs and major industries. New Product development

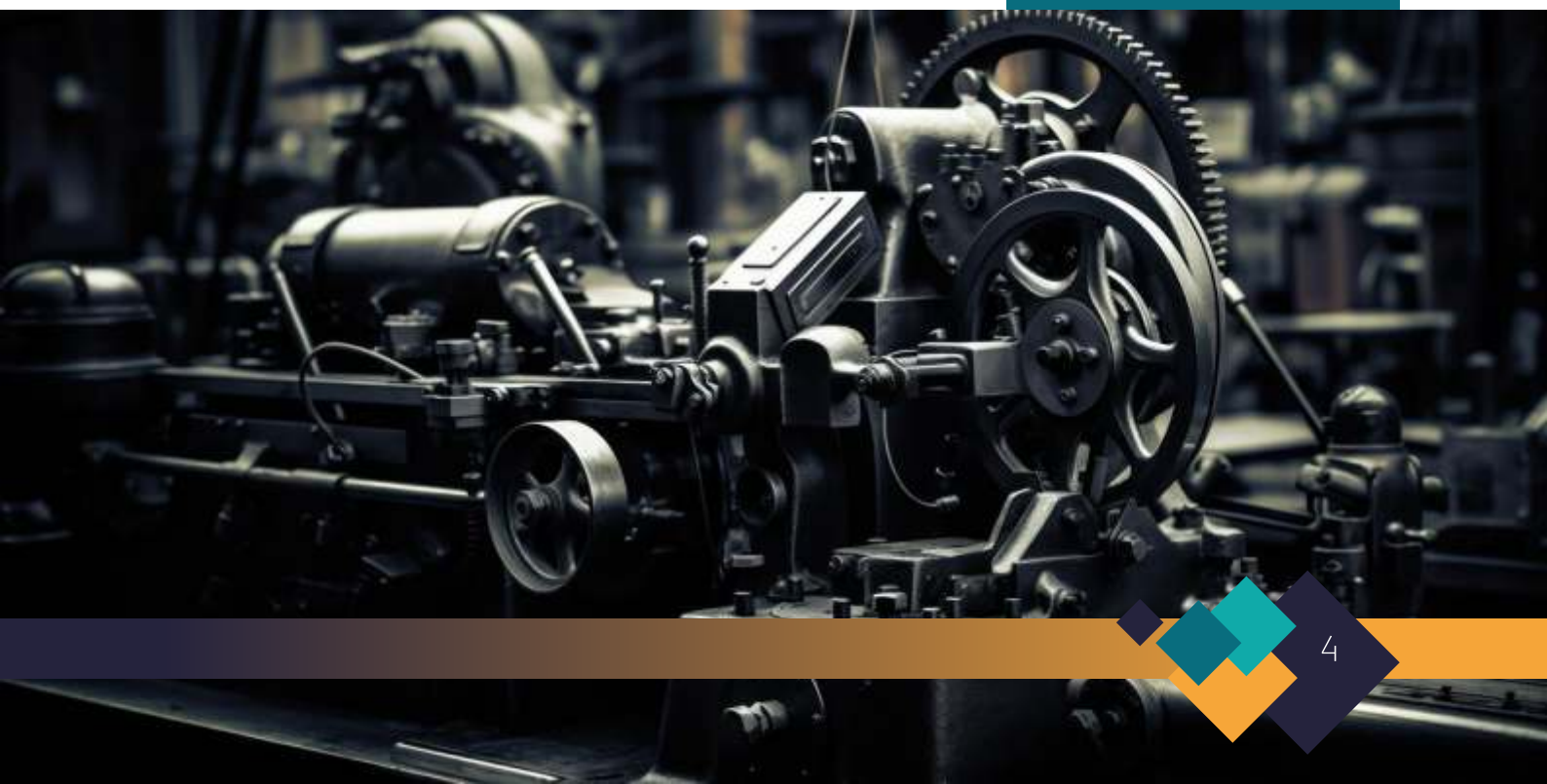
We are in a VUCA world: Volatile, Uncertain, Complex and Ambiguous. To enable positive growth , we should look at Positive VUCA ie V=Value added instead of Volatile, checking how much we can add value in all our process, U - Untapped potential tapping instead of worrying about Uncertain, Young generation, team with us have to be encouraged to tap their potential, C - Customer connect instead of complex - looking at internal and external



customer and connect, communicate the goals and A - Action oriented - ACT NOW(take decision) with digital and automation. This positive VUCA will enable strong team building towards future.

Adoption of IOT, AI and ML, Linking with new technologies of Light weighting, Flexible and Agile manufacturing is the need of the day.

Integration of TQM, TPM, Lean with AI/ML and IOT will put India in Lead if we adopt Integrated 4.0 with affordable automation.





Rabindra Sah

Chief Engineer – Strategic Project
Tata Technologies

Embracing Technology: Empowering Manufacturing for Growth and Prosperity

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The recent conference on Technology-Driven Manufacturing for Growth and Prosperity provided a comprehensive platform to delve into the myriad challenges and opportunities shaping the landscape of Indian MSMEs in manufacturing. With a focus on harnessing the transformative power of automation, digitization, and innovative technologies, the conference explored strategies to propel the growth and resilience of the manufacturing sector.

A key highlight of the conference was the in-depth discussion on the challenges hindering the growth of Indian MSMEs in manufacturing. Participants deliberated on issues such as access to finance, skill development, regulatory compliance, and infrastructure constraints, emphasizing the urgent need for targeted interventions and policy support to address these challenges effectively.

The role of automation and digitalization in driving business gains for MSMEs emerged as a central theme of discussion. Presentations and case studies showcased how embracing automation and digital technologies can enhance productivity, efficiency, and

competitiveness for MSMEs, paving the way for sustainable growth and prosperity.

Affordable factory automation was another key focus area, with participants exploring innovative solutions to streamline manufacturing processes and reduce operational costs. Discussions highlighted the importance of leveraging automation technologies tailored to the specific needs and constraints of MSMEs, enabling them to unlock new levels of efficiency and agility in their operations.

Building global supply chain resilience emerged as a critical imperative in the face of evolving geopolitical and economic dynamics. Participants discussed strategies to strengthen supply chain resilience through enhanced visibility, collaboration, and diversification, ensuring business continuity and mitigating risks in an increasingly uncertain environment.

The conference also delved into the opportunities presented by digitization and automation in SME and aerospace component manufacturing. Presentations showcased how advanced technologies such as IoT, AI, and additive manufacturing are revolutionizing manufacturing processes, enabling SMEs to achieve higher levels of precision, quality, and customization.

India-centric affordable automation and digitization solutions were highlighted as key enablers for the widespread adoption of advanced technologies among MSMEs. Participants discussed the importance of developing locally relevant and

cost-effective solutions that cater to the unique requirements of Indian manufacturers, fostering innovation and competitiveness on a global scale.

Efforts to facilitate effortless digitalization, particularly for MSME businesses in India, were also explored. Presentations outlined practical approaches and best practices for overcoming barriers to digital adoption, including access to technology, skills development, and change management, empowering MSMEs to embark on their digital transformation journey with confidence.

Cost and sustainable innovation emerged as critical considerations in the pursuit of technological advancement. Participants emphasized the importance of striking a balance between innovation and affordability, leveraging sustainable practices to drive long-term value creation and environmental stewardship.

In conclusion, the conference underscored the transformative potential of technology-driven manufacturing in driving the growth and prosperity of Indian MSMEs. By embracing automation, digitization, and new technologies, MSMEs can unlock new opportunities, enhance competitiveness, and chart a path towards sustainable growth in an increasingly dynamic and interconnected global economy.





T K Ramesh
 Managing Director
 ACE Designers Ltd

Technology, Digitalization and Sustainability

The Manufacturing Conclave organized by BCIC, focusing on Technology, Digitalization, and Sustainability, resonates profoundly with both the current global landscape and India's specific context. Bringing together Government officials, Industry leaders, thought leaders, and Academia Underscores its significance.

In an era marked by geopolitical uncertainty, India has emerged as a stabilizing force through its balanced trade and foreign policies. As we enter the era of Amritkaal, India stands on the brink of vast opportunities and challenges. Disruptions, while posing challenges, also present significant opportunities for growth and transformative change. Karnataka, with its abundant human capital and financial resources, is well-positioned to capitalize on these prospects.

While Karnataka has already made strides in sectors like

Aerospace, Machine tools, and IT, there is room for further development, particularly in emerging industries such as electronics manufacturing. The global market dynamics are shifting, with developed nations increasingly turning to burgeoning economies for economic expansion. India and Karnataka, with their skilled workforce and knowledge base, hold a distinct advantage, especially in achieving cost-effectiveness at scale.

To capitalize on these advantages, there's a need for swift responsiveness to change. The Government can play a pivotal role by transitioning from mere material arbitrage to facilitating infrastructure development, enhancing logistics, and fostering public-private partnerships. This approach can expedite critical areas like research and innovation, enabling the rapid, cost-effective deployment of technology for enhanced efficiency and effectiveness.

- 4th Position in India by contribution to Mfg. GDP
- Large contributor @ about 8%
- Rapidly growing @ about 12%
- MSME Supply Base - Around 10 Million Regd. Units.
- Good Established base of
 - Machine Tools, Aeronautics & Aerospace
 - Automotive
 - Defence Research & Equipment
 - Infrastructure
- Sunrise Areas
 - Medical
 - Electronics
 - Semiconductors

- Industrial Estates & Parks
- First Aerospace Park
- Machine Tool Park
- Toy Cluster
- 5 Auto Clusters
- Large number of Engineering & Diploma Colleges
- Scientific & Technical Research Establishments
- GI Tags - Products Authenticity, Quality & Distinctiveness

Resource | Materials | Machines | People | Capital | Land | Internet

CURRENT (The Business View)

Traditional View:
 Resources - Ex. Skill Scarce necessity
 Localizations - Ex. Cluster Spillover Eff.
 Exports as a Factor of Production
 Specialization - Markets Scale Eff. Savings

New Role Cost:
 Skill Shortage
 New Material
 Increase in Environmental & Safety Risks

Enablers: Impact on Manufacturing
 Resilient Scale / Risk of Power Failure
 Increased Emphasis on Innovation - AM, Design
 Drive Localization of Capabilities & Expertise
 Material In, Logistics In, Energy / Process



Prakash G

Chairman, Manufacturing Expert Committee, BCIC
and Chief Operating Officer
ACE Designers Ltd

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Welcome to the Manufacturing Conclave!

As the Chair of manufacturing expert committee, it was a great privilege to host the Manufacturing Conclave, which was held after a gap of 4 years. Agenda was well conceived with inputs from industry experts, leaders and committee members. Setting the right context was very important to kick start the entire day of deliberations.

Conclave was able to

- Create forum of mutual learning and sharing the best Practices among Diverse industries.
- Share Best practices helps to create speed and standardization to enable scaling in the activities.

- Bring Industry Leaders & Government Perspectives and insights on the Economy in general and Manufacturing in Particular Considering the Make in India and Atmanirbhar Bharat drive by the GOI.

- Enhance collaboration and networking among the industries & various institutions (academic and industry bodies) to achieve stability and growth in harmony.



It was an honour and opportunity to Chair the one day Manufacturing conclave of BCIC with great support and encouragement from BCIC President Dr Devarajan, Past President Dr Ravindran, Co-Chairs Mr Karthikeyan and Mrs Ira Gilani along with very effective coordination of all the staff of BCIC office secretary Mrs Roopa, Mrs Rajashree, Mr Shama Prasad and Mr Purushottam.

The welcome note and context-setting speech delivered at the conference provided me to interact with chief guests, Key note speakers, subject matter experts, moderators, and participants. It

highlighted the significance of the event, focusing on digitization, technology, innovation, and collaboration in the context of the Indian economy and the manufacturing sector.

The Indian economy described as the 5th largest in the world, with a GDP of 3.7 trillion dollars and growing at a rate of 6-7%. Specific figures regarding the Gross State Domestic Product (GSDP) of Karnataka were also mentioned, indicating significant growth and contribution to the national GDP. These statistics were cited to instil confidence in the direction of self-reliance and resilience in both Karnataka and India as a whole.



The Bangalore Chamber of Industry and Commerce (BCIC) was introduced as a prominent organization with 850 member companies representing various industries. The choice of themes for the conclave, "Make in India" and "Atmanirbhar Bharat," was highlighted as relevant to current and future needs.



The objectives of the conclave were outlined clearly, including creating a forum for mutual learning and sharing best practices among diverse industries, bringing together industry leaders and government perspectives to discuss economic and manufacturing issues, and enhancing collaboration and networking among all relevant stakeholders.

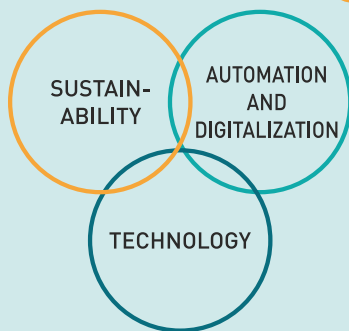


It was emphasized that the

presence of industry leaders and visionaries who have shaped the manufacturing landscape, along with the importance of speakers' expertise in automation,

sustainability, and technology. It underscored their roles as catalysts for change and advocates for environmentally conscious manufacturing practices.

CONTEXT



- All 3 are mutually inclusive & interdependent
- Disruption is Normal (Dis-continuous improvement is as important as Continuous improvement)
- Antifragile and Resilient
- Change is constant

The context was set by recognizing the impact of automation on manufacturing processes and the importance of sustainability as a business imperative, particularly in light of global initiatives like Climate Change and the ongoing COP 28 summit. The role of technology in driving innovation and eliminating limitations was highlighted, along with the dynamic interplay between technology, sustainability, and manufacturing.

The 3 themes are mutually inclusive and interdependent, and we notice that they are driving both continuous improvement and dis continuous improvement educating us that change is constant. This is compelling us to become antifragile and resilient.



“

It was privilege to invite attendees to actively participate in the conclave, engage in thought-provoking discussions, and foster collaborations that would shape the future of manufacturing. A heartfelt welcome was extended to all participants, emphasizing the transformative experience the conclave aimed to provide.

”



V Karthikeyan

Co-Chairman, Manufacturing Expert Committee, BCIC
and Chief Technology Officer, EDS Technologies Pvt Ltd

BCIC Manufacturing Conclave: Technology Driven Manufacturing for Growth and Prosperity

The recent BCIC Manufacturing Conclave held at the Chancery Pavilion on 8th December 2023 in Bengaluru was nothing short of a resounding success, leaving an indelible mark on the manufacturing landscape. As the Co-Chairman of the Manufacturing Expert Sub-Committee, I am delighted to share my perspective on this exceptional event that brought together industry leaders, policymakers, and experts to delve into the future of manufacturing excellence.

The Conclave witnessed an insightful panel discussion that delved into the heart of transformative industry practices. As the moderator, I had the privilege of guiding the conversation, exploring key themes crucial for the future of manufacturing. Here's a glimpse into the insightful discourse that unfolded.

One of the focal points of our discussion was the imperative role of automation and digitalization in unlocking business gains for Micro, Small, and Medium Enterprises (MSMEs). The panel concurred on the transformative power of technology in enhancing operational efficiency, reducing costs, and fostering innovation. The consensus was that embracing digital tools not only accelerates production processes but also provides MSMEs with a competitive edge in the market.

Affordability emerged as a key concern in our discourse on factory automation. The panel emphasized the need for accessible and cost-effective automation solutions, especially for smaller manufacturers. The collective vision was to democratize the benefits of automation, ensuring that businesses of all sizes can leverage technological advancements to enhance productivity without undue financial strain.

Our conversation naturally shifted to the evolving global landscape and its impact on supply chains. The panel acknowledged the challenges posed by changing political and economic environments and stressed the importance of building resilience in global supply chains. Diversification, robust risk management strategies, and collaborative partnerships were identified as key components in fortifying supply chains against unforeseen disruptions.

The panel also explored the specific application of digitization and automation in Small and Medium Enterprises (SMEs) with a focus on aerospace component manufacturing. Acknowledging the precision and stringent requirements of the aerospace industry, the discussion highlighted how digital technologies and automation are pivotal in ensuring quality, meeting industry standards, and fostering innovation in this specialized sector.

This panel discussion was a dynamic exchange of ideas, experiences, and visions for the future of manufacturing. It underscored the industry's commitment to leveraging technology for inclusive growth, resilience, and global competitiveness. As we navigate the complex terrain of the manufacturing landscape, the insights shared during the panel discussion serve as a compass, guiding us towards a future defined by innovation, sustainability, and collaborative progress.

The Manufacturing Conclave by BCIC was a testament to the industry's resilience, adaptability, and collaborative spirit.



It served as a catalyst for envisioning the future of manufacturing in Karnataka and beyond. As we reflect on the insightful discussions, impactful presentations, and collaborative spirit that defined the conclave, it becomes evident that the manufacturing sector is poised for remarkable growth and transformation. The success of this conclave reinforces BCIC's commitment to being a driving force in shaping the manufacturing landscape, and I am optimistic about the positive impact it will have on our industry's trajectory in the years to come.



L Krishnan

Managing Director
TaeguTec India Pvt Ltd

Forging Karnataka's Future: Manufacturing as the Engine of Growth in Bharat @ 2047

Karnataka has the potential to be a major driver of India's economic growth through manufacturing. The state can achieve this by focusing on product excellence, process efficiency, people development, and sustainability. The government, industry, and educational institutions must all work together to create a conducive environment for manufacturing to thrive. By seizing this opportunity, Karnataka can help India achieve its ambitious goal of becoming a \$22 trillion economy by 2050.

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As India sets its sights on becoming a \$22 trillion economy by 2050 under the visionary "Bharat @ 2047" mission, Karnataka, a state renowned for its technological prowess and entrepreneurial spirit, stands poised to play a pivotal role in propelling this ambition. With a strategic focus on manufacturing, the state presents immense opportunities for economic growth, not only for itself but for the entire nation.

The figures paint a compelling picture. By 2047, NITI Aayog projects India's GDP to reach a

staggering \$29 trillion, with manufacturing contributing as much as \$5.8 trillion, or 20% of the total. Karnataka, already a leader in the sector, has the potential to contribute significantly to this target. As of 2030, the state's manufacturing sector contributes 1.3 trillion dollars to India's GDP, a figure projected to double by 2040 and nearly quadruple by 2047 if strategic interventions are implemented.

This growth, however, cannot be achieved passively. It demands a proactive approach, one that capitalizes on existing strengths and addresses future challenges. Here's how Karnataka can seize the manufacturing opportunity:

1. Building on core strengths:

- State-of-the-art products: Karnataka is already a hub for high-tech industries like aerospace, automotive, and electronics. The state must continue to invest in

research and development, fostering innovation and ensuring its products remain cutting-edge and globally competitive.

- More value for money: Value engineering and lean manufacturing practices must be prioritized to deliver products that are not only technologically advanced but also cost-effective.
- Reliability and consistency: Building a reputation for consistent quality and timely delivery is crucial to attracting and retaining customers in the global market.

2. Streamlining processes:

- Stable and predictable regulatory environment: Streamlining regulations and ensuring their consistent implementation will create a predictable





business environment, boosting investor confidence.

- Continuous improvement: Embracing a culture of continuous improvement, incorporating lean manufacturing principles, and leveraging Industry 4.0 technologies will enhance efficiency and productivity.
- Flexibility and agility: Adapting to evolving market demands and consumer preferences through flexible production lines and agile workflows will be essential for long-term success.
- Digitization: Implementing digital solutions across the entire value chain, from design to production and logistics, will enable real-time data analysis, optimize processes, and improve decision-making.

3. Investing in people:

- Skilling and reskilling the workforce: Building a skilled workforce capable of operating in advanced manufacturing environments is crucial. Upskilling existing workers and introducing relevant training programs for youth will be essential.
- Critical thinking and problem-solving skills: Fostering critical thinking, problem-solving, and innovation within the workforce will equip

individuals to tackle complex challenges and contribute effectively.

- Leadership development: Nurturing strong leadership capabilities across all levels of the manufacturing ecosystem will be instrumental in driving growth and innovation.

sustainable practices. Educational institutions must tailor their programs to meet the evolving needs of the industry. And individuals must take initiative, acquire relevant skills, and demonstrate a commitment to excellence.



Ensuring the entire product, process, and people cycle is sustainable is no longer an option, but a necessity. This includes adopting eco-friendly manufacturing practices, using renewable energy sources, and minimizing waste generation.

A Collective Effort:

Achieving these ambitious goals requires a collaborative effort from all stakeholders. The government must provide the necessary infrastructure, create a conducive policy environment, and incentivize research and innovation. Industry leaders must invest in technology, upskill their workforce, and embrace

By harnessing the power of manufacturing and strategically focusing on product excellence, process efficiency, people development, and sustainability, Karnataka can not only drive its own economic growth but also contribute significantly to achieving the vision of a thriving "Bharat @ 2047." The time to act is now, and the opportunities are immense. Let us seize them and forge a future where Karnataka stands as a shining example of manufacturing excellence on the global stage.



Realizing Business Gains for MSME through Automation and Digitalization

Chandrashekar Bharati
Managing Director
Ace Micromatic Manufacturing
Intelligence Technologies Pvt Ltd

MSMEs in manufacturing are characterized by an acute need for generating cash flows, leveraging scarce resources, and meeting uncertain and unpredictable customer demand cycles. Senior leadership and management tend to be invested in core areas of generating topline, and ensuring customer delivery, using legacy methodologies and tools in use pretty much since the inception of their businesses.

Changes, especially those that require acquisition of new skills, new processes and methods of realizing value can generate a perception of risk, and loss of investment. This is further accentuated when senior management perceives a lack of inability in themselves to harness, or leverage new tools, technologies and methodologies. Ensuring bottom line impact and sustenance of such gains requires enabling and ensuring their next generation workforce to have access to increasingly digital tools and technologies that can drive processes towards



greater transparency, visibility, and ability to react at the right time.

For effective change management therefore, it is critical to matrix in the concept of "Value", which by definition, encompasses both the "Benefits" that would accrue, as well as the "Investment" or "Cost" to be paid.

What is Value?

Qualitative measures Gain compared of emotional, physical, social, economic, cultural and environmental factors	Quantitative measures Actual gain measured in terms of numbers, percentages and money
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When viewed comprehensively, and applied to specific areas of operations, MSMEs would be able to place bets on pilot initiatives, realize value, and start to horizontally expand.

Take for instance a typical machine shop, or job shop in manufacturing. Core of such businesses is the ability to realize better "machine hour rates" by improving production yields, reducing stoppages from any of the 5 M's.

Below is a sample worksheet of how a sample machine hour calculator can provide insights into how ROI may be gained through appropriate use of digital tools and techniques to improve operational parameters.



IMPACT OF DIGITIZATION	
My Company	
Description	Value
A. Avg. machine hour rate (₹ \$ € ¥)	300
B. Improvement in productivity (target or hypothesis)	10%
C. Increase in machine hour rate (A * B)	30
D. Work hours in a month (200 hours, 3 shifts daily)	600
E. Regular monthly revenue (A * D)	1,80,000
F. Monthly productivity increase (C * D)	18,000
G. Total monthly revenue, after increase (E + F)	1,98,000
H. Increase in Annual revenue (F * 12 months)	2,16,000
I. Investment, 1-time (INR)	1,00,000
J. Months for full realization (I / H) * 12 months	4 months
K. 1st Year R.O.I. (H/I) %	>150%

Such ROI could be deployed through appropriate use of automation (Industry 3.0) and/or Digitization (Industry 4.0).

Digitization and Digitalization are terms used at times interchangeably in common parlance. However, the nuance is Digitalization refers to the process of getting access to digital data about any process, while Digitization refers to a big picture concept of leveraging end to end value.

Largeky, there are 6 stages of leveraging “digital” in any company. Picture below illustrates these broad stages.



Few real world examples of manufacturers realizing sustained value is shown below.



Broadly, digital transformation is driven using these 5 principles to achieve vertical integration inside each company.

- Interconnected digital and physical systems
- Real time, intelligent, actionable analytics
- Automated digital workflows & processes
- Intelligent control
- Technology-enabled workforce

Once a company achieves digital integration for its core processes and functions, and ensuring value is being created, it would then be prepared to integrate horizontally with its network of suppliers and customers and ensure broad basing of use cases, digital touchpoints to further optimize processes, and explore new business models that may otherwise not have been possible without going digital.

It would be prudent to keep in mind both the drivers and challenges in play, prior to and during rollout of digitization and automation.

Drivers & Roadmap

Transformation Drivers : PQCD5M

- Productivity, Quality, Cost, Delivery, Safety, Morale

Challenge – People centric

- Adoption challenges: Start, Sustain, Refresh, at multiple hierarchies
- 4 Cs: Clarity, Culture, Competency, Change management

Challenge – Tech centric

- Diversity of controls, vintage, applications, manufacturers, sensors, extensibility...

Challenge – Collaboration centric

- Agility, and ability to sustain development cycles

Framework for mass propagation

- One-size doesn't fit all, can't drink from a fire hose!
- **DIY, low-end, Entry level tech not scalable/value beyond initial kick!**
- Domain expertise and sustaining support is key to outcomes, eliminates tech trap (enduring disillusionment, limiting self-belief)





V Sivaganesh
GM - FA Business Support
FANUC India Pvt Ltd

Technology Driven Manufacturing for the Growth and Prosperity

Conducted by BCIC on Dec 8, 2023

It is essential to have seamless automation across the manufacturing chain – starting from a job shop to OEM. To make Automation affordable, all the key contributors – Edge control, Digitisation and Digitalisation, IIoT with embedded remote monitoring, AI and Data analytics, Robotic Automation and Digital Twin to be considered to achieve consistent improvement in OEE.

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Today in Factory automation world, providing a comprehensive affordable automation solution is vital to improve the productivity with the increase of OEE. The automation to be seamless and benefit all the stake holders across the supply chain starting from job shop users to OEM.

To achieve affordable automation, the key contributors following components are essential:



Digitisation and Digitalisation are the elementary needs for the automation solution in a manufacturing Industry.

Digitisation:



Digitisation:



IoT tool seamlessly connects CNC, Robots, and Machines with PLCs, and simplifies the process of connecting, collecting, and storing data from Edge devices. Additional features, such as Auto Data backup for the entire CNC system, Centralized Part Program Management, Asset Management, and Traceability, can be effortlessly implemented.

ZDT, or Zero Down Time, is instrumental in minimizing downtime for FANUC Robots. By providing advance notifications of potential malfunctions in mechanical parts and errors in the Robot control system, ZDT helps avert actual breakdowns.

Digital Twin revolutionizes the efficiency and optimization of machine tool design by operating as a "Digital Twin for CNC." This

application of digital technology (DX) allows for simulation based on real machine tool feedback, enhancing workflows in machine tool design, machining, and maintenance while improving overall machining performance.

The AI-driven Predictive Maintenance Software, FANUC AI Servo Monitor, enables users with insights into potential machine issues before they occur. By collecting and analyzing daily data from FANUC CNC-equipped machines, the software enhances visibility into machine abnormalities.

Further Robotic automation solution emphasises on consistent output with the improvement in over all plant efficiency.

Hence it is essential to have seamless automation across the manufacturing chain - starting from job shop to OEM . To make Automation affordable, all the key contributors - Edge control, Digitisation and Digitalisation, IIoT with embedded remote monitoring, AI and Data analytics, Robotic Automation and Digital Twin to be considered to achieve consistent improvement in OEE.



T R Parasuraman
Past President
BCIC

Building Manufacturing Excellence Toyota Way

Indian manufacturing sector is likely to grow over two fold in the coming decade. This growth will bring in significant progress in the manufacturing eco system such as supply chain, connected technologies, digital manufacturing, logistics, associated logistics infrastructure, development of new skill sets and new employment apart from contributing significantly to the Indian GDP from the current 17% to over 30%.

This growth is propelled to several positive winds such as "China plus one" syndrome, emerging geo political crisis, a strong youth power and strong push by the government on "Make in India".

The global investors have been thinking on alternative destinations for future investments other than China over the recent times and thanks to the huge drive on "Make in India", skill India, digital India, Performance Linked Incentives Schemes on new technology developments

including advanced chemistry for manufacturing for battery manufacturing for electric vehicles, electric motors, generators, ECU, etc have given a significant momentum to the growth of manufacturing in the country.

India's foreign policy and neutral stand on geo political issues coupled with a strong growth in economy, digital infrastructure and knowledge power, reforms in ease of doing business such as GST, digital gateway for payments, pro active policy reforms, revised National Education Policy has won the admiration of foreign investors over a period of time.

Another important factor propelling the growth is the abundance of youth power being one of the youngest population in the world providing a great opportunity to reap huge



demographics of dividend much ahead of other aging countries such as China, Japan, most parts of Western Europe and US.

Thanks to COVID 19, the world has learnt smarter ways of working and use of advanced technologies is finding a significant presence in the world of manufacturing. Undoubtedly India has been driving and leading the change in use of digital infra structure much ahead of other countries.

Rapid urbanisation due to huge spent on infra structure in the recent budget announcements, transition from lower income to higher income base have rapidly increased the use of personal mobility in terms of increasing ownership of two wheelers and 4 wheelers has been significantly contributing to the growth of automobile industry and India has



proudly positioned as third largest manufacturer of passenger cars and the worlds largest market for two wheelers .

While there is a huge opportunity, it is important to understand and address the potential challenges and way forward.

With the increasing labor cost, changes in life style and work balance , learnings and reflections through covid pandemic there is a greater necessity to adopt new technologies such as IOT, Machine learning & AI, Robotics and automation, 3D printing, VR, 3D Printing, predictive maintenance and condition monitoring through connected devices & data analytics, cloud computing, E learning etc to integrate with manufacturing. Unfortunately the skill sets available in these areas are quite inadequate with expected growth and it is very important to create many centres of excellence and spent on R&D needs to. E significantly enhanced while accelerating the industry academia connects for a greater purpose .



Another important focus area should be towards maximising the cost competitiveness among the increasing MSME segment in the country. Today we have close to 7 crore MSMEs in the country and this no is likely to double in the next 10-12 years when India is edging towards a 10 trillion economy .Currently MSMEs employ close to 100 Million people and contribute to about 40% of manufacturing output and 45% of country's export. Unfortunately there is a huge divergence of skill sets and performance vin this segment. This was very clearly visible when thousands of MSMEs could not survive the onslaught of COVID 19.

Fundamentally we should focus on four pillars namely,

- Operational excellence through daily shop floor management.
- Human Resource Development.
- Finance management and strategy building.
- Problem solving through Quality circles.

It is very important to provide hand holding by the Government through many promotional measures such as easy loans, incentives, ease of doing business and OEMS should play a vital role in the HRD of these MSMES by involving them in all the developmental activities and providing timely and necessary support from time to time.

The manufacturing industry also can leverage a huge growth through nurturing startups for breakthroughs in products and processes. The Government corporates, academia and the trade bodies should play a significant role in inspiring, handholding and developing these startups in various fields to meaningfully contribute and bring in significant value to the manufacturing supply chain.





Divya Seethapathy

Director, Procurement Resilience
Schneider Electric

Building Resilience

As the world order gets more ambiguous, volatile and incomprehensible, Resilience becomes more and more a necessity than just another process in the supply chain. On deeper thought, we see technology can aid us in the journey to build resilience.

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We live in a more volatile and ambiguous world. The COVID taught us that we could stare at a day when the entire supply chain across Tiers is shut down without notice. The Russia-Ukraine, Israel-Hamas conflict taught us that the age of wars can dawn on us any day and we cannot take peace for granted. The steep increase in cyber attacks taught us that virtual is as real as 'real' can be. The steep increase in natural calamities taught us that climate change will have deep ramifications on our supply chains than we anticipate.

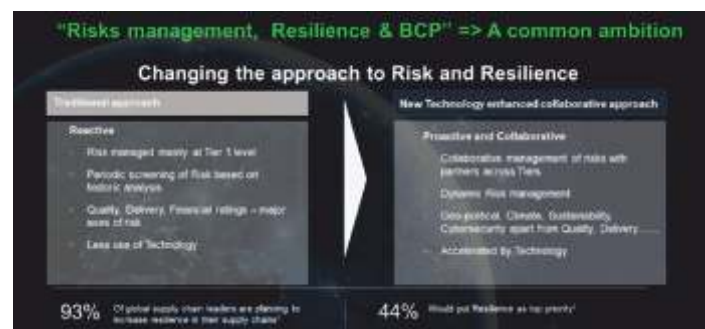
So it is no longer sufficient to look at risk mitigation as just another normal process. The resilience of a supply chain will determine its competitive edge moving forward. Building resilience requires a deep dive into the underlying process people and governance. Organizations have to put in efforts driven by the top management to make their supply chains truly resilient. It is also no longer sufficient to mitigate risks at the tier one level the strongest supply chains have visibility and control over tiers deeper into the supply chain. The new requirements around regulations compliance and carbon footprints require organizations to develop visibility across the tiers.

On the process and governance front there has been significant work done by organizations in order to put in risk control towers and risk mitigation centres. So through benchmarking this can be harnessed across other organizations who wish to embark on the same journey. Another dimension which is emerging is that of technology and how organizations leverage technology to identify risks early on to get a head start on mitigation there are many startup companies working to provide signals around risk events and also help organizations to analyse the impact of these events on their supply chains. But one must understand that data is the backbone of technology and in order to leverage technology organizations have to first set an order the data within their companies the stronger the data the stronger will be the leverage with technology.

A lot of work needs to happen in parallel to build a resilient supply chain the first is to assemble a strong team which has competence experience and agility to put in place processes and governance which will be followed across

the organization. This team has to execute a change management and instill a sense of importance on the topic of resilience across the organization. The second is the work to be done around data quality and data architecture, which will help to instill credibility and provide actionable insights for the team executing mitigations. One of the major blockers for risk mitigation today in organizations is the lack of actionable insights at the right time. Technology can be a huge boost to solve this problem.

By adopting these 2 pronged approach an organization irrespective of its size can develop resilient supply chain and reap its benefits overtime. The point to be remembered is that building resilience requires top management support and attention and it also requires sustained efforts over a period of time to actually start seeing results.





Rakesh S B

Vice President - Aerospace and Defence
Sansera Engineering Ltd

Sansera Engineering Limited

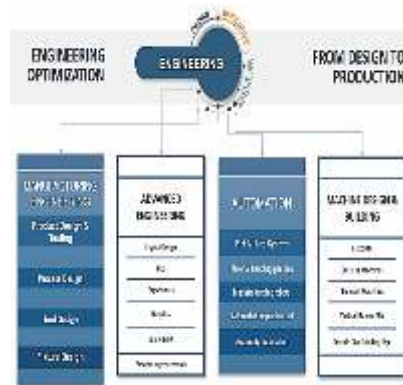
Chasing Excellence by Automation & Digitalization

AUTOMATION JOURNEY

- In 2002, Sansera took its first step into robotic automation by installing a system for the Connecting Rod Bolt Hole process. Recognizing the potential and benefits of automation, Sansera officially established its Automation Department in the mid of 2013.
- In the same year (2013), Sansera expanded its automation initiatives by installing a second robotic system, the focus was on automating the Connecting Rod Final Cell process. The company extended its automation efforts beyond Connecting Rods, exploring opportunities to implement robotic solutions in other product lines. This diversification aimed to improve overall operational efficiency and flexibility.
- The incorporation of robotics, particularly in the Connecting Rod Final Cell Automation, demonstrated Sansera's proactive approach to

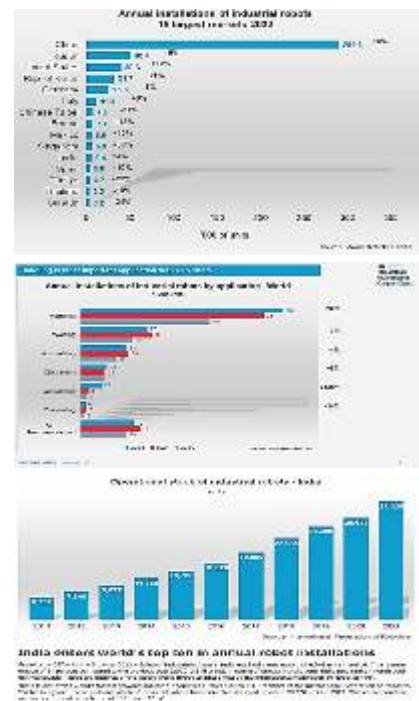
enhancing quality and precision by minimizing manual errors. The company explored ways to integrate automation seamlessly into its manufacturing ecosystem, promoting a comprehensive and interconnected automated production environment.

- Today Sansera Group has over 250 Robots and 18 Gantries which is interfaced with 500+ machines.



Automation is the backbone of the industry leading to improved productivity, consistent quality and operator safety.

Robotics: Global Statistics



Illustrative list of reasons to Automate / Objectives:

- lesser influence of human factor to technological process.
- improved production reliability.
- increased production speed and quality.
- increasing labour costs.
- maximum safety for man and machine.



- relieve personnel of unpleasant & monotonous tasks.
- making employees job more attractive.

Automation Systems:

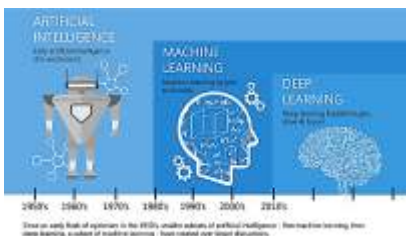
- Cartesian Axis & Gantry
- Transfer Robots (4-Axis)
- Robotic cells (6-Axis)
- Gantry mounted Robots
- AGVs (Automated Guided Vehicle Systems)

TECHNOLOGY ADOPTION

Challenges of the robotics industry

Collaboration - humans and robots in shared workplaces without fences opens up new possibilities and concepts in production and in non-industrial areas

- Robots assist humans in the workplace
- More flexibility in the production process - increase of productivity
- Shop floor flexibility - not defined by cages
- New processes to manage low-volume high-mix production
- Robots in warehouses to manage increasing order volume.



AUTOMATION IN COMMERCIAL AEROSPACE MANUFACTURING

- Airplane and turbine engine manufacturers have integrated automation technology into all assembly lines, including

material handling, fastening, sealing, welding, inspection, and testing.

- Airframe manufacturers can deploy automated solutions for each section of the airplane - body, wings, and tail. Automated drilling and filling solutions save time and money by reducing errors and increasing throughput.

AUTOMATION & DIGITALIZATION IN THE COMMERCIAL AEROSPACE INDUSTRY

The benefits of automation are growing. Automation technologies are flexible and scalable. With aerospace assembly automation, you can adjust to peak seasons or new market changes, keeping the work quality as well as workforce health and safety top of mind. Commercial aerospace automation has a high return on investment because of reduced error and scrap rate. Human error and variability lead to wasted resources and high cost per part. With vision and inspection automation, companies can complete inline inspection and traceability.

Benefits of Automation

Increased Productivity:

Automation streamlines processes, reduces human error and enables higher production rates, leading to improved overall productivity.

Cost Savings:

Automation reduces labor costs while increasing efficiency, resulting in significant cost savings for businesses in the long run.

Enhanced Safety:

By removing humans from hazardous tasks, automation helps create safer working environments and reduces the risk of accidents.

Consistent Quality:

Automated systems ensure consistent quality control, minimizing defects and ensuring that products meet high standards consistently.

Challenges and Considerations in Implementing Automation

1. Initial Investment:

Implementing automation may require a significant upfront investment, but the long-term benefits far outweigh the initial costs.

2. Workforce Transition:

Managing the transition of employees from manual to automated processes requires careful planning, communication and training.

3. Data Security and Privacy:

As automation relies on data exchange and connectivity, safeguarding sensitive information becomes paramount in a digitally connected world.

Conclusion and Key Takeaways

Automation is reshaping industries, offering numerous benefits such as increased productivity, enhanced safety, cost savings and consistent quality. However, successful implementation requires careful planning, addressing challenges and learning from inspiring case studies.



Sundararaman G
Co-CEO
Wipro Pari Pvt Ltd

India Centric Affordable Automation and Digitization Solutions

Preamble

We see significant changes in the Indian manufacturing sector, specially post covid. We see a greater appreciation for remote monitoring, feedback, control of production processes. We see that efforts are being made to reduce the number of human touches in material handling through better automation. Unlike China, where we compare the number of robots being retailed per year as a measure of automation penetration, we in India, seem to be reinventing "India Centric Automation" in our own way, which is more frugal and at the same time serving the purpose of improving productivity & quality.

Wipro Pari - Major Indian Automation Player on the Global Scale

Wipro Pari has over 33 years of history having executed over 3000 Automated Manufacturing Systems of which more than 300 are complete turn-key lines for Global customers in 5 continents & 30 countries. Wipro Pari has been one of the first companies globally to successfully execute first automated mass manufacturing capacities in EV (Electric Vehicle) manufacture and with this first

mover advantage, we have executed turnkey projects in all segments of automotive EV segment – be it Battery pack (all technologies cylindrical cell, prismatic or pouch), e-motor, e-transmission, Vehicle assembly. The complete value chain from business development, sales, design, manufacture, test & debug, install & customer handover is well established with a global talent pool, systems & processes. The manufacturing & integration facilities are established in Pune - India, Detroit - USA, Mexico, Romania, Germany and sales & service offices in Canada, Turkey, Vietnam.



Key enablers for our success

Following have been the major enablers in our growth story:

1. Customer centricity
2. People skill focus
3. Continuous upgradation in technology solutions and product offerings

4. Regional expansion with satellite execution centres
5. Vertical integration and investment in our manufacturing capacity

Global Execution Model

Wipro Pari has a strong Global Execution Model efficiently aligned with local delivery infrastructure, fine-tuned to Local strengths & constraints with the combination of front-end local presence and capacity-based backend in India. Wipro Pari has a capacity Efficient Off-shore Execution model out of Pune which handles,

- Offshore Project Management for all execution planning, tracking, control
- Detailed Engineering Design, Materials procurement, Manufacturing
- Integration & Testing (driven by onshore plan)
- Installation Supervision

Human Capital

Our human capital includes over 4000+ workforce, with a strong 1000+ engineering talent (Mechanical, Control systems, Software programmers) and over 330+ experienced overseas manpower. Our success comes



from strong engineering base with a design library of standardized solutions and constant investment in automation R&D. Strong IT system form the backbone with unique enterprise systems for Project Management, Resource Management, Knowledge Management, and Engineering Management – for the entire business lifecycle to be managed seamlessly.



India's Opportunity in Global Manufacturing Sector

India in the last three decades of growth skipped the manufacturing sector and focused more on the services sector to propel its GDP. But now with all the advantages of demographic dividend, government impetus through various PLI schemes, its software prowess, China+1 strategy of major Global companies, we are looking at this and next decade as digital manufacturing era generating significant employment opportunities.

The acronym that comes to my mind for India's Manufacturing growth story is 3E's that will propel our digital manufacturing in this and next decade and thereby achieving our trillion dollar manufacturing economy:

Electric Vehicle: India as a home to world's largest 2 wheeler and 3 wheeler market, we are poised for this major transformation. All requirements of digitisation

“Cradle to Grave” track, trace, monitor, improve, optimise will get deployed in this segmental growth. With a staggering projected CAGR of over 90%, we will be witnessing a revolution in our digital manufacturing footprint.

Ecommerce: The rapidity with which our billion consumers are embracing online stores, consumption of day to day livelihood items, is propelling unimaginable level of digitisation from Factory to End-consumer. On-line retail growth and consumer demands for faster delivery, forces industry to develop automated and digitised logistics infrastructure in the network across all stakeholders from factories, Distribution Centre's (DC), Transportation, Fulfilment Centre's (FC), Micro Fulfilment Centre's (MFC) and the last mile delivery.



Electronics Manufacturing: With China+1 strategy, we are seeing huge manufacturing investments happening from semiconductors, battery cells, smart phones and all consumer electronics goods. Already we have witnessed the mobile phone production going from 60 Mn in 2015 to 300 Mn in 2022, now we are poised to take this to 1 Billion level over the next 5 years. This segment will witness a major investment in precision engineering automation along with world class digitisation



technologies penetrating the high speed fault free manufacturing lines.

Digitisation Opportunities in Manufacturing Sector

The first step in digitisation is to connect the machine to the world of internet. Today we have affordable data gathering devices even for legacy machines. The low-cost but effective entry route for SMEs is to keep the entire digitisation requirement simple & purposeful. If the machine is connected, the entire team in SME can monitor the productivity through simple mobile apps and only engage in detailed investigations when required. Sometimes, standard IoT offerings from many of the proprietary players will warrant them to invest heavily in the beginning. There will be so many sensors, digital / analog ports gathering hundreds of data at very short time intervals with heavy analytics. This could lead to overdose of IoT for SMEs and the real purpose of productivity monitoring and improvement gets lost. So the essential requirement for SMEs is to ensure machines are connected with just the requisite data / information getting gathered, simple mobile app based analytics to understand the productivity measures and intervene with larger tools and investment only when the ROI is justified or the problem is insurmountable.



Himanshu Jadhav
CEO & Director
Jendamark India Pvt Ltd

Human-Centric Approach to Digitalization

For developing countries like India, a human-centric approach to industry 4.0 is essential which will promote doing more work whilst involving more people and not focusing on replacing humans from industries. This article focuses on presenting a unique digitalization solution that promotes a human-centric approach to industry 4.0. The solution is the ODIN ecosystem developed by Jendamark Automation to meet the industrial needs in developing economies while giving advanced state-of-the-art industry 4.0 solutions

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Abstract

The fourth industrial revolution or Industry 4.0 is driven by cutting-edge technological developments like IoT, cloud computing, big data, 3D printing, collaborative robots, etc. The world is accepting the changes brought in by industry 4.0 and moving towards an advanced era of industrialization. Starting earlier in Germany, the fourth industrial revolution has now gotten worldwide acceptance. Being the driver for change and improved industrialization, it has certain limitations and disadvantages when it comes to developing economies like India. Developing economies have a great asset in terms of manpower due to the immense population. Replacing humans in industries with automation will lead to situations of social unrest, unemployment, and loss of livelihood and ultimately impact the development of demographics. Hence, for developing countries

like India, a human-centric approach to industry 4.0 is essential which will promote doing more work whilst involving more people and not focusing on replacing humans from industries. This article focuses on presenting a unique digitalization solution that promotes a human-centric approach to industry 4.0. The solution is the ODIN ecosystem developed by Jendamark Automation to meet the industrial needs in developing economies while giving advanced state-of-the-art industry 4.0 solutions.

1. Introduction

Each industrial revolution introduced major transformations in industries using the disruptive technology of that period. All of them are believed to accelerate the Growth. The common factor was doing MORE with LESS! The very first industrial revolution back in the late 18th

century was driven by the invention of steam engines in England. The first industrial revolution gave the world new avenues to explore such as manufacturing, coal mining, energy, and railways. In the late 19th century, the second industrial revolution, more advanced than the first in terms of invention, technology, and results, replaced the steam engine with internal combustion engines. It shifted the focus to the mass production of goods, electric energy, and communications. The second industrial revolution is touted as the one with the most significant impact due to the developments of automobiles and planes in the 20th century. The 20th century also witnesses the third industrial revolution. It digitized the industries and service sectors with computers,



telecommunications, electronics, programmable logic controllers, and robots. It focused on electronics and information technology to revamp the industries and digitize them in order to optimize time, investments, and outputs. All three of these revolutions were centered around increasing the productivity and efficiency of industries.

As the trend follows, the fourth industrial revolution is also introducing new advanced concepts leading toward smart digital factories fueled with automation. 4IR is concerned with making the factories intelligent by enabling devices, machines, production modules, and products to independently exchange information, trigger actions and control each other. It is evident, 4IR is moving towards automation and intelligent manufacturing. 4IR has introduced breakthrough technologies, and automation, and promoted smart intelligent industries capable of functioning with very less human interaction. While these developments have their advantages on a larger scale, it also impacts countries with huge population in a negative tone.

2. Brief Overview

In order, to introduce the human-centric approach to industry 4.0 a review of the existing system and industry technology trends was done. The objective of the review was to highlight the trends and

technologies prevalent in industry 4.0. Further ahead the challenges faced by developing countries are discussed to throw light on the needs of developing economies and the need for a human-centric approach in developing economies like India which has a large population asset. The review thoroughly examines the existing solutions under the industry 4.0 umbrella which is later contrasted with the solution of digitalization over automation. Further ahead, ODIN manufacturing - A Jendemark Ecosystem, is introduced to elaborate and illustrate a human-centric approach to 4IR. The various solutions under the ODIN ecosystem are contrasted with the needs of developing countries and countries with large population assets.

3. Industry 4.0

Various new technologies and futuristic advancements in existing technologies are believed to be drivers of the fourth industrial revolution. Fig.1. highlights the most prominent and promising technologies leading the fourth industrial revolution. These technologies not only aim at improving a specific process or industrial entity but strives to collect, network, and manage large amounts of data in any industry to streamline the functioning and thus optimize the industry performance. Most of these technologies utilize information and data to create a value chain. The most promising 4IR technologies are the Internet of Things (IoT), Big

Data, Additive Manufacturing (3D Printing), Cloud Computing, Collaborative Robots, etcetera.



4. Current v/s Proposed framework



Fig.2. Challenges faced by developing economies

Fig.2. depicts the challenges faced by developing countries across the globe. The population is a huge asset for developing countries if put to proper use. The trends show increasing projections of populations in upcoming years which will require more employment opportunities. Literacy is the next challenge the hat majority of developing countries face. Amidst the global competition and a technology-driven world, these countries lag behind due to lower literacy rates. Diversity makes people thrive but also



acts as a barrier at times. For instance, the diverse languages spoken across countries like India makes it imperative to standardize every process and bring in linguistic homogeneity to eliminate the barriers of language. Developing economies face a significant economic gap with their developed counterparts. The per capita income in developing economies is very less as compared to the developed economies, and complete automation will only worsen this situation. Lack of healthcare hinders the progression of developing countries by giving rise to issues such as lack of human resources even with a large population.

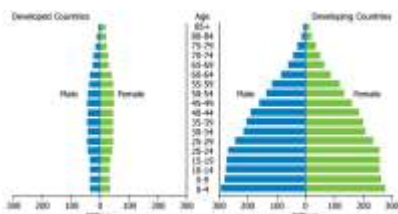


Fig.3. Automation v/s Digitalization

As shown in fig.3. the gap between developed and developing economies is huge in terms of the availability of manpower and the need for automation. Developed economies like western Europe have fewer people at an early age which will mean lesser skilled workers for industries in the future. On the contrary, developing nations like Africa and India will see a huge number of people in the future working in the industry. The solution for developed countries is automation which can compensate for the low

population. However, the solution for developing countries having large populations is not automation but digitalization. Digitalization is doing more with more people.

Why a human-centric approach?

India	Germany	India
Population	8.3 Crores	100 Crores
Area	3,28,726 sq.km	3,287,263 sq.km
Languages	5-10% speak 1 language	700 official, 2000+ dialects
Per capita income	22,121,440, USD/annum	22,121,440, USD/annum
Literacy rate	99% over 15 years age	74% over 15 years age

Comparison of Germany Vs India 2023

A human-centric approach focuses on moving ahead into the future with technology and people. With this approach, technology is focused on aiding humans and not replacing them. So far in industries, the focus has been on optimizing the machines. Machines already run at an efficiency that is much higher than the efficiency of the human worker. A machine whose efficiency is in the range of 90-95% will not benefit much from further improvements as compared to a worker whose efficiency is less than 75%. Optimizing manpower is crucial for developing countries. Developing countries are already facing considerable unemployment rates. The exclusion of people from industries will only worsen the case for booming economies. In developed countries, the population in the bracket of working age is moving towards retirement, and lesser people are expected to come ahead in the future due to low population rates at an early age. The case is exactly the opposite for developing countries.

From Fig.4. we can infer that the developing regions of Africa, Asia & Oceania, and India contributes largely to the world population. In the upcoming decades, the world population will reach 10 billion, 8 billion of which will be in developing economies. Automation which aims at being technology-centric and eliminating human intervention is not a solution but a problem for developing economies. Developing countries need a human-centric approach to utilizing technology to improve the efficiency of our factories and industries. This human-centric approach is digitalization. Digitalization unlike automation is centered around humans and not machines. It aims at doing more with more people. At an industrial level, there are several challenges that need to be addressed before solutions of industry 4.0 are implemented.

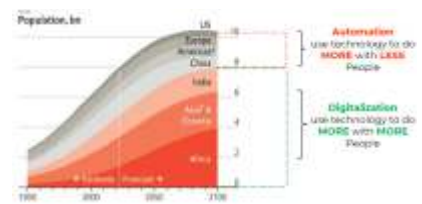


Fig.4. Projected world population growth

The INDIAN CONTEXT

- Many Indian companies, especially SMEs, faced challenges in implementing Industry 4.0 technologies due to high initial costs, lack of skilled personnel, and difficulties in integrating new technologies with existing processes.
- Blind adoption of WEST initially leads to failures in arriving at tangible results



Subsequently industries took a cautious approach towards I4.0, especially given the uncertainty and risks associated with the actual benefits

Human Centric approach to SMART Manufacturing is better suited to us as it utilizes

1. Our strength which is our YOUNG population
2. Emphasis on sustainability & inclusivity

With India's vast and diverse workforce, we leverage human skills and creativity, leading to higher productivity and innovation.

5. Solution - ODIN Ecosystem



The above figure represents typically what MSMEs and SMEs strive towards

With ODIN Manufacturing we have provided the TECHNOLOGY which helps organizations from small, medium, Tier 1s, Tier 2s and even OEMs to achieve this

ODIN - A Jendamar Ecosystem revolutionizes industries. It aims at doing more with more people without eliminating manpower from the entire scenario. ODIN ecosystem focuses on digitalization rather than automation thus enabling developing economies to grow along with their people.

Advantages of ODIN Manufacturing software 'solution:

- Tools are simple and easy to self-configure - customers do not feel locked in. Ensures simpler, same-day deployment and configuration.
- Proven compliance to global OEMs and Tier 1s' standard operating procedures (SOPs).
- Deep hardware integration allows for closed-loop control of processes (presses, bolting tools, scanners, measuring machines, PLCs, etc.) - built from the bottom up
- Engineering as a service" included in the pricing of each app. Customers often struggle to initiate & sustain continuous improvements. Our team will assist in providing feedback to



Fig.5. Factory equipped with ODIN

5.8 ODIN Workstation

ODIN Workstation stands out as a data-driven Machine Execution System (MES) solution that prioritizes the role of operators, redefining the digitization of your production line. Its fundamental attributes include heightened operator guidance, stringent quality assurance measures, seamless integration with

various devices, and comprehensive production planning capabilities. Tailored specifically for Small and Medium-sized Enterprises (SMMEs), it offers a scalable solution, allowing customers to commence operations with a single station and seamlessly expand to enterprise proportions. These solutions are driven by humans and for humans. Even after being intelligent systems powered by industry 4.0 technologies, human operators and workers play a crucial role in the industry. Thus, ODIN Ecosystem does not replace but supports humans in industries. Odin Workstation connects with all field devices via ProfNet or Ethernet and allows for two-way communication between the database and line.



Fig.6. ODIN WORKSTATION

Key features:

1. Direct Hardware Integration:

- Ensures process integrity and quality assurance by directly connecting to station
- Facilitates detailed data collection for predictive analysis.



2. Agile Manufacturing (Multi-Product):

- Enhances line flexibility with one-piece flow (Batch size 1).
- Simplifies customization, reducing costs and accommodating different product types on the same line.

3. Quality Assurance and Traceability:

- Pre-configures operation result parameters, notifying operators of deviations.
- Enables operators to confirm, send for rework, or fail a part.
- Each part has a unique identifier, and quality control reports are accessible during and post-production.

4. No-Code Line Planning and Configuration:

- Boosts assembly line flexibility.
- Simplifies hardware setup and configuration, reducing time and costs.

5. Smart Worker Guidance:

- Digitizes work instructions for accurate assembly processes.
- Captures data to aid in efficient and informed decision-making.

6. Reporting:

- Access production data quickly.
- Saves time by providing readily available reports on ODIN Workstation.

5.1.1 ODIN Manager

It is primarily used to configure a production process virtually, define the sequence of

operations, and link line assets to process steps. This tool has an easy-to-use interface allowing customers to carry out modifications or improvements on their own. As it is web-based, the reporting functionality can be accessed from any location with secure access control. ODIN Manager takes complex data from the production line and turns it into reports that are easy to understand for admins. With reports, admins can view data for a particular category, sequence, and for a selected period of time. Reports can be downloaded in Excel and PDF formats. This offers a great organization of data by reducing paperwork and incorporating industry 4.0 solutions.

5.1.2

ODIN Ensure

ODIN Ensure is a Quality Assurance solution built by Jendemark that helps companies achieve their goal of manufacturing & shipping products of the highest quality. 'ODIN Ensure' is used on an Android device as a digital checklist. Operators can use it

to validate all operations and click required pictures for documentation purposes.

Traditional quality assurance process involves manual documentation. It requires operators, supervisors, or quality assurance engineers to manually fill out a quality assurance form. This process has the following drawbacks:

- Dependency on the performance of individuals
- Ongoing costs of training staff
- Inconsistency and unreliability in data entry
- Single standard QA process created for a variety of products
- Variant-specific checklists are not possible
- Room for errors while performing SOPs
- Improper data collection due to manual data entry
- Time-consuming to find relevant data
- Absence of Data Analysis and Authenticity

ODIN Ensure gives a complete solution for the quality assurance process. It facilitates end-of-line inspection ensuring consistent product quality and avoiding unintentional errors. It also provides step-by-step work instructions to quality personnel enabling them to act quickly and take accurate decisions and generates and stores comprehensive quality reports that improve transparency, traceability, and auditability. With ODIN Ensure,



Fig.10. ODIN ENSURE



the latest technologies are integrated into one system to ensure maximum fool proofing. Table 1 gives details of the components of ODIN Ensure.

5.1.3 ODIN PHANTOM

Introducing an all-in-one AI Vision System that virtualises station hardware with machine learning models. ODIN Phantom uses these models to replace hardware such as sensors, buttons and tool positioning systems

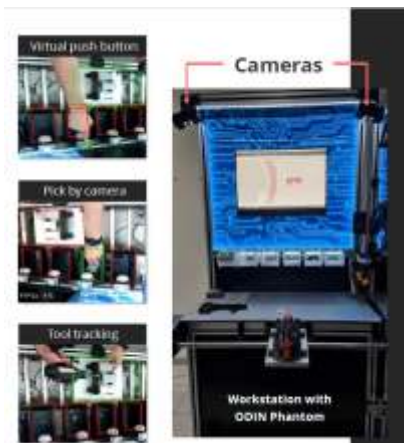


Fig.14. ODIN PHANTOM

Key features:

- 1. Google Maps' for operators drives improved quality**
Together with ODIN Workstation, the system guides operators and ensures that the correct work steps are performed. If an error is made, the operator is 'rerouted' in a pre-defined manner to ensure the integrity of the assembly or disassembly process.
- 2. Cost savings**
Phantom devices replace hardware such as push buttons, sensors, tool positioning systems, pick-to-light systems and many more.

This significantly reduces cost in terms of physical hardware, installations, labour, cables, wires, replacing and fixing of hardware etc.

3. Increased flexibility

Phantom devices can be trained to fit the requirements of the specific product being built.

4. Reduced time and cost of training

For newly introduced products, the combination of ODIN Phantom and ODIN Workstation speeds up the training time required.

5. Simple tool- and hand-tracking setup

Tool tracking enables the user to track, for example, a bolting tool. Only when the tool is in the required position (that is no-code configurable and adjustable), will it activate. Hand tracking recognises hand motions and gloves, if required. This is for safety and quality assurance.

5.1.4 ODIN INSIGHTS

ODIN Insights consolidates all ODIN Workstation data onto one platform, allowing your



Fig.13. ODIN INSIGHTS

data to inform and guide your next action. With dashboards, production KPIs, and smart algorithms, you can close the feedback loop from shop floor to top floor.

Key features:

1. Convenience

Immediate access to production, equipment and quality data. Use the filters to gain Insight into more specific machines or processes.

2. Operator motivation

Live, transparent feedback on overhead displays stimulates healthy competition between operators.

3. Quality management

On-demand, quality-focused Six Sigma checks and process capability measures are carried out more efficiently. This allows quality engineers more time to solve problems and avoid time-consuming, inefficient manual capturing of quality data.

4. More efficient problem-solving

React to problems faster by having access to live, objective data.

5. Objective decision-making

Providing management and supervisors with live, objective data aids informed decision-making about potential facility improvements.

5.2 ODIN CHECKPOINT

ODIN Checkpoint is all about ensuring that routine tasks are carried out consistently - again and again. ODIN Checkpoint forms part of the ODIN Manufacturing ecosystem,

developed by Jendamarck under its digital services offering. This software solution is unique as it does not involve the addition of any new hardware on existing lines and hence is easy to implement and roll out. It is based on the principle of enhancing the current maintenance process and providing digital tools to technicians to improve their performance and efficiency.



Fig.7. ODIN CHECKPOINT

ODIN Checkpoint is a cloud-based solution that schedules all the maintenance activities of all the assets in a plant, assigns the activities to technicians, and shows the overall health of the plant. It also guides the technicians on the process to be followed (pictures and videos).

It prompts a response from the technician by asking him to enter crucial data points which are used to predict any deviation from normal. ODIN Checkpoint also ensures quick and easy access to all documents relevant to the line required by the technicians.

Key features:

1. Simple planning of tasks

Plan multiple departmental tasks, such as preventative maintenance, safety checks, verification and calibration of equipment, in one place.

2. Upskilling

Through an intuitive mobile user interface (including Standard Operating Procedures, video, images, etc.), technicians can learn and develop skills on the job. Unskilled workers easily learn to perform more complex tasks.

3. Key parameter recording

Record and auto-verify key parameters. Workers don't need to memorise correct parameters, settings or values. These values are recorded and can be used for further analysis such as predictive maintenance.

4. Traceability

Live task statuses, as well as multi-level reporting and analytics, are easily available through any connected device.

5. No slip-ups

With ad-hoc task scheduling and the 'Raise Alert' feature, anyone can raise an alert for any asset, thereby auto-generating a job card. Technicians are instantly informed of any irregularities and can act immediately.

5.2.1 ODIN Documentation

It is a web-based service that can be accessed from the shop floor, allowing technicians to fetch manuals and get quick guides to solve problems

faster. QR codes are placed on each machine. When scanned, they open a login page. Once you are logged in, you will see a layout of your entire plant along with hyperlink bubbles, each representing a particular asset. You will also be able to see all of your documentation for the entire plant organized according to categories such as BOMs, Drawings, Spares, and more. ODIN Documentation acts like a safe haven for machine documents and makes it easier for operators to access them. ODIN Maintenance comes with a digital platform that safely centralises all the company documents online and makes them easily available whenever needed.

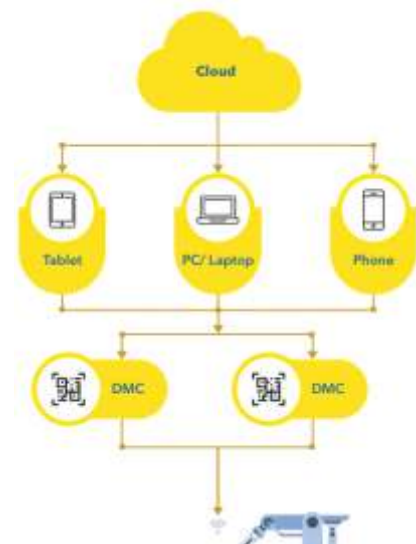


Fig.8. ODIN Documentation

5.2.2 ODIN RAVEN IOT

Get objective machine utilisation data – without a PLC. Use ODIN IOT to gather real-time data straight from your new and old machines, and



harness it to predict potential critical failures and avoid unnecessary downtime.



Fig.9. ODIN RAVEN IOT

Key features:

- 1. Get new eyes on old machines**
Ideal for use on older, low-tech equipment, where just the vibration of the machine is used to collect data.
- 2. Just-in-Time maintenance**
Together with ODIN Checkpoint, ODIN IOT can schedule real-time preventative maintenance tasks based on actual machine run time plus alerts generated from the sensor analytics. Use it to help optimise reaction time in tending to machines on downtime.
- 3. Every machine is different**
By generating a unique machine learning model for each asset, the ODIN Raven sensor training is customised to the specific asset it is monitoring – ensuring more accurate output data.

4. Simple and non-invasive

Installation on your existing equipment is simple and non-invasive, with no gateway devices required. Easily onboard your sensor to the ODIN IOT platform via a mobile app.

5. In the cloud

Device records are accumulated and accessible in the cloud, providing you with all your key machine data at a glance. This is done using Wi-Fi – no LAN cables are required.

6. Know what's happening

Get a new perspective on your existing machine's capacity and usage, especially when considering new asset investment.

5.3 ODIN VR

VR allows plant managers to replicate and simulate the production process as well as assembly line configurations, thus helping to identify potentially dangerous situations. Virtual reality is used to immerse an employee in a future workstation, then capture the employee's movement to evaluate task feasibility and proficiency.

Key features:

- 1. Train anywhere worldwide**
Global training can be facilitated from a central company metaverse.
- 2. Gamification**
Create a fun and engaging training experience. Users receive training scores and can adjust the level of difficulty, use scenarios and set different goals to achieve.

3. Risk-free training

By training in a 3D virtual space while activating muscle memory, training becomes more effective. It is also the safest choice, eliminating real-world risks to the operator, facility, and product.

4. Content unique to you

VR, AR and 360 video content can be created to suit your individual needs.

5. Simplify complex training

Any sequence can be replicated in the virtual space. Even the most complex assembly sequence can be broken down and learnt far more effectively, in a risk-free setting.



Fig.12. ODIN VR

6. Conclusion

The rapid evolution of Industry 4.0 has fueled a surge in automation, with cutting-edge technological solutions increasingly automating manual tasks across industries. However, a significant drawback of these advancements is their tendency to replace human operators and workers. While this shift may be well-suited for certain regions, it poses substantial risks for others.



Developing economies, characterized by large populations and expected growth, are particularly vulnerable to the challenges posed by widespread automation, leading to potential unemployment issues. This not only jeopardizes livelihoods but also raises concerns about social unrest and the hindrance of economic development, notably in countries like India and South Africa.

In addressing the challenges faced by industries regarding operator and human efficiency, there is a prevailing focus on enhancing machine efficiency. Despite continuous efforts to boost overall efficiency by improving machine capabilities, these incremental advancements often fall short

of significantly enhancing the efficiency of the entire production process. For developing economies, it becomes imperative to shift the focus towards improving the efficiency of operators and workers, thereby integrating them as crucial components of the business. The solution to this evolving landscape lies in prioritizing 'Digitization' over conventional automation. The ODIN ecosystem stands out by offering solutions underpinned by Fourth Industrial Revolution (4IR) technologies, revolutionizing the role of humans in industries. Each facet of the ODIN Ecosystem contributes to achieving superior performance, monitoring, traceability, and error reduction in specific processes.

By adopting the ODIN Ecosystem, industries in developing nations can thrive by embracing digitization while staying abreast of the latest trends in the Fourth Industrial Revolution. This approach not only addresses efficiency challenges but also ensures that human workers remain integral to the industrial framework, fostering sustainable growth and aligning with the contemporary trajectory of Industry 4.0 and modernization.





Ravikiran Pothukuchi

Director - Manufacturing & Logistics
Dassault Systemes

Optimize Product Design for Climate Neutrality

Approach product design with sustainability in mind to effectively decarbonize products and value chains for a low-carbon future.

The Importance of Early Carbon Optimization

Do you know that about \$88 trillion worth of goods and services are produced yearly¹? The sheer amount of natural resources used and waste generated from this massive production alone could cause irreversible damage to our environment. One effective way to lessen the environmental impact is to incorporate sustainability early in the product design stage. Early carbon optimization is crucial because:

- Companies can determine what and how resources are used, thus ensuring sustainable behavior throughout their value chain.
- By embedding sustainability into the product design, companies can determine an estimated 80% of their future carbon footprint.

Our sustainability initiatives delve into how you can optimize your product design strategies on the 3DEXPERIENCE® platform to achieve climate neutrality.

Perform Early Assessments

The concept of sustainable product design has long focused on using more recyclable materials to lessen the impact on the environment. These days, however, design decisions go further than this. Companies are examining each product lifecycle stage to understand better how a product is made and how it will be used. As such, a complete product lifecycle assessment (LCA) is indispensable. Through Sustainable Innovation Intelligence on the 3DEXPERIENCE platform, designers gain an agile and iterative development process to optimize every lifecycle stage to make more sustainable products with a longer lifespan. It enables them to identify and optimize the main

carbon emitters throughout the lifecycle - from the use of raw materials and manufacturing to recycling and disposal. Real-time data on the platform offers the traceability and transparency needed to design for disassembly. This means recovering materials and components for meaningful next use (upcycling) which maximizes their economic value while minimizing the environmental impact at the end of intended use - closing the circularity loop further. Data and real-time collaboration across every lifecycle stage also enable designers to:





- Redesign materials and components, and reformulate sustainable alternatives
- Boost reuse of materials or create multiple uses for a single product
- Analyze and optimize carbon footprint at each lifecycle stage

Design for Sustainability

One key to quick and effective climate-neutral design is digitalization. A connected platform complete with simulation capabilities can simplify carbon-driven innovation. For example, generative design allows companies to explore multiple options and perform rapid prototyping in a low-cost and highly collaborative environment to boost research and development initiatives, optimize design and evaluate for quality and

environmental compliance. This allows companies to bring more sustainable products to the market faster and at a more affordable cost. Generative design is also instrumental in lightweighting products - an important strategy in low-carbon design. Designers identify and optimize material use without compromising a product's structural strength and performance to avoid waste. This opens up additive manufacturing opportunities, which further reduces per unit transportation emissions and helps save fuel and energy.

Run Sustainable Manufacturing Practices

At a time when manufacturing and production consume 54% of the world's energy and produce 20% of global CO2 emissions³, it is only

logical to make sustainable manufacturing part of a company's business practices. Designing products with locally sourced materials or components remains crucial to reducing a product's supply chain footprint. In recent years, consumer goods supply chain accounts for 80% of greenhouse gas emissions and more than 90% of the impact on air, land, water, biodiversity, and geological resources⁴. With local and distributed manufacturing strategies, the supply chain carbon footprint can be significantly reduced. Choosing the right materials at the design stage can eliminate a substantial manufacturing carbon footprint. For example, substituting hazardous chemicals that affect the environment directly with cleaner, safer, and reformulated alternative materials. Additionally, improving forecasting accuracy, planning, and process efficiency can reduce product wastage as well as reduce energy input for production. At the same time, non-renewable energy resources such as fossil fuels can be replaced with renewable energy options. A sustainable product design can:

- Reduce input for production
- Improve process efficiency
- Lower impact of product use and at disposal.





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Material Compliance Regulation and Sustainability

Material compliance regulation typically refers to adherence to laws and standards related to the materials used in products, ensuring they meet safety, environmental, and other regulatory requirements.

Sustainability, on the other hand, focuses on practices that support long-term environmental, social, and economic well-being. In the context of material compliance, sustainability may involve using eco-friendly materials, reducing waste, and minimizing the environmental impact of production processes.

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Compliance:

Material compliance refers to the adherence to regulations and standards related to the materials used in the manufacturing of products. Governments and international bodies often establish guidelines to ensure that materials used in consumer goods, electronics, and other products are safe for human health, environmentally friendly, and comply with specific standards at specific region. Below compliance regulations are required to adhere if you are manufacturing or exporting to EU & USA

ELV - End of Life Vehicle.

IMDS - It is a tool to provide a support on ELV Directive.

REACH - Registration Evaluation Authorisation of Chemical

Substances (Applicable to EU, UK, Turkey, Korea, China, India)

RoHS - Restriction industries.ous of substances.

AIS-129 - Automotive Industry Standard 129 (Applicable to Indian Automotive Sector)

POPs - Persistent Organic Pollutants (Stockholm Convention)

California Proposition 65 - (Warning label has to be provide if you have substance of concern in product you manufacturer and export to California)

LCA - Life Cycle Assessment (As per ISO 14040/44)

TSCA - Toxic Substance Control Act

WEEE - Waste of Electrical & Electronic Equipment.



Battery Passport (Battery Regulation)

Keypoints:

Legal Requirements: Material compliance regulations are often driven by legal requirements aimed at protecting consumers and the environment. These regulations may vary by region and industry.

1. Substance Restrictions: Regulations may include restrictions on the use of



certain substances, such as hazardous chemicals, heavy metals, and other potentially harmful materials. Compliance involves thorough testing and documentation of material composition.

2. Product Labelling:

Compliance often requires accurate product labelling to inform consumers about the materials used, potential hazards, and proper disposal methods.

3. Traceability:

Manufacturers must establish robust systems for tracking and documenting the origin and composition of materials throughout the supply chain to ensure transparency and accountability.

4. Verification and Audits:

Regular audits and verification processes are essential to ensure ongoing compliance. Companies may be required to provide documentation and evidence of adherence to material compliance regulations.

Sustainability:

Sustainability in the context of business involves integrating practices that minimize environmental impact, promote social responsibility, and ensure long-term economic viability. This includes responsible resource use, reducing carbon footprints, and fostering ethical business practices.

Key points:

- 1. Environmental Impact:** Sustainable practices aim to reduce the negative impact of business operations on the environment. This includes minimizing waste, adopting renewable energy sources, and promoting energy efficiency.
- 2. Social Responsibility:** Sustainable businesses consider the social implications of their operations, including fair labor practices, community engagement, and ethical sourcing of materials.
- 3. Circular Economy:** The concept of a circular economy is central to sustainability, emphasizing



the reuse, recycling, and repurposing of materials to minimize waste and promote resource efficiency.

- 4. Stakeholder Engagement:** Sustainable businesses actively engage with stakeholders, including customers, employees, and local communities, to understand and address concerns related to social and environmental impact.
- 5. Regulatory Compliance:** Many countries and regions have introduced regulations and standards to encourage sustainable business practices. Compliance involves meeting these standards and often goes hand-in-hand with material compliance regulations.



In summary, material compliance regulations ensure that products meet safety and environmental standards, while sustainability focuses on broader business practices that consider long-term environmental, social, and economic impacts. Together, they contribute to responsible and ethical business conduct in a global context.



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Ancient Indian (Vedic) Wisdom of Science and Technology

Insights and Applicability in the Current Context

The arena of Ancient Indian Science and Technology covers a wide spectrum of Grammar, Prosody, Poetics, Etymology, Logic, Philosophy, Hermeneutics, Mathematics, Art and Architecture, Dramatics, Yoga, Kama, Chemistry, Physics, Astronomy, Ayurveda, Agriculture, Horticulture, Lexicography, Metallurgy, Arithmetic, Engineering, Geometry, Botany, Ecology, Economics, Political Science, Geography, Warfare, Phonetics, etc. The paper tries to give a wide angle of the Ancient Indian Sciences and discusses and appreciates what existed in the ancient era and its applicability.

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The topic is challenging, alluring, and interesting - Ancient Indian (Vedic) Wisdom of Science and Technology – Insights and Applicability in the Current Context. I observed a word in my topic when I received an email from the team. The word is- Vedic. Let me shed some light on the word at the beginning. Although the Indian tradition has strong faith in the Veda-s, and they are considered as the roots of Dharma - vedo'khilo dharmamilam, everything cannot be Vedic. A famous Indian mathematician, Aryabhata, lived in the 5th – 6th century of the current era; his magnificent contributions cannot be termed as 'Vedic'; the Vedic period was around 1500-2500 BCE, almost 2000 years ago! Unfortunately, we have Vedic

biscuits, Vedic soap, and Vedic toothpaste; at one of the conferences, someone was talking about Vedic computers! The crux of this discussion is, let us call it as Ancient Indian Sciences and discuss, appreciate, study, and apply what existed in the ancient era rather than simply speculating and building castles in the air. The word Vedic has different and specified connotations in Sanskrit. Let us not dwell on it now.

When I refer to the Indian Knowledge System, i.e., IKS, I consider the period right from the Vedic period till the 14th – 15th century of the current era. The geographical extent is definitely not the current one, but I refer to the greater India. For instance, Panini, who composed the highest possible monumental work of

human intelligence - Astadhyayi - was from the north-west side of India, which is today's Pakistan. But the entire world accepts Panini as an Indian. When discussing the IKS, we should never confine ourselves to the Sanskrit language only. We should also look for the texts available in Pali, Prakrit, and the folk traditions.

The arena of Ancient Indian Science and Technology covers a wide spectrum of Grammar, Prosody, Poetics, Etymology,



Logic, Philosophy, Hermeneutics, Mathematics, Art and Architecture, Dramatics, Yoga, Kama, Chemistry, Physics, Astronomy, Ayurveda, Agriculture, Horticulture, Lexicography, Metallurgy, Arithmetic, Engineering, Geometry, Botany, Ecology, Economics, Political Science, Geography, Warfare, Phonetics, etc. The name of the seventh chapter of the Bhagavadgita is- Jñana-Vijñana-Yoga. The knowledge of the tangible world is Vijnana. Vijnana is Vishesh Jnana - special or additional knowledge. Vijnana can be perceived with the help of organs, logic, and intelligence.

Let us now dwell on some examples from the scriptures-

Kautilya' Arthasastra - In modern connotation, the term Arthasastra is always associated with the science of Economics. But traditionally, in India, the word Arthasastra means the science of politics. In his text 'Kautilya Arthasastra,' Kautilya has mentioned the six elements of the state, viz. the king, the minister, the subjects, the fort, the treasury, the army and the ally. He is dealing with many nitty-gritty of administration in the treatise.

Panini's Astadhyayi - as mentioned, an extraordinary work on the then Sanskrit language. The observations of the prevalent Sanskrit language are coded in around 4000 sutra-s/aphorisms. This is called as Sabda-Vidya. Astadhyayi is a pioneer in

linguistics and natural language processing.

Astronomy - Astronomy is the science of planetary motions and their scientific studies. Astrology covers areas like phalajyotisa, we are not going to deal with Astrology. Texts like Taittiriya-Samhita, Aryabhatiyam, Suryasiddhantasiromani of Bhaskara - II, Brhatsamhita of Varahamihira are the important texts on Astronomy.

The development of ancient Indian mathematics is certainly considerable. Be it Sulbasutra-s of Yajurveda for constructing fire-altars, astute scholars like Aryabhata, Bhaskara-s, etc., or advancements in mathematics to study the planets, we were always sound enough. Recently, we organized a workshop at Amrita Vishwa Vidyapeetham, Bangalore on Aryabhata's Kuttaka algorithm by Mr. R. Gopu Ji. Kuttaka is an algorithm used to solve Linear Indeterminate Equations. That is, equations of $N=ax+b=cx+d$, where a,b,c, and d are known quantities, but N and x are unknown quantities. Aryabhata's algorithm is the oldest known to solve such problems for large numbers. The workshop explained step by step how to use Kuttaka.

One of the major domains of Indian Philosophy- Vaisheshika-Darsanam, gives a systematic account of Physics and the scientific temper



in ancient India. A rich commentarial literature on the stream is very helpful in understanding the gradual development. The text like Bhrgu-Samhita, Yuktikalpataru, Samaranganasutradhara, Agni-Purana, Manasollasa, Mayamata, and Manasara are excellent sources for the manufacturing processes. We get mentions in the Rgveda and the epics, but these scientific texts deal with the ground processes.

Indians made an exponential development in the field of medicine. There are three sub-domains in Ayurveda - Manuśya-Ayurveda for humans, Paśu-Ayurveda for animals, and Vrksa-Ayurveda for plants. The three musketeers of Ayurveda- Susruta, Caraka, and Vagbhatta and their texts Susrutasamhita, Carakasamhita, and Astangahrdya respectively, are the gospels of the Indian medicinal system. The commentarial literature and the later study based on the texts have created an indispensable place for Ayurveda at the global level. Indian



civilisation has been a very health-conscious culture and nurtured a rich and diverse system of health care comprising folk and classical streams of knowledge. The dictum "health is the basis for pursuit of the goals of human life" has inspired the development of a people-oriented health care system. So much so that the spectrum of non-Ayurvedic texts in many languages and folk traditions across centuries have codified a wealth of health-related information. One of the complementary fields of Ayurveda is Chemistry or Rasayanasastra, which is often used in the Ayurvedic texts to prepare medicines. But apart from the Ayurvedic purpose, the domain of Chemistry developed as a special branch, and important texts are Rasaratnasamuccaya and Rasarnava.

Yoga, has always been a good companion of Ayurveda. Generally, people consider Yoga is just asanas and pranayama. But many are not aware that there are 8 stages of Yoga

- Yama - Self-restraints
- Niyama - Personal Disciplines
- Asana - Yogic postures
- Pranayama - Regulation of breath.
- Pratyahara - Withdrawal of Senses



- Dharana - Concentration on Object
- Dhyana - Meditation
- Samadhi - Salvation, liberation.

Definitions of Yoga

Bhagavadgita:

समत्वं योग उच्यते: Yoga brings balance or equanimity of the body and mind.

योगः कर्मसु कौशलम्: Yoga is the skill in any action.

Yogavasistha:

मनः प्रशमनोपायः योग इत्यभिधीयते: Yoga is the technique to calm down the mind.

Yogasutra:

योगश्चित्तवृत्तिनिरोधः: Yoga is to control the modifications of the mind

The scriptures like Upavana-Vinoda are specially dedicated to horticulture. The texts like Krishi-Parashara deal with many agricultural practices, like different types of soil, fine-timing of sow-time, groundwater, seed collection and upgradation, water retention, rain forecast, and other aspects of agricultural management.

Then what about Metallurgy? The aforesaid texts on Chemistry are certainly useful for metallurgy, but I wish to bring your attention to the Chola period idol making- which is known as the famous Chola bronze. The descendants of these artists from the 8-13 centuries of the current era still use the lost-wax method to prepare the idols.

The measurements and proportions have been specified in the scriptures, like Mayamatam. The icons like Nataraja, Somaskanda, etc., are the brainchildren of this Chola bronze tradition.



The discussion is incomplete without speaking about aeronautics. Speaking about aeronautics, which is quite a controversial area in the field, we must have a balanced point of view. We get the flying vehicles' descriptions, but unfortunately, we do not have any texts explaining the manufacturing process. Hence, it would be unsafe to claim the production of planes in the ancient world without having the texts in our hands. We should focus more on something we have in abundance and details rather than on something imaginary.

Do we find applications of any of these things anywhere? The answer is yes. Archaeology is a fantastic source for seeing its application. Let us take only one example- The Harappan civilisation, a pioneer of basic technologies. We find well-executed civil engineering in city planning and construction, which requires many allied fields of science and technology. The best examples are the drainage systems and the great bath at



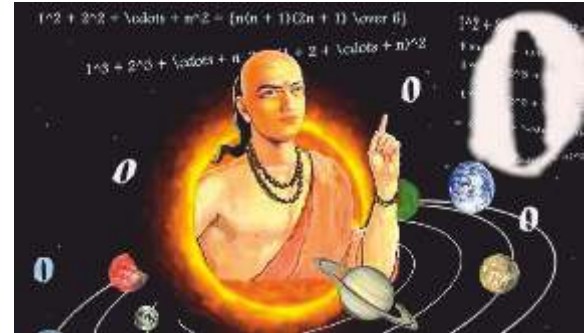
Mohenjodaro. They were rather the pioneers of water harvesting and management. The earliest dockyard found at Lothal exhibiting their trade strategies was during the Harappan period, which was also responsible for the growth of Indo-Europe sea-route trade. Exploring and discussing Harappan science and technology is a vast area. We can discuss this sometime later. A similar case is with the temple architecture as well.

This rich tradition was severely disturbed and hindered due to multiple invasions, especially the British Raj. We must strive to continue the thread of the tradition. The modern science and

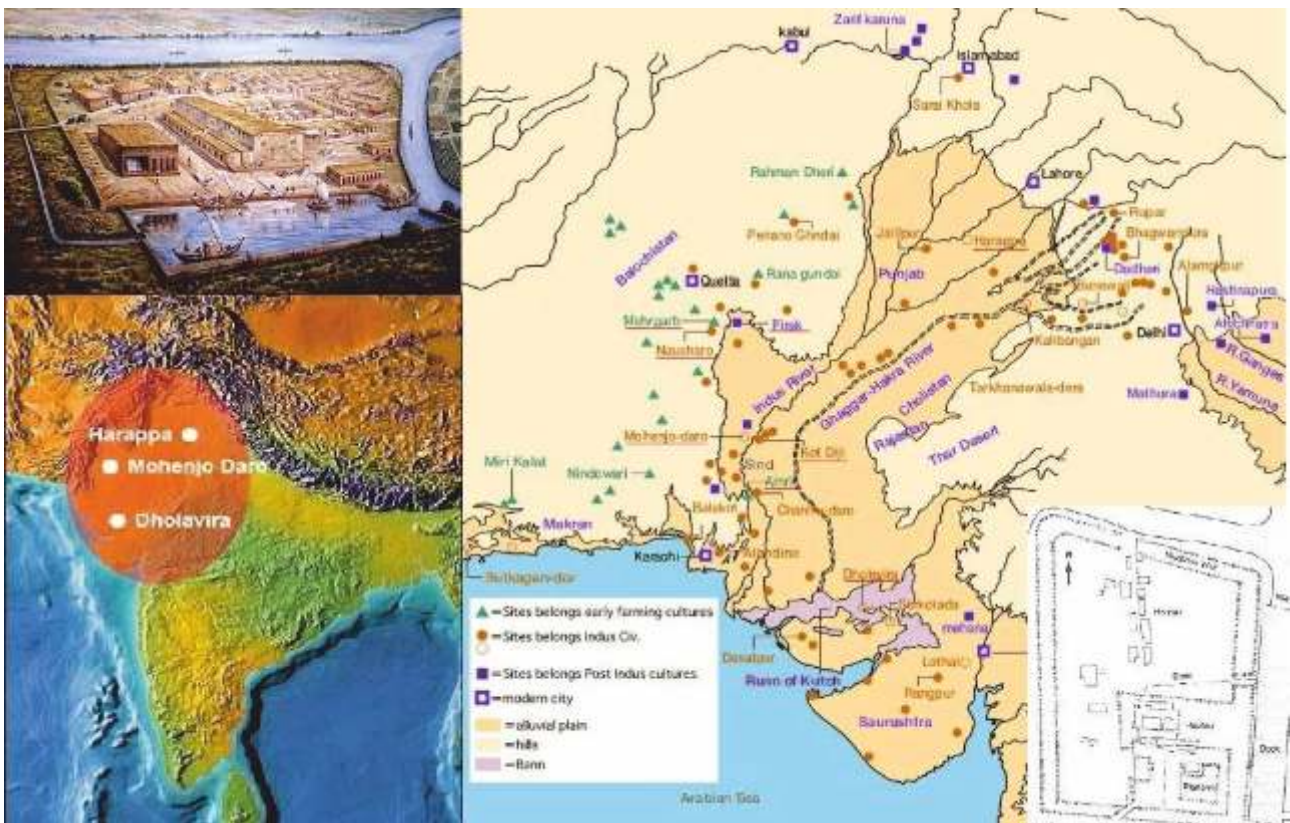
technology have been progressing to the fullest. But we must endeavour to get insights from our ancient sages and their works. The last verse of the Bhagavadgita says-

यत्र योगेश्वरः कृष्णो यत्र पार्थो
धनुर्धरः।
तत्र श्रीर्विजयो भूतिर्धुवा
नीतिर्मतिर्मम॥

The meaning goes like this-
Wherever is Krsna, the Lord of Yoga, wherever is Arjuna, the wielder of the bow, there is prosperity, victory, happiness and firm policy; such is my conviction.



Hence, we seek both- Krsna-Jñanasakti (knowledge) and Arjuna-Kriyasakti (execution) to understand the insights from the Ancient Indian Wisdom of Science and Technology.





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CEO & MD
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Redefining Cost Innovation

A Path to Sustainable Growth in a Changing Landscape

The evolving strategies for managing costs and driving innovation in today's dynamic business landscape. By prioritizing collaboration and embracing digital transformation, organizations can navigate disruptions and unlock new opportunities for sustainable growth. The future of cost management and innovation, guided by the imperative of building resilient, forward-thinking organizations.

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Depending on an organization's services or products, the cost strategies can vary, as every decision in the product development process or operations redesign affects costs. Many product and service organizations are under tremendous pressure to drive several initiatives around cost, as no business can escape disruptions happening at lightning speed around them. The low-hanging thinking strikes best as savings through Value Engineering, Six Sigma, or Total Quality Management, as part of business excellence or strategic initiatives. These initiatives have delivered some level of positive results in the past, as the product life cycle used to be longer than it is today. Cost reduction or savings projects have helped to increase profits, maintain profitability, or

ensure survival. This trend could further intensify as leaders and businesses face increased cost pressures post-coronavirus pandemic crisis.

Cost-Pressurized Large Organizations vs. Small Organizations

This mantra has also benefited organizations by bringing a common language and realizing that cost reduction is everyone's job in the organization, by optimizing their processes or cutting costs to the core year on year for decades. In the process, it has fostered an inward-thinking

mindset within the organization and its leadership, driven by an overemphasis as a DNA of the organization, without considering the intangible damage to the organization's culture. Organizations design their reward systems to encourage a focus on costs rather than on new revenue streams or new value to enable customer retention. The cost-focused Kaizen improvements are celebrated, expecting year-on-year contributions to the bottom line or transfer price/delivery cost. No organization is built to last solely by focusing on cost savings for increased profit or growth, but instead by offering new products and services that excellently meet customer needs and have a purpose to stay in business. The inability of large organizations to innovate is transferring this burden to the shoulders of their suppliers and vendors to reduce





costs year on year by 10-15 percent, but the asking rate is anywhere between 35-50 percent to save businesses from low-cost competitive countries such as China, leaving India and even countries like Singapore, Korea, and Malaysia struggling to compete with Chinese firms compared to the US and Europe. Small and medium-sized businesses and contractors are hard-pressed to cope with increasing cost pressures as operational costs and labour costs are ever-increasing, which could lead to unwarranted practices to save their business.

New Mindset - The Art of Leading Collaboration

It is high time for organizations to reinvent their cost innovation strategy to a new level. The software services industry has been a great reference for industries across sectors, as they could maximize the value of contractors by integrating them into the culture of the organization with no disparity and equal opportunities in their professional and technical contributions. These organizations respect the origin or source of ideas. However, this scenario is more or less inverted in

the manufacturing sector with a 'factory mindset' as contractors are seen as vendors and generally treated as a secondary workforce. They do not deeply integrate into the culture of the organization to solve innovation challenges or initiatives toward cost reduction year on year. Contractors lose their urge to go beyond the definition of job work, and this is a lost opportunity as no organization has a clear profit-sharing policy in place with vendors.

The Future of 'Build to Last' Organizations

Forward-looking business organizations are thinking to reinvent with a new mindset - mission zero 'cost to zero' 'downtime to zero' 'defects to zero' 'accidents to zero' 'waste to zero' 'mis-communication to zero' as every aspect is a cost to the company. There is an attempt to redefine cost innovation with digital transformation solutions by integrating to co-create and profit-sharing with vendors as business partners by encouraging the development of intellectual property. Traditionally, these organizations had adopted methods of costing with wide tolerance. Organizations need to



design a holistic digital transformation blueprint by revisiting their end-to-end manufacturing or process journey, identifying inefficiencies, safety risks, data transparency, and openness to work with young organizations by setting the cornerstone based on a quick return on innovation, thus, building confidence for subsequent stages of digital transformation. Organizations need to value and choose their partners wisely to discover next from amplifying process efficiency or cost to new revenue and exponential growth opportunities as their innovation engine. Their short-sightedness must not hinder their long-term goal of end-to-end growth innovation in a circular economy.





Keyur Bhalavat
CEO & Founder
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How XR Technology Can Digitalize and Transform Small and Medium Enterprises

In Small and Medium Enterprises (SMEs), the integration of digitization and automation has become paramount, particularly in the thriving landscape of the Indian manufacturing sector. In this article, we will explore the challenges faced by industrial enterprises and suggest solutions using emerging technologies like AR, VR, and MR. Also suggests a step-by-step digitalization approach, emphasizing its necessity for SMEs to stay competitive in the evolving business landscape.

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The Indian manufacturing sector is booming, creating both opportunities and challenges for companies. To remain competitive and sustainable in this dynamic environment, digitalization plays a pivotal role in streamlining operations, enhancing efficiency, and fostering innovation.

Many companies still overlook the significance of integrating their front-line workforce, especially deskless workers, into their digitalization strategies.

Great platforms exist in all areas of Industries except for the deskless worker



In the current landscape of rapidly advancing technology, many businesses have successfully integrated digital tools and automation into various aspects of their operations. However, a substantial portion of the workforce, particularly those engaged in fieldwork, construction, and other hands-on roles, still grapple with traditional, manual approaches that limit efficiency and hinder adaptability.

Bridging the gap between the digital revolution and the frontline workforce emerged as a pressing challenge demanding immediate attention. Beyond

this, there are several other key challenges faced by industrial enterprises. These include:



The above challenges pose significant roadblocks to maximizing the potential of digitalization in the manufacturing sector.

Solution: The Emerging Technologies XR, AR, VR, and MR

Emerging technologies like Extended Reality (XR), Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR) offer innovative solutions to these challenges.

XR, AR, VR, MR: What's the Difference in Reality?



Augmented reality is like adding a layer of digital magic to the real world. You use a device, like a smartphone or glasses, to see computer-generated images, information, or even animations overlaid on the things you see in the real world. It's like having a secret layer of extra stuff on top of what you see with your own eyes.

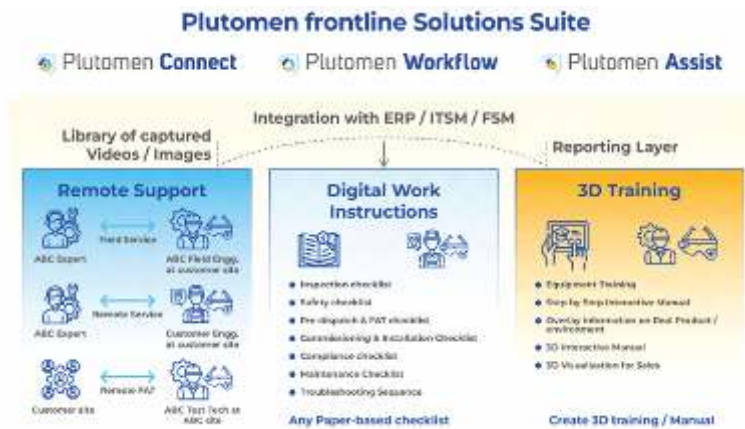


Use Cases of AR, VR and MR in Manufacturing:



A Step-by-Step Approach to Digitalization:

It's important to adopt a step-by-step approach to digitalization, starting with simple solutions like remote support, work instructions, and then training. This allows companies to gradually integrate new technologies and measure their impact.



Impact in Numbers:



Conclusion:

Embracing digitalization isn't just a choice; it's a necessity in today's landscape. It provides new opportunities for development, sustainability, and eventually success. Businesses may harness the transformational potential of digitization and maintain their competitiveness in this ever-changing market by following a step-by-step approach and concentrating on the needs of their workforce.

Snapshots



Snapshots



Snapshots



BCIC Manufacturing Conclave

Technology Driven Manufacturing for the Growth and Prosperity

Date: 08-Dec-2023

Venue: Sigma Hall, Hotel Chancery Pavilion, Residency Road, Bengaluru

Agenda

Setting the Context	Mr. G Prakash , Chairman, Manufacturing Expert Committee, BCIC
Welcome Address	Dr. S Devarajan , President, BCIC
1st Session: Theme: Scope & Opportunities for Economic growth through Manufacturing in Karnataka	
Chief Guest Address	Mr. L Krishnan , Managing Director, Taagutec India.
Special Address	Smt. Gunjan Krishna, IAS , Commissioner for Industrial Development & Director Industries & Commerce, GoK
Keynote Address	Mr. T K Ramesh , MD, Ace Designers Ltd
Special Talk on Challenges for growth of Indian MSMEs in Manufacturing	Mr. Rohan Shah Director, PwC
2nd Session: Theme: Affordable Digitization and Automation in Manufacturing	
Moderator: Mr. V Karthikeyan , Co-Chairman, Manufacturing Expert Committee, BCIC	
Realizing Business Gains for MSME through Automation and Digitalization	Mr. Chandrashekhar Bharati MD, Ace Micromatic Manufacturing Intelligence Technologies Pvt Ltd
Affordable Factory Automation in Manufacturing	Mr. V Sivaganesh GM - FA Business Support, FANUC India Pvt Ltd
Building Global Supply chain resilience in the changing Political and Economic Environment- Insights & Way forward	Ms. Divya Seethapathy Director, Global Procurement Resilience Program - Global Supply Chain, Schneider Electric
Digitization and automation in SME and Aerospace Component manufacturing	Mr. Rakesh S B Vice President - Aerospace & Defense, Sansera Engg. Ltd
3rd Session: Theme: Home Grown Technology: Challenges, Opportunities and Enablers for Growth	
Moderator: Mr. Chandrashekar , Head of Manufacturing and Logistics, Buhler India Pvt Ltd	
India Centric affordable automation and digitization solutions	Mr. G Sundararaman CEO, Wipro Pari Pvt Ltd
Approach for Effortless Digitalization, especially for MSME business in India	Mr. Himanshu Jadhav CEO, Jendamark India Pvt Ltd
4th Session and Panel Discussion: Theme 04: Sustainability: Trends, Challenges and best practices	
Moderator: Ms. Ira Gilani , Co-Chairperson, Manufacturing Expert Committee, BCIC	
Special Talk	Mr. Ravikiran Pothukuchi Director - Manufacturing & Logistics, Dassault Systems
Panellists	Mr. V C Mohan EHS Regional Co-ordination India, Australia & Support ASEAN, Besch Mr. Rajesh Kumar Jha Country Environment & Sustainability Manager, ABB India Ltd Mr. Akshai Sarin , Founder, BlessedBuy Mr. Shridhar Rajappanavar Founder and CEO, Key Sustainability Solutions
Special Address on Building manufacturing excellence - Toyota way	Mr. T R Parasuraman Executive Advisor Toyota Group and Past President, BCIC
Special Address on Ancient Indian (Vedic) Wisdom of science and technology - Insights and Applicability in the current context	Dr. Manish Rajan Walvekar , Assistant Professor (Senior Grade) & Centre Coordinator, Amrita Darshanam International Centre for Spiritual Studies, Amrita Vishwa Vidyapeetham, Bengaluru
5th Session: Theme: Implemented Tech Solution in Manufacturing	
Cost and Sustainable Innovation	Mr. V Lokesh , CEO & MD, Innomantra Consulting Pvt Ltd
Digitization and automation in SME	Mr. Keyur Bhalavat , Founder & CEO, Plutomen
New Technologies Developed in Manufacturing	Mr. Prakash Vinod , Joint Director - Central Manufacturing Technology Institute (CMTI), Bangalore
Vote of Thanks	Ms. Rajashree Iyer , Deputy Secretary, BCIC

Overview of BCIC



BANGALORE CHAMBER OF INDUSTRY AND COMMERCE

Namma Karnataka

The Gateway to Future India

- Promoting Trade and Industry in Karnataka since 1976
- Apex organisation of large and medium industries
- An amalgam of Domestic, International and wholly owned subsidiaries of foreign companies
- Facilitating and promoting business contacts and networking



INDUSTRY AND GOVERNMENT FORCES MEET TO PARTNER PROGRESS

We have presently a membership of 880+ companies representing various sectors of Industry such as - Manufacturing, ITI/ITES Biotechnology, Engineering, Consultancy and Legalfirms etc.

BCIC plays an active and important role in promoting trade and investment in the State and has an excellent domestic and International network with MoUs with the leading Chambers of Commerce across the globe. Being the apex Chamber of Commerce in Karnataka, BCIC organises Seminars / Workshops and Interactions with Senior Government Officials both from the Centre / State on critical issues concerning trade and industry from time to time.

BCIC - Partner in Progress

- Outreach
- Government Interaction
- Eminence
- Special Projects
- Governance and Member Services



MoUs with Foreign Trade Offices/Associations/ Universities and Colleges

- BCIC and The Association of People with Disability (APD)
- BCIC - Brigade Skill Development Academy
- BCIC - MS Ramaiah Institute of Management
- BCIC - Institute of Indian Interior Designers,
- Bangalore Regional Centre, Bangalore (IID)
- BCIC - Best Cluster of Indian Institute of Science
- BCIC Tokyo Office MoU: BCIC, Japan External Trade Organisation, Toyota Tsusho India Private Limited, Inter Trade K K, India Research Institute Pvt. Ltd
- BCIC and Bangalore International Mediation, Arbitration and Conciliation Centre (BIMACC)
- JSS Science and Technology University, Mysore



Industry Focus

- Aerospace and Aviation
- Agro and Food Processing
- Automotive
- Banking, Financial Services and Fintech
- e-Commerce, Retail, Logistics & Warehouse
- Infrastructure: Energy, Environment and Water
- IT & Cybersecurity
- Pharmaceuticals
- Real Estate
- Semiconductor, Electronics and Telecom
- Start-Up
- Tourism, Hospitality and Facility

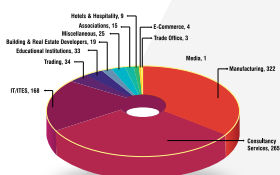


Our Offices (Domestic and International Office)



Cross Section of Our Members

INDUSTRY CLASSIFICATION



Start-up Hub Programs and Activities

- Fireside chat with eminent entrepreneur
- Mini Conference - Thematic Start-up conference Technology Commercialisation
- BCIC Annual Start-up Award 2022-23
- Start-up Conclave
- Series of Start-Up Showcases



Major Summits and Conclaves

- BCIC Economic Analysis Research Report
- Report on Direct Tax Administration and Capital Gains Tax Regime
- Direct Tax Recommendations-Policy Paper
- Approach Note to Transfer Pricing
- Human Capital Index in Karnataka
- Co-existence stakeholder model for effective healthcare delivery in the backdrop of pandemic
- Chief Financial Officers - handbook
- Synergy
- Annual Report



Policy Advocacy and Government Interaction

- Request for easing the pain points of industries operating at Chikballapur District
- Request for exemption on levy of road tax, registration fees on purchases of all forms and types of EVs up to March 31, 2030 and to extend the benefits of Karnataka Electric Vehicle and Energy Storage Policy, 2017.
- Matters requiring attention for enhancing Customer experience of using Indian Railways for Bangaloreans
- BCIC Policy Paper in Relation to Income Tax Matters
- BCIC Pre-Budget Memorandum 2023-2024 on Customs
- Recommendations on Direct Taxes- both at Policy level and Tax Administration level.
- Note on Difficulties faced by LLPs with MCA V3 system
- Request to expedite the construction work at Bengaluru-Mysuru Expressway
- Request to empanel BCIC to support Govt. in Infrastructure planning and management in times of distress, caused due to flooding



Research Report and Publications

- BCIC Economic Analysis Research Report
- Report on Direct Tax Administration and Capital Gains Tax Regime
- Direct Tax Recommendations-Policy Paper
- Approach Note to Transfer Pricing
- Human Capital Index in Karnataka
- Co-existence stakeholder model for effective healthcare delivery in the backdrop of pandemic
- Chief Financial Officers - handbook
- Synergy
- Annual Report



Membership Privileges

- Thought Leadership**
 - Dissemination of Industry best practices
 - 27 Expert committee - Workshops, seminars, Industrial site visits, training and skilling
 - Access to resources and opportunities
- Industry Voice - Business Support and Advocacy**
 - Strong advocacy with Union and State Governments
 - Representation to Government in consultation with Industry to support Ease of Doing business
- Foreign Collaboration**
 - Collaboration with Foreign Embassies and Trade Offices
 - Regular interaction with foreign offices for opportunities and hassle-free business interactions
 - Regular hosting of trade delegations from abroad and facilitate business delegation visits to foreign countries to business expansion
- Networking, Outreach and Visibility**
 - Networking opportunity with Thought Leaders and Professionals from Large, Medium, Small Industries, Educational Institutions and Government organisations
 - Networking events to exchange and validate innovative ideas with Industry professionals
 - Foster collaboration with members for expansion/ business interests



Women Empowerment and Leadership and Start-up Awards

- 1st Edition of BCIC Emerging Star Awards on February 5, 2021
- BCIC Women Leadership Award 2020-2021 on August 18, 2021
- 2nd Edition of BCIC Emerging Start-up Summit and Awards Ceremony on July 16, 2022
- 2nd Edition of BCIC Women Leadership Conclave and Award Ceremony held on August 5, 2022

MISSION
Namma Karnataka- Gateway to Future India

VISION
Look Beyond

Together We Should

Our Industry Focus



- Agri Business and Food Processing
- Automobiles and Components
- Apparel and Readymade Garments
- Aerospace and Aviation
- Electronics Energy Environment
- IT/BT
- Tourism
- Machine Tools
- Human Resource
- Startups/Innovations
- Real Estate
- Pharmaceuticals
- Precision Engineering
- Telecommunications
- Consultancy
- Women Entrepreneurs
- BFSI

BCIC has developed excellent and extensive contacts with Foreign Embassies and Trade Offices in India and counterpart Associations in other countries.

Partners and network

- Key Departments of Union and State Governments
- State owned Corporations
- Industry Associations and Chambers of Commerce in India and abroad
- Foreign Embassies, Consulates and Trade Missions
- Trade and Investment Promotion Organisations in India and abroad Financial Institutions

Expert Committee:

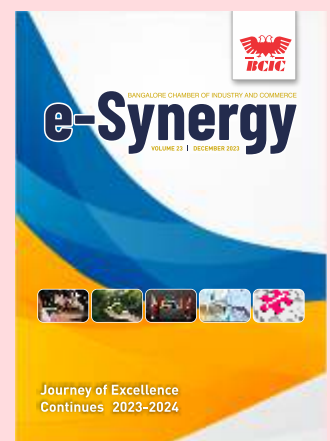
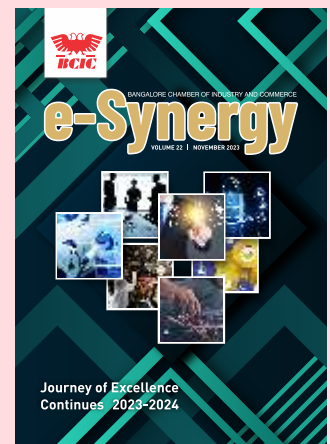
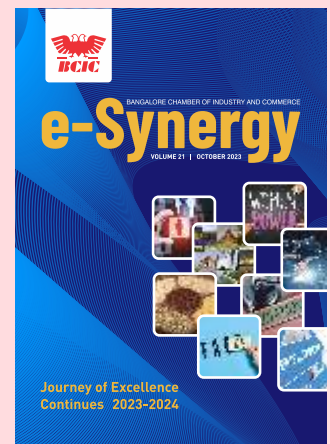
- Aerospace and Aviation
- Agro and Food Processing
- Banking, Financial Services and Fintech
- BCIC – Japan Initiatives
- Corporate, Economic Affairs and Legal (including BIMACC & ICSI Coordination)
- CSR & Societal Branding
- Design and City Infrastructure
- Direct Taxes
- Ease of Doing Business
- Environmental, Social, and Corporate Governance
- e-Commerce, Retail, Logistics & Warehouse
- Government Coordination
- Golf, Sports and Culture
- Hospitality, Travel, Tourism & Wellness
- Human Resources & Women Leadership
- Indirect Taxes
- Industry 4.0
- Industry-Institute Interface and Edutech
- IT & Cybersecurity
- Infrastructure, Energy, Environment and Water
- International Business
- Leadership Forum
- Membership Expert Committee
- Manufacturing
- MSME & Skill Development
- Publications and Corporate Branding
- Semiconductor, Electronics and Telecom
- Start-Up

The Functions of BCIC are driven by exceptionally-enabled Apex Advisory and Expert Committees comprising of senior Industry representatives from Core Sectors.

Expert Committees

Our Expert Committees are Chaired by senior Representatives who are experts in their respective industry segments

BCIC Publications: Connecting with Members



WTCA 54TH
GLOBAL
BUSINESS
FORUM
BENGALURU, INDIA

MARCH 3-6
2024

WTCA 54th GLOBAL BUSINESS FORUM 2024

- Opportunity to connect with Indian businesses
- 12 Sectors in focus
- B2B meetings and field visits planned
- Interaction with Tech start-ups
- Trade delegations expected from Member countries

#WTCAEvents

Empowering
Progress through
Innovation &
Collaboration

Knowledge Partner



Business Sectors in Focus

Aviation & Aerospace



Agro & Food Processing



Automobile & Ancillaries



Bio-Tech



Heavy Engineering



Real Estate and Construction



IT & ITES



Manufacturing



Education



Travel & Tourism



Textiles



Tech Start-Ups



For more details, request interested organizations to please write to
Mr. Prashant Gokhale, Vice President, BCIC on vp@bcic.in

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BCIC INTERNATIONAL OFFICE : Tokyo, Japan
MEDIATION CENTER : Tie-up with BIMACC, Bengaluru
START-UP AND INCUBATION CENTER : MG Road, Bengaluru

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