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Industry 4.0 for MSME Clusters

"Digital is the main reason just over half of the companies on the Fortune 500 have disappeared since the year 2000."

Pierre Nanterme,
CEO, Accenture

Introduction

Rapid technology advances and dynamic market forces have altered the business landscape as also fundamentally changed existing business models. Information and Communication Technology (ICT) usage and deployment has opened the doors for all enterprises and especially Micro, Small, and Medium Enterprises (MSME), to compete in any marketplace. Information Superhighway has further muddled the competitive waters by providing round-the-clock access and dissemination of information. The following examples illustrate the power of ICT and WWW.

■ The most prominent media company in the world is Facebook, but interestingly Facebook does not create any content. This content is created by its 2.94 billion monthly active users in 112 languages. Facebook is the 3rd most popular website on the Internet.

■ The largest car company in the world is Uber. Still, interestingly Uber does not own any of the taxi cabs that use its ride-hailing app to provide mobility as a service for the gig economy. 122 million people use Uber on a monthly basis in 72 countries and 10,000+ cities.

■ The largest retailer in the world is the e-commerce giant Alibaba, but interestingly, Alibaba does not own or run any swanky stores in malls or shopping complexes. Alibaba is a pure online-play retailer in a crowded virtual marketplace with a turnover of US$ 134.5 billion in 2022, as per the company's financial statements. On 11th November 2021, singles day as per the Chinese calendar, Alibaba and JD together had a whopping single-day sales of US$ 139 billion.

One of the recent buzzwords widely spoken about is Industry 4.0, also popularly referred to as the fourth industrial revolution. The first three waves of the industrial revolution were headlined by the steam engine, assembly line & mass production, and automation facilitated through computers, respectively. Industry 4.0 is the latest disruptive trend of automation headlined by Cyber-Physical Systems (CPS). It includes cutting-edge ICT tools and technologies such as autonomous robotics, business analytics, Industrial Internet of Things (IIoT), simulation, cloud computing, cyber security, additive manufacturing, horizontal & vertical system integration, and Augmented Reality (AR). Industry 4.0 has realized the manufacturer's dream of a "smart factory." Within these modular structured smart factories, cyber-physical systems monitor physical processes, create a virtual copy of the physical world, and make decentralized decisions. Interestingly these systems are fueled not by gasoline or oil or electricity but by 'data' and the capabilities to leverage and mine this data using machine learning and artificial intelligence. Manufacturing and production become adaptive, agile, autonomous, automated, collaborative, coordinated, connected, decentralized, fast, flexible, and intelligent resulting in greater operational efficiencies and lesser costs for enterprises.

To put it simply, processes and devices become inseparable in Industry 4.0. The origins of these technologies for manufacturing, collectively being referred to as Industry 4.0, stems from the famed German engineering. The German government, as also leading industrial powerhouses like Robert Bosch and Siemens, unveiled the basic concepts and recommendations in the Hannover fair to be adopted by industry worldwide.

CPS consists of collaborating computational elements controlling physical objects, whose processes are seamlessly monitored, coordinated, controlled, and integrated. The resultant value chain becomes more agile, collaborative, visible, and responsive. An example would be a connected and retooled supply chain, which can reconfigure itself on receipt of any new data point.
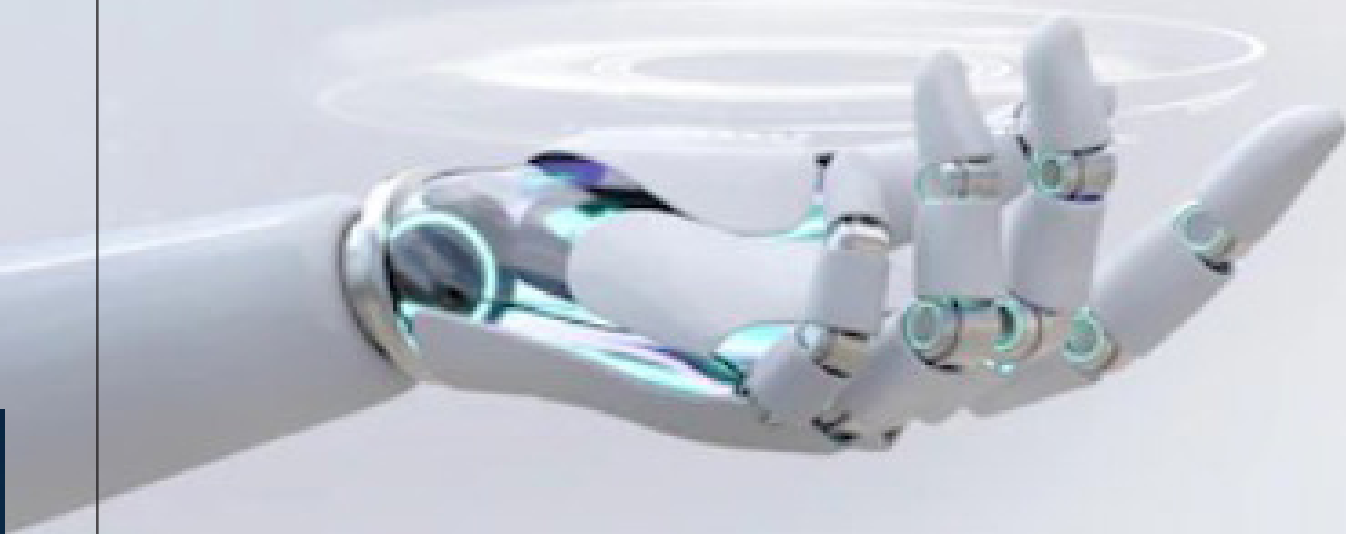
Over the Internet of Things (IoT), i.e., connectivity of physical assets, CPS communicates and cooperates with each other and humans in real-time both internal & cross-organizational services are offered & utilized by participants of the value chain.

If a weather delay ties up a shipment, an interconnected system can proactively adjust and modify manufacturing priorities bringing about perfect alignment between supply chain planning and execution.

German manufacturing powerhouse Siemens is implementing an Industry 4.0 solution in medical engineering. For years, artificial knee and hip joints were standardized products, with engineers needing several days to customize them for patients. New software and steering solutions enable Siemens to produce an implant within 3 to 4 hours. Predix, the Operating System (OS) for the Industrial Internet, is powering digital enterprise businesses that drive the global economy. By connecting manufacturing equipment, analyzing data, and delivering real-time insights, Predix-based apps are unleashing new levels of performance for General Electric (GE).

Industry 4.0 Building Blocks

■ Autonomous Robotics: Advanced and autonomous industrial robots are designed to collaborate with humans in real time. They have embedded electronic software, integrated sensors, actuators, and standardized interfaces that enable them to wirelessly connect with the internet and interact in real time with other equipment and humans. The cost of these robots will progressively decrease as also these robots will develop better capabilities and competencies.

■ Business Analytics: Business analytics aims at building fresh perspectives and new insights into business performance using data, statistical methods, quantitative analysis, and predictive modeling. At a lower level, there is business intelligence which is the standard measure for comparing past performance for future improvement based on enterprise data and statistical analysis. Some common usages are retailers using business analytics to predict consumer behavior and buying patterns, understanding citizen needs for government to provide better delivery of services, and banks & financial institutions detecting and preventing fraudulent transactions or categorizing their customers based on their credit history. Business analytics will have become an industry worth US $ 200+ billion by 2022. Corporate data generated and managed by enterprises amounts to billions of gigabytes of data, and this data is primarily unstructured and raw. The explosion of information is now dubbed Big Data, and its analytics can point toward actionable intelligence to help enterprises tweak their strategy.

■ Industrial Internet of Things (IIoT): Industrial IoT establishes interconnections across all industrial devices, equipment objects, and humans using Internet technologies. Industrial IoT enables networking and collaboration, and communication between all internal and external stakeholders in the manufacturing environment which includes factory machinery, production shop floor, assembly line and their operators such as workers, shop floor supervisors, and managers, as well as the suppliers and customers. Real-time communication and interaction between all connected stakeholders result in fast, adaptive, real-time decision-making and responses.

■ Simulation: Simulation methodologies are modeling tools used to predict and evaluate the potential of complex systems and give unique empowerment and autonomy to workers, equipment, and processes. Simulations create digital twins of physical processes like manufacturing or inventory. The real-time access to the data, as also its interactions with workers, equipment, and processes give,facilitates better decision-making, operational efficiency, and speed.
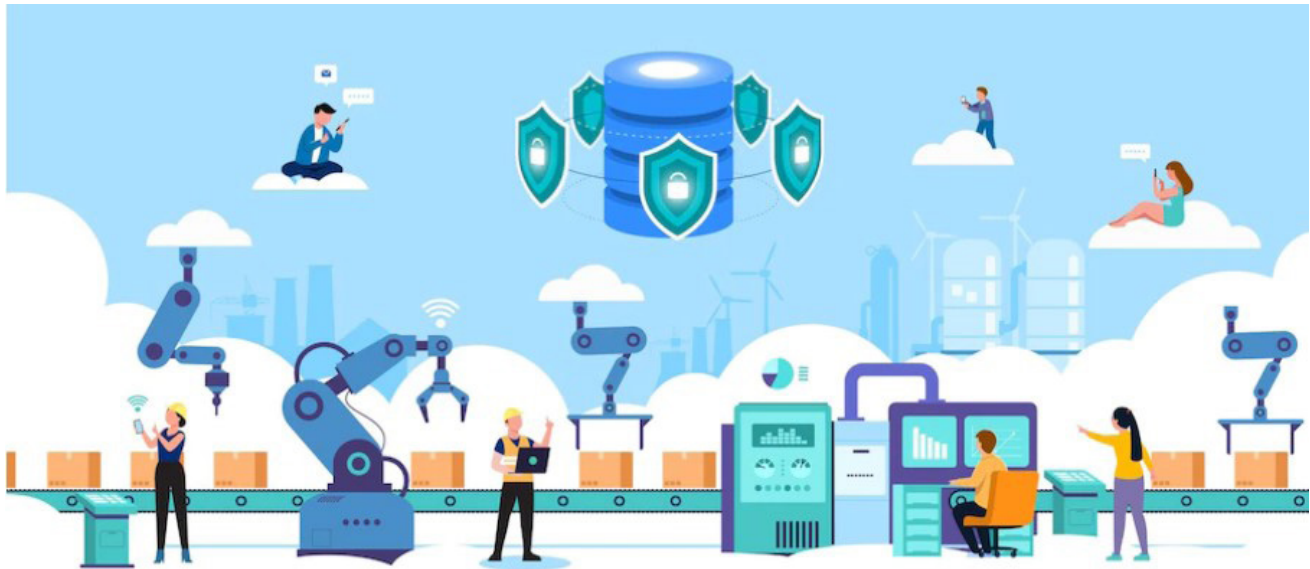

■ Cloud Computing & Virtualization: Cloud computing and associated technologies like virtualization, Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) are touted as the next 'big' thing and a game changer for enterprises. The global cloud computing industry has grown from US $40.7 billion in 2010 to more than US$ 241 billion in 2021. Cloud reduces the Total Cost of Ownership for enterprises. Cloud computing is a form of utility computing where hardware, software, storage, and plat form are made available as per need and on a subscription basis. In this service model, clients can access the cloud-based application through an Internet browser. The data can be resident in a remote place also. Complementing the cloud is the usage of server farms and data centers where all applications and data can be stored, shared, and accessed on demand using virtualization. Cloud is a 'green' technology as it eliminates the need for enterprises to procure and maintain large servers and associated space and infrastructure.

■ Cyber Security: 'Data' being the new 'Oil' means its security becomes paramount. Ensuring secure operations within connected networks and open systems is a challenging requirement of connected enterprises and their supply chain processes. Industrial systems and manufacturing processes have to be protected from cyber security threats. This entails secure and reliable communication as also secure access controls and identity management for both machines and human users.

■ 3D Printing: This is a form of additive manufacturing that can be used for rapid prototyping and producing individual components. The focus is to produce customized modules that are easy to use and also minimize transportation and inventory.
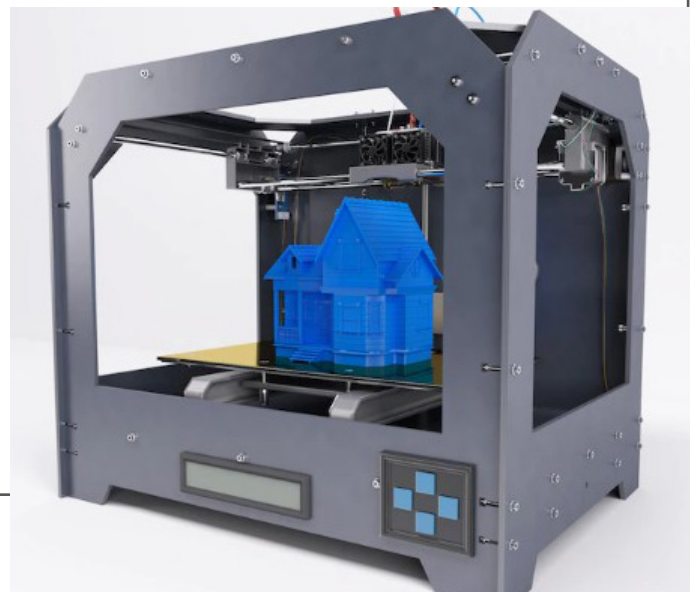
■ Horizontal & Vertical system integration: Horizontal Integration is a modular system that connects the information across the entire value chain. Vertical Integration pulls together information from across all verticals and levels of the organization and seamlessly exchanges this across all levels. As a result, management functions such as production, HR, and finance, as well as departments, branches, and capabilities, are interconnected and cohesive and interrelated with stakeholders such as suppliers, partners, and customers.

■ Augmented Reality (AR) / Virtual Reality (VR). These technologies provide an interactive representation of the real-world environment. This is enlarged and improved by computer-generated interpretation of required information to aid decision-making. AR is now possible across sensory perceptions, including auditory, visual, touch, smell, heat/cold, and pressure. Potential applications include customer co-creation, remote maintenance, predictive maintenance, virtually guided self-service, and remote monitoring and control.

MSME Sector in India

The Micro, Small, and Medium Enterprises (MSME) sector has emerged as a vibrant sector of the Indian economy over the last five decades. MSMEs contribute more than 29% to the GDP and are responsible for 50% of the country's total exports. They are also accountable for one-third of India's manufacturing output. Interestingly, in the EU, 99% of all businesses fall under this category. Globally it is 90% as per the International Finance Corporation MSMEs not only play a crucial role in providing large employment opportunities at comparatively lower capital cost than big industries but also help in the industrialization of rural & backward areas, thereby reducing regional imbalances, assuring more equitable distribution of national income and wealth.

MSMEs are complementary to big industries as ancillary units, and this sector contributes enormously to the socio-economic development of the country. Khadi, village industries, and coir have historically been the early MSME clusters. The coir industry originated in Kerala and spread to other coconut-producing states like Tamil Nadu, Karnataka, Andhra Pradesh,

Orissa, West Bengal, Maharashtra, Assam, Tripura, etc. Likewise, the MSME segment includes various verticals and sectors, including services, and the recent governmental classification scheme for MSME has also widened the net as also provided more extensive benefits accrued to the MSME. As per the MSME ministry's annual report of 2021-2022, there were 65 lakhs+ MSMEs registered in the Udyam portal at the beginning of 2021, but the actual number is in the order of 10 times that number in sectors including manufacturing, services, and trades. 99% are micro, with 0.52% small and 0.1% medium. The number of jobs in the MSME sector is estimated to be 15+ crores.

Considering the sector's importance, the Government of India has a separate ministry for MSME under a senior cabinet minister. Over a period of time, through MSME-friendly policies and initiatives, it is nvisaged that MSME will contribute 50% of GDP and 75% of exports. The Ministry of MSME has executed a slew of ICT initiatives for the benefit of the sector. These include web-based application modules, namely,

MyMSME and other e-portals for loans, job-seekers, procurement, digital payments, marketing, and app development.

Our Small Hands to Make you LARGE

CHAMPIONS

MEDIUM

SMALL

MICRO

The Ministry of MSME has taken numerous initiatives to enable the entire MSME ecosystem digitally. This includes subsidies for cloud and analytics platforms and the CHAMPIONS (Creation and Harmonious Application of Modern Processes for Increasing the Output and National Strength) portal, a technology-driven centralized control room, grievance management, and an information platform to support MSME. This is a one-stop solution for handholding MSMEs and uses the power of AI & ML. Future enhancements of the CHAMPIONS portal include information intelligence and sentiment analysis based on widely available social media and online data and AI-enabled Chat Bots for faster response to the query of portal users.
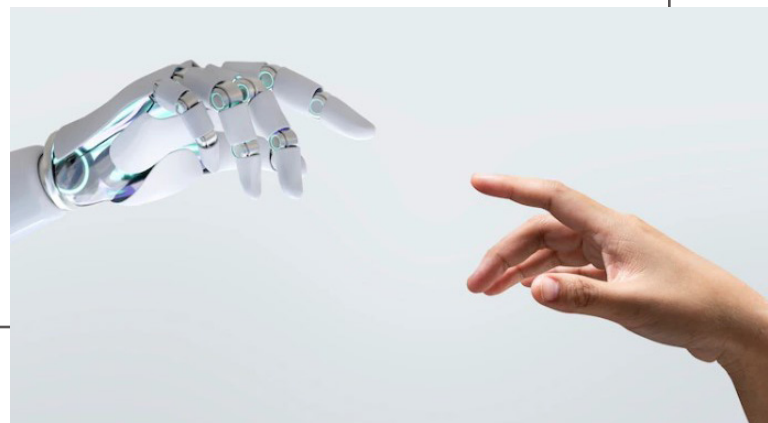
Indian MSMEs are steadily moving towards technology adoption and usage. The Covid-19 pandemic has accelerated this trend and the Internet economy. MSME's software deployment is primarily restricted to stand-alone packages for finance, HR manufacturing, or payroll. Video-conferencing and messenger services are also being widely used. There has been a visible digital shift in channels for communication, marketing, payments, hiring, and other business verticals. Since many MSMEs are suppliers of raw materials and other goods for large corporations, the latter are also impacted if vendors in their value chain are not entirely compliant with the latest intelligent manufacturing protocols. However, most MSMEs do not have a comprehensive ICT policy or wide deployment of enterprise-wide software like ERP and/or Industry 4.0 technologies.

A minuscule percentage of these MSMEs harness cutting-edge Industry 4.0 technologies such as business analytics, blockchain, robotics, 5G, IoT, sensors, AI, AR/VR, 3D printing, etc. Generally, MSMEs are slow towards technology adoption. Added to this, funding, working capital, and availability of trained manpower resources are also a challenge.

There is also a lack of awareness of these advanced ICT-based solutions and/or technologies and their wide-ranging benefits. There is also a misconception that these are of a disruptive nature. MSME employees are also apprehensive with respect to the changes that are likely to occur due to the adoption of these technologies.

This could be in terms of layoffs and also the need for upskilling themselves. Another pertinent issue is the absence of frameworks and steps that assist MSMEs in adopting Industry 4.0 technologies like understanding data.

Recommendations for MSME Clusters towards Adoption of Industry 4.0

■   This white paper provides recommendations to MSMEs for adopting cutting-edge Industry 4.0 technologies. This is very relevant considering the fact that there is a significant digital divide between big industry and MSME. Most of the MSMEs fall into the group of low digitalization and low data-driven companies. This is a trend not only in India but even in developed economies.

The adoption of Industry 4.0 technologies provides immense benefits to industries and MSMEs and gives them opportunities to transform their supply chains into value chains. No doubt, at the initial stages, some of these technologies may be out of reach for individual MSMEs due to the cost and the fact that these MSMEs may also face liquidity issues. MSMEs may have to look for alternatives for short-term financing that can assist in fixing credit issues and enhancing financial performance.

The scarcity of loan-granting institutions other than nationalized banks poses another challenge. However, a cluster-based approach towards procurement and adoption of Industry 4.0 technologies can prove to be beneficial to them if these procurements are done as an MSME cluster. Total Cost of Ownership (TCO) will reduce for these MSMEs

An added advantage is that most of the MSME clusters are well-organized. To cite an example, CODISSIA, Coimbatore District Small Industries Association, boasts more than 2000 members in 43 sectors. A world-class trade Fair Complex as an industrial and exhibition venue and incubation center for defense are some of the achievements of this cluster. Likewise, there are many similar success stories Pan-India. Another cluster representing the pump, foundry, and motor sectors in the Coimbatore region is the Southern India Engineering Manufacturers' Association (SIEMA) has 300 members.

■ Regarding software packages in AI and/or IoT as part of Industry 4.0, these packages can be sold as a cloud-based solution to the MSME. This would reduce the TCO as the MSME need not procure expensive servers, hardware, and/or infrastructure to host the software package.

■ Exploring open-source packages and menu-based approachesis also an option. In other words, procure the required modules from the software package as per need and top up as required. However, these targeted digital improvements need to be focused and dovetailed into the strategic roadmap of the MSME.

■ MSMEs can incrementally procure Industry 4.0 technologies. They can start small by starting with apps, sensors & IoT and then move up the value chain to high-end robotics, AI, and the like. This results in the optimization of resources. Pilot projects can be pursued as proof-of-concept and implemented in localized value chains.

■ Considering the rapid growth of digital technologies, regular upskilling and training programs for employees in MSMEs are essential. Their domain knowledge, coupled with their expertise in analytics and the link, would be an excellent combination.

■ Awareness needs to build from top to bottom of the organizations such that not only the top management but employees at all levels champion the adoption of Industry 4.0. This awareness would also propel top management to make the necessary investments toward procurement of other digital technologies. Data management and associated policies must also be formulated and communicated to all stakeholders.

■ MSMEs should target external value chains first by utilizing commercially available Industry 4.0 tools in the e-commerce and logistic sectors. Batch and continuous manufacturing MSMEs will be the early beneficiaries of Industry 4.0 solutions compared to those involved in the process and discrete manufacturing. This is because they rely on an established Bill of Material (BOM) and defined work processes in the form of assembly lines, while process manufacturing relies on a process formula.

Undoubtedly, Industry 4.0-enabled MSMEs have a massive opportunity for growth and success. This is the right time for MSMEs to embrace Industry 4.0 to bring about dramatic improvements in their performance.

This will go a long way in terms of streamlining their processes & support systems digitally, bringing in automation, and leveraging big data toward customer satisfaction. Using these recommendations, the next course of action would be to develop a framework on the factors that affect the adoption of Industry 4.0 in MSMEs and empirically capture their contribution towards the organizational performance of MSMEs.