VIEW POINT

DRIVING INNOVATION WITH INTELLIGENT MANUFACTURING

Abstract

The fourth revolution in manufacturing, Industry 4.0, gives manufacturers various tools to differentiate their services, customize production capabilities, and improve business planning. But some manufacturers shy away from intelligent manufacturing due to high investments involved and limited implementation knowledge. This POV looks at the drivers of intelligent manufacturing as well as the use cases that help manufacturers gain quick wins. It also provides guidelines on building competence in IoT technologies.

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Introduction

The world is becoming more competitive and disruptive with every passing day. Manufacturers are exploring innovative ways to cut costs, be resilient, and increase revenues.

Intelligent manufacturing is the driving force behind Industry 4.0. It aims to optimize production and product transactions using advanced information and manufacturing technologies.

It is based on intelligent science and technologies that upgrade the design, production, management, and integration of the entire lifecycle of any product. Intelligent manufacturing is complemented by two new-age manufacturing models, i.e., IoT-enabled manufacturing and cloud manufacturing.

From an innovation perspective, the intelligent manufacturing model is futuristic, since it uses AI-backed, smart decision-making, enables advanced manufacturing planning, and is supported by technologies such as advanced robotics, new-generation sensors, and Big Data analysis. Given its potential, though, manufacturers may find that the model could transform into an operational imperative instead of being just a competitive differentiator.

Driving Factors of Industry 4.0 Adoption

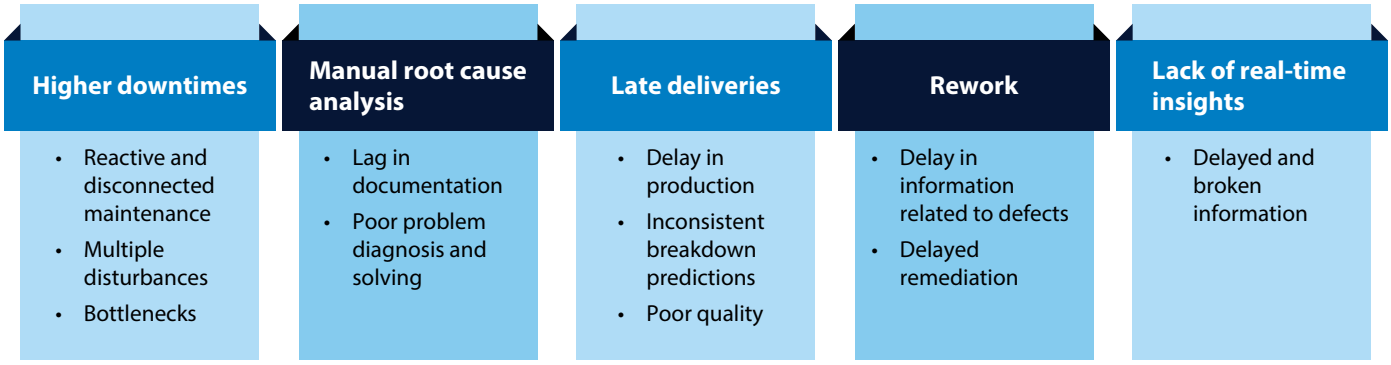


Figure 1 – Limitations in current manufacturing models

Manufacturers were exploring ways to deal with the limitations of current manufacturing models, but the onset of COVID-19 changed it all. It amplified existing gaps and unveiled many other challenges related to machine downtime, planning and forecasting, wastage in production, manufacturing inflexibility, and poor quality.

Intelligent manufacturing empowers manufacturing organizations to become more competitive with long-term investments aimed at increasing ROI in the future. Some of its key drivers are:

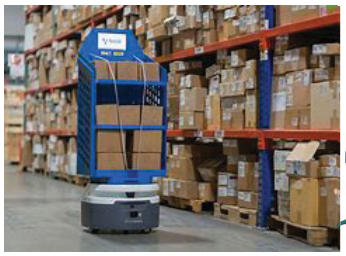
- Rapidly changing customer behavior
- Faster rate of technological innovation
- Business emphasis on scalability and flexibility
- Pricing pressure from disruptors
- Leaner supply chain and optimized production/inventory
- Next-generation business models like servitization

A Look at Intelligent Manufacturing Systems

An Intelligent Manufacturing System (IMS) can be used for warehouse management, predictive maintenance, data collection, and more, as shown in Figure 2. Such use cases are enabled by five main features that build up the IMS framework:

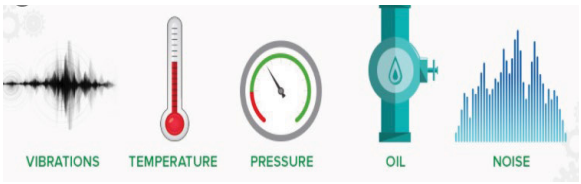
- **Smart design:** New-age technologies such as Augmented Reality (AR), Virtual Reality (VR), and 3D printing are at the core of smart product design.
- **Smart machines:** Smart robots and other machines developed with real-time sensing and interacting capabilities are the backbone of this category.
- **Smart monitoring:** This feature is vital for operations, maintenance, and scheduling in the era of Industry 4.0. Sensors that track and report on the multiple parameters of different machines are critical for smart monitoring.
- **Smart control:** A cloud-enabled platform allows users to manage and operate smart machines and tools from anywhere, anytime, using their smartphones or other devices.
- **Smart scheduling:** This layer includes advanced algorithms and models to draw and analyze the data captured by sensors. Advanced decision architecture and data-driven techniques are the pillars of smart scheduling.

Manufacturing Use Cases for Industry 4.0



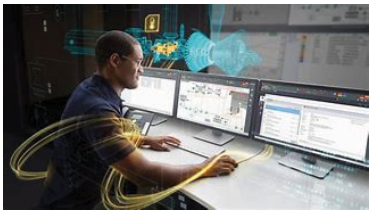
1. Digitalized in-plant logistics for warehouse management

2. Data collection from supply chains



3. Data-based predictive maintenance

4. Automated human-machine collaboration



5. Advanced process control

6. Digital performance management system

7. Direct product delivery to customer through agile and smart operations

Figure 2 – Popular use cases for intelligent manufacturing *Source: McKinsey*

As a partner of choice for manufacturing organizations, Infosys has been helping manufacturers leverage digital and IoT to pilot Industry 4.0 technologies. Some leading implementations and value-delivering use cases are as follows:

Predictive maintenance – Machine Learning (ML) algorithms enable predictive maintenance of assets, while Robotic Process Automation (RPA) triggers jobs and alerts. For a global oil and gas manufacturing company, Infosys developed an ML engine-enabled Smart Fault Tree for heat exchange operations. The solution reduced the number of in-line faults and improved failure forecasts. Tangible benefits include 25% reduction in repair time, 30% reduction in unplanned downtime, and 5% boost in production rates.

Mobile-enabled operations – AR/VR help visualize production process flows and guide operators. Other technologies like IoT, AI, and ML are used to set up real-time dashboards, which give users the ability to access and operate various control switches via mobile applications. Infosys Smart Factory Solution, a combination of IoT, smart analytics, and mobility, helped an industrial tools and household hardware manufacturing company improve in-line effectiveness by 20% and productivity by 5%. The mobility solution reduced manual and on-paper jobs by 90%. Further, the IoT application provides real-time traceable digital quality, improving defect identification by 10%. Smart analytics has improved unplanned equipment downtime by 10%.

Logistics – ML algorithms can predict cargo arrivals and departures. In case of delays, they also recommend countermeasures to be taken. AR is particularly useful in warehouses, to find the exact location and quantity for product pick-up through navigation tools, barcode scan-based pick-up confirmation, etc.

Forecasting – AI/ML models can be trained to predict parts replacement and asset lifetime. These outputs can feed Sales and Operations Planning (S&OP) for more accurate asset forecasting. For a leading air conditioner manufacturing and cooling solutions brand, Infosys designed and implemented digital transformation through Industry 4.0. The main capabilities delivered were advanced planning and scheduling, robust capacity production planning, and production traceability. This helped the client improve overall equipment effectiveness by 20%, final assembly throughput by 15%, and cycle time by 10%.

Manufacturing flexibility – 3D printing greatly optimizes inventory and material wastage, improves lead times, helps customize offerings, and revamps spare parts management. Further, a mix of technologies enables real-time production inputs from raw materials, Work in Progress (WIP) items, finished products, and manpower requirements to maintain product prioritization. For a premium global motorcycle brand, Infosys developed a manufacturing intelligence solution that integrates shop floor operations and equipment with their ERP system. Real-time KPI trackers have helped the client reduce cost of spares by 6%, increase cost savings by 10%, and achieve predictive maintenance.

How Manufacturers can Build Competence in Intelligent Manufacturing

Many manufacturing companies are aware of the limitations of existing models as well as the promised rewards of Industry 4.0. Yet, they hesitate from adopting intelligent manufacturing, due to requirements such as high initial investment, skilled labor, and extensive training. The right strategy, roadmap, and tools are important to achieve the quick wins mentioned above and drive further transformation.

Some guidelines for manufacturers are as follows:

1. **Identify the value proposition** – This is vital to establish the right infrastructure for intelligent manufacturing. Key considerations are:
    - Recognizing the variations across manpower, machine, material, and methods
    - Establishing real-time solutions to address waste, variability, and inflexibility
    - Developing a culture of continuous and sustainable improvement focused on safety, quality, productivity, cost, delivery, and morale
2. **Envision digital transformation** – A thorough digital strategy is imperative for intelligent manufacturing. Organizations must define digital requirements, goals and implementation areas, roadmaps, and timelines. Key considerations are:
    - Scanning the industry
    - Conducting a Digital Maturity Assessment (DMA)
    - Defining the digital strategy
    - Ensuring high-level planning and roadmap
    - Executing and validating

Conclusion

Intelligent manufacturing enhances asset utilization, quality, productivity, and flexibility. It enables accurate planning and forecasting by considering the impact of external factors. Many manufacturers are hesitant towards the adoption of intelligent manufacturing, due to challenges like high initial investment and limited implementation expertise. However, a milestone-based strategy that focuses on digital transformation and IoT enablement can channelize adoption efforts for faster ROI from intelligent manufacturing.

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Venky Venkatesh is part of the Infosys leadership team focused on thought leadership and consulting on transformational programs for Industrial manufacturing organizations.

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