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Whitepaper

Laying the Course for an Inclusive Industry 4.0 Transformation Journey

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Contents

Abstract

Undeniably, global manufacturing is presently exposed to unprecedented changes – multiple inflection points of different dimensions converging at the same time. Digital transformation, technology led disruption, high speed telecommunication, advances in materials, and demographics are all at their own inflection points. Changes tend to automatically build expectations of better products and services, which creates additional pressures in an intensely competitive atmosphere.

The present era is marked with increasingly flattened global supply chains, customized products and lean manufacturing operations. Consequently, digital manufacturing is not conceptual, but an imperative – critical for driving efficiencies and to acquire the competitive edge in the market. Industry 4.0 solutions help drive benefits across two dimensions – shop floor efficiency and 'smarter' products. Given the heterogeneous nature of manufacturing shop floor application landscape across plants and the decentralized nature of decision making multiple challenges exist to drive industry 4.0 initiatives. The true value of Industry 4.0 initiatives can only be realized if an all-inclusive approach is adopted, where the 4 Ps – People, Plant, Process and Platform are leveraged to function smoothly as cogs in the wheel of transformation.

This Whitepaper drills down into the various challenges that piggyback on the transformation journey and the approach necessary for realization of true value of the implementation. The analysis also includes the all-important sustainability factor which will effectively determine if companies last the race. Finally, the document identifies the boxes that need to be ticked to ensure that transition to digital factory is successful by design and implementation, with progressive outcomes.

IoT technologies are being adopted at an accelerated rate, **47%** of respondents currently deploy IoT solutions and an additional **39%** plan to deploy in the next 12 to 24 months.

Challenges in the Industry 4.0 transition roadmap

The challenges companies face largely depends on the exact stage of their Industry 4.0 journey. This slots companies into two broad categories, demanding appropriate strategies/actions to negotiate the roadblocks during transition, in addition to contending with challenges that are intrinsic to industry verticals.

Category 1: Companies on the threshold

The first category is of companies that are commencing the transition to Industry 4.0. The state of preparedness is characteristically common among companies of this category. The Proof of Concepts (POCs) are more likely to be few, carried out at a very localized plant level. These companies on the threshold would like to chalk out strategies to move forward by clearly defining the Industry 4.0 roadmap. This is typically wedded to business case scenario with ROI considerations for deciding solution implementation. These companies intend to scale up the implementation across plants and geographies – this could also be staggered in nature.

Category 2: Companies in expansion mode

The second category is of companies that have a well-defined Industry 4.0 strategy and roadmap in place after the successful implementation of Industry 4.0 on a pilot basis. These companies are likely to have experienced first-hand the business value of these solution implementations and the impact of use cases on assembly lines or manufacturing facilities. These companies are generally on an expansion mode, looking for implementation methodology to scale it up further by deployment across plants and geographies.

The first goal – Strategy for ideal implementation

The ideal Industry 4.0 implementation and value realization framework should adopt a persona centric approach that is actively and fully supported by data and analytics. This will help scale and sustain digital products and capabilities across plants with an agile first approach. Successful Industry 4.0 implementation can only be ushered by leveraging the partnership ecosystem that comprises of startups, sensors and gateway OEMs, IOT platform providers and system integrators. This enables faster deployment of solutions, helping companies to benefit from the unfettered capabilities of Industry 4.0.

60% of enterprises are, expanding or transforming with new lines of business with the help of their IoT initiatives, Forbes insights survey

Avoid adoption failure with mandatory inclusion of key components

Solutions are only as good as the components in the solution and the way the requirements are mapped. Operational excellence hinges on multiple underlying factors, and it is necessary that adoption includes the following components that are critical to avoid suboptimal performance.

- User centric problem definition approach
- Industry 4.0 assessment methodology
- Reference architecture
- Global rollout toolkit
- Post deployment support methodology
- Robust change management process

User-centric problem definition approach to meet end-User needs

The transition to Industry 4.0 needs to ensure that old unmanaged complexities are resolved, while preventing new complexities from emerging as a result of the new processes. Stakeholders need to adopt the right design thinking strategy, persona and end user focused design practices. This needs to be supported by lean UX principles to ensure that digital products specifically meet user needs. The typical persona centric value creation map illustrated below, highlights the interdependencies and enablers of solutions.

Key Personas	Key challenges	Digital transformation enablers
Plan Manager	• Challenges in optimizing Manufacturing Planning, Schedule attainments because of inconsistent Processes • Not able to share best practices across plants	• Digital control tower providing real-time business KPI and visibility across production lines • Global template based factory visibility and OEE Reporting
Quality Manager	• Need to meet stringent plant quality metrics • Reduce deviation in batch variations and inability to trace and analyze root cases for process and quality deviations	• Integrated MES, OEE and quality analytics tools • Enforcing CAPA processes and ability to perform historical analytics using batch trends
Maintenance technician	• Not able to share best practices within plants for machine maintenance and troubleshooting • High unplanned downtime of machines	• Mobile based Maintenance application along with digital twin • Integration of shop floor systems - machines, Cobot, AGV into a single consolidated dashboard
Plat Operations Supervisor	• Disparate application or manual paperwork leading to high effort to execute and audit operations • Inability to lookup for quick help guides	• Mobile Supervisor applications helps to monitor operations and collaborate • Helps operators perform tasks enabled by Digital Twin/AR for training and work instructions

Industry 4.0 assessment methodology to assess maturity Level of plants

Objective	Opportunity Levers	Prioritization and solution definition	Outputs
Reduce Energy Consumption by **15%**	Consumption Pattern by Line / Asset Real Time Forecast vs Actual Consumption	Sensor Options based on systems / assets Maintenance data for the systems / assets **Critical Processes** • Dynamic Asset Classification • RCA/FMEA/Criticality Analysis • Maintenance Management • Production Planning and Scheduling Manufacturing Operations Mgt • Asset Management	Prioritized Use Cases and Scope Finalization Selected Lines / Assets to Monitor Selected Sensors Analytics done at Edge, Plant and Enterprise Levels
Downtime reduction by **12%**	Condition Monitoring (Sensory) Predictive Maintenance		
Overall productivity improvement by **10%**	Production Modeling and Optimization Factory visibility and Intelligent Dashboards		

Reference architecture for defining technical solution

In Industry 4.0, various business processes, functions, data and communication streams converge through digitalization to develop/produce final solution. It is essential to incorporate reference architecture to ensure connectivity with shop floor machines and equipment using standard industrial protocols. The reference architecture enables this convergence and collaboration by considering the following aspects of the manufacturing shop floor environment:

- A mechanism to collect data from legacy machines not having support to expose equipment condition data
- Edge analytics for providing faster insights to shop floor operator and to limit the volume of data getting ingested in IoT platform for analytics and visualization
- Plant level visibility for driving efficiency across multiple dimensions, for example – production efficiency, supply chain efficiency, energy efficiency and improvement in quality
- An orchestration framework that accommodates various use cases and provides the flexibility to configure the solution based on plant requirement
- Accommodating different manufacturing shop floor landscape consequent to new plant addition, as a result of mergers and acquisitions

Global rollout tool kit for faster deployment across multiple plants and geographies

The rollout plan of Industry 4.0 factors in the entire value chain. This essentially means that the deployment methodology needs to be robust and should take into consideration the local plant nuances. In other words, it is a global approach with local improvisation that seamlessly integrates with the solution. This approach via rapid digital deployment toolkit helps expand the solution to cover multiple plants and productions lines with limited disruption to existing operations and plant landscape.

Critical aspects that should never be overlooked in the scramble to adopt solutions

A toolkit that prepares the plant and makes it ready for deployment - provide a clear view of necessary preparatory work that needs to be performed. This includes the infrastructure requirements, various systems and devices necessary for the implementation.

Plant readiness criteria – transition to Industry 4.0 will trigger changes in existing ways of working. It is necessary to plan and manage the steps to ensure that business functions likely to be impacted by the expected changes are ready for it.

Training analysis and training content – the adoption of new processes, technologies, control systems and devices will create the need for re-skilling and re-tooling. Identify the gap between employee skills and the training necessary to prepare the employees to adopt the new processes. Learning and development initiatives need to be focused on achieving the objectives of enabling the plant and shop floor personnel to work efficiently, as a cross trained team on new system and processes.

Post deployment sUpport methodology for ensuring stability

The integration of the physical and the virtual through Industry 4.0 does not end with the implementation of solutions. The support systems need to be an intrinsic part of the deployment strategy. A scalable and flexible support model is necessary for providing the requisite assurance to plant personnel regarding the availability and stability of new systems. The model should comfortably accommodate and integrate new plants and production-lines coming online, both downstream and upstream, across geographies.

Robust change management process for better delivery of value

In Industry 4.0 transformation journey, business labs for simulation of plant setup are extensively used for development, and outcomes take shape only after issues related to various processes are sorted out. While the infrastructure and processes are continually evolving, a key dimension for successful implementation of Industry 4.0 initiative is effective change management within client organization. This will ensure that all stakeholders are aligned to agile way of working with a clear understanding of the value that the program will deliver. This can be achieved by:

- Clearly establishing and defining the goals and benefits the program will deliver across various iterations and after the completion of all iterations
- Identifying a champion at each plant and gain the buy-in from key stakeholders by closely engaging with them throughout the journey
- Communicating and enabling the end user regularly as the iteration progresses and carry over the feedback from previous iteration to next
- Closely looking at incentivizing the end users for adopting new processes, systems and ways of working

Summary

For a successful deployment of Industry 4.0 solution, various aspects need to be carefully considered along with skillset requirements. As organizations navigate their Industry 4.0 journey, the scaling of the solution – onboarding the IoT framework, and adoption of the solution by the new plants is pivotal. Success will entirely depend on the ability of organizations to effectively align internal stakeholders and make them realize value from the transition to Industry 4.0, regardless of the position of the organization in the transformation journey.

About the Author

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Kartik heads the delivery for IoT Practice across industry verticals. In this role, he is responsible for delivery of IOT transformation program for global customers. He has over 20 years of experience and has played sales, program and delivery management roles in different geographies. His areas of expertise include product design, industrial automation and Industry 4.0. He has helped multiple customers define and navigate their digital transformation journey by bringing in solutions on IT-OT convergence, factory visibility, condition monitoring, predictive maintenance, digital twins for process & asset, and digital thread.

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