INCISIV

2021 Market Perspective

The Fast Track to Manufacturing Intelligence

Leveraging IoT, Edge Computing, Low Code

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Table of Content

Manufacturing Intelligence: An Introduction

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With technologies like the Industrial Internet of Things (IIoT), AI, Edge Computing and Low Code driving Industry 4.0, manufacturing is experiencing a digital revolution. Manufacturing has reached a critical tipping point and companies need to either embrace digital technologies are be left behind.

Manufacturing Intelligence (MI) refers to software solutions or a set of solutions that can gather, analyze, and present manufacturing information from across the enterprise to the right decision-makers.

Manufacturers are operating complex supply chains seek to model and predict volatile consumer demand amidst shortening lead times and increased product portfolio. They are compelled to take manufacturing intelligence beyond just the manufacturing plant. Enterprise manufacturing enables trade-offs across end-to-end value chains by better understanding constraints (capability, capacity, etc.) to deliver agility.

The market for these MI solutions is positioned to grow with a CAGR of 18% between 2021-2025. With the increased use of data analytics and visualization, MI solutions can enable 360-degree monitoring of the factory floor.

Enabling MI is a multi-step transformation initiative that can be both time-consuming and expensive, so manufacturers must have a clear strategy set before embarking on such initiatives.

The use of IIoT, edge computing and low code is not only expediting the time to market of the MI solutions but also making the data and insights omni-present. IIoT is fast becoming the backbone of MI by enabling seamless connection between the virtual world and the real world.

Manufacturers can now optimize and simulate processes and products in the digital world and then apply them to the physical environment. Companies can then apply how a process or product works in the physical world and use those learnings to create a digital twin.

This also presents new opportunities for advanced manufacturing, drives productivity improvement, and ensures sustainable operations by reducing real material resources.

Enterprise Manufacturing Intelligence powered by IIoT, AI, edge computing and low code has shown to deliver multiple benefits:

Improve productivity:	15%+
Reduce direct material cost:	5-10%
Reduce labour cost:	5-12%
Improve factory throughput:	10-15%
Reduce product design lifecycle:	10-25%
Reduce plant maintenance cost:	10%

By 2021, 40 percent of manufacturers will have made a full, factory-wide digital makeover. By 2022, 35 percent of manufacturers will have an entirely new digital ecosystem that includes AI, robotics, and blockchain.
- IDC

Manufacturing Intelligence Trends & Challenges

Manufacturing Intelligence Trends & Challenges

The COVID pandemic introduced far more uncertainty into day-to-day operations. It compelled companies to find new ways to operate efficiently and effectively, from sourcing of goods to the plant and delivery to the customers. This has driven the need to connect and unify data sources into one accessible model, providing capabilities to explore and drill down into contextualized data and empower real-time decision making. Key trends include:

- **Increased investment IIoT**: IT/OT integration is critical to improving operational efficiency while accelerating success through digital transformation initiatives
- **Move to Edge Computing:** The need for agility has taken center stage and to enable that computing power data processing is shifting to the edge.
- **Human-Centered AI:** Adapting AI designs and models customized to user needs and values
- **Adoption of low code:** Faster application development using a prebuilt library of foundation components and functional logic. This also enables user centred design

Technology Trends and Manufacturers Concerns

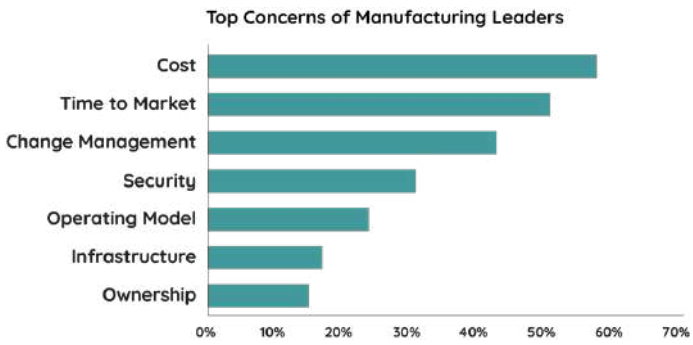
	Cost / ROI	Time to Market	Change Management
IIoT	★★	★★	★★
Edge	★★	★	★★
AI	★★	★	★
Low Code	★★	★★	★★

★★ Fully Addresses ★ Partially Addresses

Source: Incisiv Survey of Manufacturing Executives

Business leaders acknowledge the need and benefits of Enterprise Manufacturing Intelligence powered by IIoT, AI, edge computing and low code. This is also evident from the rapid rate of adoption. But challenges remain. In a survey of top executives of large global manufacturers, the following challenges / concerns were highlighted:

- **Cost**: What is the business case? How much will it cost? What is the RoI?
- **Infrastructure**: Will I need to change my IT infrastructure?
- **Change Management:** Will it make the existing workforce redundant? What will be the cost to retrain?
- **Operating Model**: Will I need to add more resources? Will I need to revisit the hierarchy?
- **Ownership**: Who owns this transformation? (IT or business)
- **Security**: Will my confidential data be easily accessible? How many additional security controls will be needed?
- **Time to market**: How long will it take to implement?



"60% of global executives have concerns about implementation cost and 50% are concerned about the time to market for Manufacturing Intelligence transformation."

- Incisiv Survey

The Elixir:
IIoT, Edge and Low Code
Driving Manufacturing Intelligence

IIoT, Edge Computing and Low Code Drive Manufacturing Intelligence

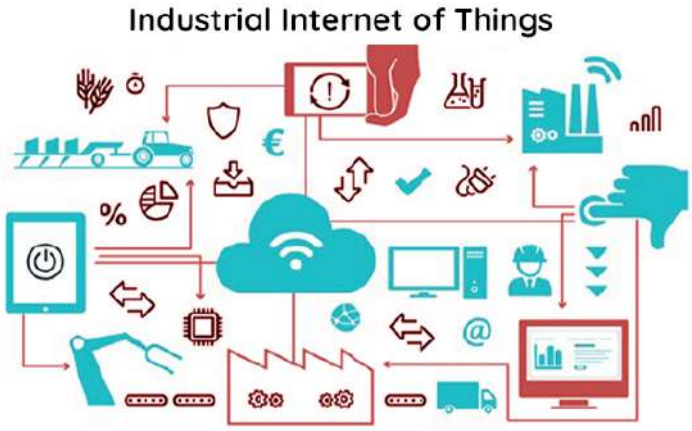
IIoT has amalgamated both hardware and software with the internet to create a technology driven operational environment. IIoT is used in the manufacturing industry to connect machines, products, plants and systems.

Edge computing is then used to compute the data and bring it as close to the sensor as possible so that data processing can take place on the device or in the network instead of being sent to an external cloud. Thus, IIoT is used for connectivity and edge computing is used for processing the data collected.

In addition to this, **Low/ No-code development** platforms are used to quickly create applications to support all these new business needs for digitization.

If executed properly this combination of IIoT, edge computing and low code can address most of the challenges cited by executives, including operating cost, timelines, manpower, wastage of raw material, obsolescence of finished goods and sustainability.

IoT, edge computing and low code have numerous applications in enabling Manufacturing Intelligence: Digital twins, asset management, predictive maintenance, analytics, design and sustainability.



Digital Twins

Digital twines are virtual representations of a physical product or process. Manufacturing Intelligence tools constantly provided real time data from the IIoT sensor on an asset. These twins are vital to enhancing the performance of an asset by testing future scenarios, predicting outcomes, improving situational awareness and proactively anticipating maintenance faults. They are used to streamline asset management and failure management operations.

Asset Management

Most plants have inconsistent performance standards as all assets are of different ages, types, makes, suppliers etc. Connecting assets and enable with infrastructure an equips teams to gain complete transparency into asset health and performance.
Example - This Is extremely useful in storage facilities where key health indicators like temperature, pressure, humidity etc. can be monitored in real time along with actuators to maintain safe storage temperatures. This makes it possible to quickly identify and resolve issues, prevent downtimes from occurring and constantly improve asset performance over time.

IIoT, Edge Computing and Low Code Driving Manufacturing Intelligence

Predictive Maintenance

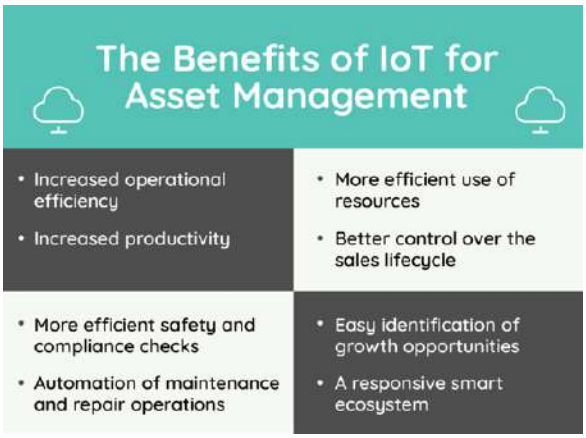
The real time processing of underlying data from various assets makes it possible to forecast future maintenance cycles in order to prevent unplanned downtime. Prediction Models are designed using specific variables like temperature, load, pressure to predict the health of an asset.

Example – A team that is responsible for improving the throughput of a aerated beverages bottling plant, identifies 2 main factors that affect output: throughput of individual machine and throughput of the entire-line. By monitoring and tracking these the team can predict & improve the quantity of yield produced.

Analytics

Analytics is at the heart of the Enterprise Manufacturing Intelligence. Data and analytics not just play a major role in assessing one's own assets performance, throughput, resource consumption etc., but it extends beyond the enterprise and helps the companies understand current market trends, competition, market needs based on customer requirements and key improvement areas.

Example – Exploratory and Correlation analysis as well as Hypothesis tests can be conducted to understand the relationship between demand, supply and pricing of consumer products.



Prescriptive Maintenance

Prescriptive Maintenance is extremely useful in reducing unnecessary maintenance costs. By assessing the condition of an asset, the life of an asset can be prolonged. This in turn improves the overall performance of the asset.

Example - Given an asset running at varying temperatures, analytics can help identify the temperature at which the asset is likely to fail and perform optimally.

Design

Building and implementing IIoT applications, powered by edge computing and orchestrated by low code can be a difficult undertaking for many companies. Issues with long prototyping and development cycles often arise, and companies can often get bogged down in the complexity of the process.

The entire data visualization and analysis process are presented on an easily navigable dashboard along with additional scheduling and alerting features. The design Is easy to Implement and provides secure connectivity for all the factory assets.

No additional server Installations are also required to use IIoT in the manufacturing Industry. All the data Is directly uploaded to the cloud and can be accessed in real time.

Manufacturing Intelligence and Sustainability

Manufacturing Intelligence and Sustainability

The benefits of Manufacturing Intelligence extend beyond cost savings, operation streamlining and visibility. Manufacturing Intelligence can be central to an organization's drive towards sustainability initiatives across all processes and developments. A well-crafted Manufacturing Intelligence solution blueprint powered by IIoT, edge computing and low code can power many positive improvements, including:

Resource and Energy Efficiency: IIoT solutions, powered by edge computing and orchestrated by low code applications increase productivity while also decreasing defective units and lowering energy consumption.
Supply Chain Effectiveness: MI systems ensure that companies are providing the required energy resources at the lowest cost and environmental impact
Circularity and End of life Aspects: Enterprise Manufacturing Intelligence systems can support a more circular economy by making it easier to repair and maintain products. IIoT and edge computing plays a significant role in the rise of predictive maintenance. This results in the extension of life for machinery or equipment, adding an element of sustainability.
Waste Reduction and Management: Enterprise Manufacturing Intelligence solution enable real time tracking of resources and reduce waste by optimizing the operating conditions for most efficient.

The overall sustainability impact of IoT, edge computing, AI and low code is estimated to be to more than $ 100 billion by 2024 through improvement in efficiency and effectiveness of operations.

Close to 60% of total global energy consumption is from the manufacturing industry. However, according to a study from Emerson, 37% of the energy consumed by manufacturing facilities is wasted.

Key challenges in manufacturing:

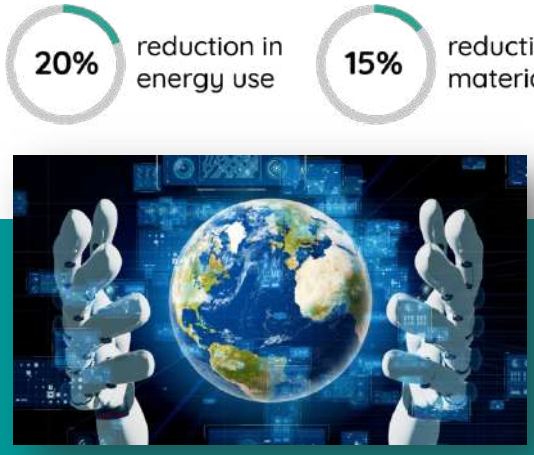
- Enhance the efficiency of assets to decrease energy consumption per hour
- Eliminate **idle** time for machines not in use
- Streamline processes, leading to more machine hours per unit

MI Solution powered by IIoT, Edge and Low Code

- Gain insights **into** the energy consumption of your facilities
- Identify ways to procure energy more cost-effectively
- Leverage renewable/low-emission energy sources
- Custom application for real-time decision making

Results

- Eliminate inefficiencies to reduce energy consumption
- Become more environmentally friendly
- Comply with regulatory requirements



"84% of use cases of IIoT address, or could potentially address, the UN's sustainable Development Goals."
- World Economic Forum

Manufacturing Intelligence
How to Start the Journey?

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The business value of Manufacturing Intelligence initiatives is the ability to improve the effectiveness of the core business processes that drive business performance. However, the change management can be overwhelming for many business leaders because of the direct costs involved and the resources required, including workforce, IT infrastructure, and potential disruption to the business. In a survey of 100 business leaders from manufacturing companies, 50% cited siloed planning and lack of preparedness as the reason for MI initiatives not realizing business goals. Organizations should conduct a 5-step readiness assessment covering:

- Is my business strategy defined?
- Is my customer strategy defined?
- Is my operational strategy defined?
- Is my IT strategy defined?
- Is my people strategy defined?

- Are my processes defined?
- Do my processes have KPIs?
- Are my KPIs measured?
- Is my exception handling defined?
- Are my processes digitized?
- Is my business and IT aligned?
- Are my business applications jointly owned?

- Do i have a data strategy?
- Is my data complete?
- What is the integrity of my data?
- Is my data secure?

- Is my infrastructure future proof?
- Is my infrastructure IIoT and Edge Computing ready?
- Are my backend and front end systems fully integrated?

- Is my organization structure clearly defined?
- Are my roles and responsibilities clearly defined?
- Are the skills for each role defined?
- Do my roles across levels have goals defined?
- Are my goals measured?

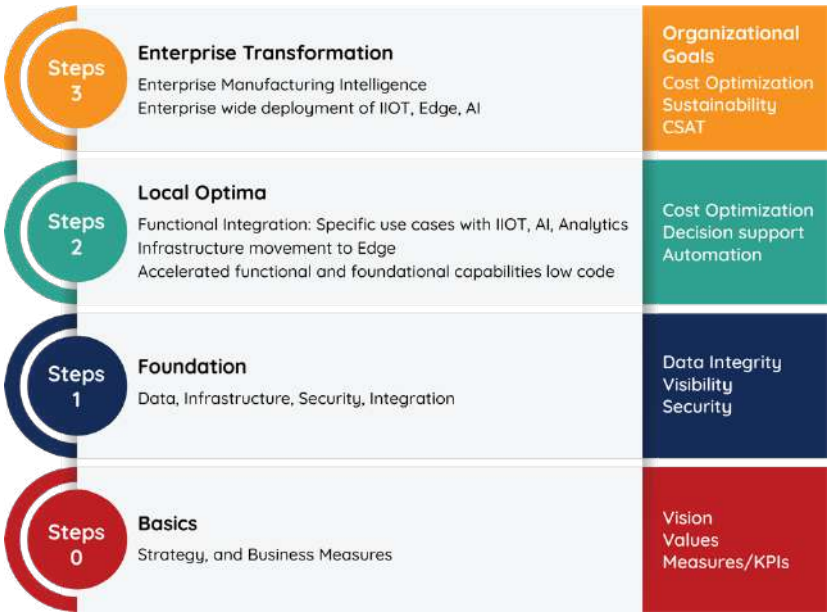
"30% of transformation initiatives fail due to lack of assessment of preparedness for change."
- Incisiv Survey of Business Leaders

Manufacturing Intelligence: How to Start the Journey?

The assessment will help determine the current readiness and maturity which in turn will help determine the path to Enterprise Manufacturing Intelligence, the cost involved and the return on investment.

Take the Assessment

	Objective / Outcome	
Step 0:	Basics	Business strategy
Step 1:	Foundation	Data visibility & Integration
Step 2:	Local Optimization	Function / Process Efficiencies
Step 3:	End to End	Transformation



Conclusion:

Enterprise Manufacturing Intelligence not only enables organizations to survive in the increasingly complex and competitive global environment, it is a key component to drive future success. As sustainability becomes ever more critical, achieving Manufacturing Intelligence can enable more efficient operations.

The many concerns around Manufacturing Intelligence transformation: Cost, Timelines, Change Management etc. can be overcome through the adoption of IIoT, edge computing and low code.

The business case for Enterprise Manufacturing Intelligence transformation is clear: Companies must assess their readiness and then leverage the latest technologies available to set themselves up for success.

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Siemens Digital Industries Software is driving transformation to enable a digital enterprise where engineering, manufacturing, and electronics design meet tomorrow. Our solutions help companies of all sizes create and leverage digital twins

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