Industrial IoT Networks: 5G transforming industry verticals

Research and standardization perspectives on industrial IoT

Standardization Research Lab and Industry Standards Group
Nokia Bell Labs
Industrial IoT and the quest for new economic value

### 2025 value creation ($B)

<table>
<thead>
<tr>
<th>Sector</th>
<th>Low estimate</th>
<th>High estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factories</td>
<td>1210</td>
<td>3700</td>
</tr>
<tr>
<td>Worksites</td>
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<td>930</td>
</tr>
<tr>
<td>Cities</td>
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<td>1660</td>
</tr>
<tr>
<td>Logistics &amp; Transport</td>
<td>560</td>
<td>850</td>
</tr>
<tr>
<td>Health</td>
<td>170</td>
<td>1590</td>
</tr>
</tbody>
</table>

Source: McKinsey Global Institute

### New basestation sites (M)

<table>
<thead>
<tr>
<th>Sector</th>
<th>Low estimate</th>
<th>High estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factories</td>
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<tr>
<td>Worksites</td>
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<tr>
<td>Cities</td>
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<tr>
<td>Logistics &amp; Transport</td>
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<td>0.3</td>
</tr>
</tbody>
</table>

Source: The Private LTE Opportunity for Industrial and Commercial IoT, Harbor Research

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Every €1 spent on 5G network services will enable over €4 of IoT value creation

Industrial IoT will triple the number of base stations globally

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Triggered by industrial IoT, new digital service provider markets offer significant revenue expansion
5G-supported industrial IoT investments will unlock massive value

**Increase efficiency**
with intelligent industrial automation on a shared virtualized infrastructure

**Higher value outcomes**
from greater flexibility, adaptation, and personalization

**Reduced risk**
through resilient, scalable infrastructure

Radical transformation in multiple industries, triggered by the convergence of IT and OT*

* OT: Operational technologies in industrial control
Technology enablers for an industrial IoT revolution
Intelligent, converged operational technologies in a Future X network

- **5G wireless, converged automation protocols**
  - Eliminate wires; support time synchronous ops

- **Private edge cloud**
  - Scalable, secure local computing

- **Deep slicing for industrial IoT networks**
  - Multiple stakeholders on one infrastructure

- **ML-enabled automated operations**
  - “Expertless” monitoring, prediction, optimization

Openness across the architecture

- Emerging Devices & Sensors
- Massive Scale Access
- Converged Edge Cloud
- Converged Node
- Smart Network Fabric
- Digital Value Platforms
  - Augmented Cognition Systems
  - Programmable Network OS
  - Universal Adaptive Core

Dynamic Data Security

Short waves & wires

Long fibers

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5G’s universal adaptive core and edge cloud
Meeting requirements of resilient, scalable, private networking and computing

A single 5G core infrastructure supports diverse industrial IoT applications & stakeholders
Technology enablers for the factory of the future

Industry IoT technologies transforming factory operations

- **5G wireless, converged automation protocols**
  - Eliminate wires; support time synchronous ops

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  - Scalable, secure local computing

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**Factory floor flexibility**
- Rapid reconfiguration & product customization

**Resilient, secure operations**
- Critical factory data stays local

**Shared infrastructure costs**
- Custom networks for on-site ecosystem

**Resilient, efficient production**
- Optimized prod. lines, minimized downtime

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5G technologies will trigger an IoT revolution in future factories
Trial at Nokia’s Oulu Factory with 5G
Advanced quality assurance with 5G-enabled video analytics

1. Video camera monitors the assembly work
2. Live video is streamed from an Intel trial 5G UE to a Nokia base station
3. Video analytics can be run on a remote Telia DC or on a local Nokia MEC
4. Driven by machine learning, quality control is locally flagged in real time
Nokia’s technology leadership ensures that 5G impact

Join us on the journey to the next industrial revolution!