



Impact of IIoT Systems on Bulk Solids Management

After a volatile year for supply chains and bulk pricing fluctuations across industries—from milling to plastics to aggregate—the state of industrial markets in 2026 remains uncertain.

With the [total cost of inventory distortion projected at \\$1.7 trillion in 2024 \[IHL\]](#), it is clear that plant operators and worksite supervisors need better visibility into their bulk inventory levels to maximize production and minimize costs.

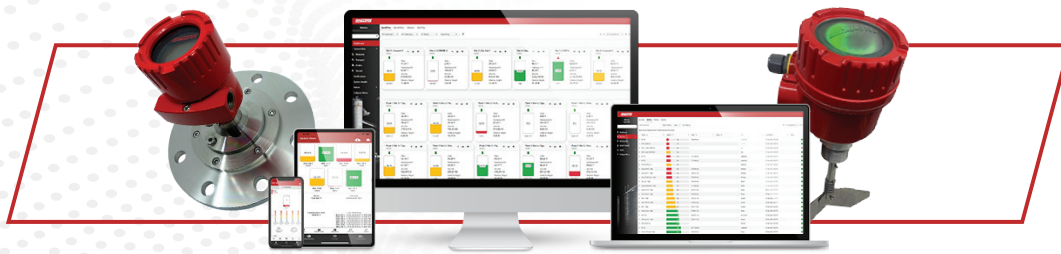
A solution that provides **actionable data** and **strengthened control** starts with level sensors and Industrial Internet of Things (IIoT) networks.



Advantages of Sensor & Software Systems

On their own, level sensors offer more inventory insights than would be available without them. Adding software to the equation enables operators to make **smarter, data-driven decisions** and act **before** critical inventory issues arise—even more so with access to remote monitoring platforms. **A smart system will:**

- **Reduce Overall Costs:** Prevent ordering too much or too little bulk materials, reduce waste and out-of-spec product, and keep carrying costs low
- **Optimize Labor:** Eliminate the need for tedious—and often risky—ladder climbing and manual measurements, ensuring employees can focus on high-value tasks and stay safe on the ground
- **Eliminate Guesswork:** Less confusion and miscommunication around inventory levels keeps purchasing and production departments on the same page
- **Shorten Lead Times:** Plants operate at peak productivity when interruptions such as dry runs or unplanned downtime no longer occur
- **Enable Lean Manufacturing:** Just-in-time fulfillment becomes possible with tight control around inventory and Vendor Managed Inventory (VMI)



Choosing the Best Sensor(s) for Your Operations

When planning which level sensor to implement, careful consideration helps tailor the system to your measured materials and unique application.

Do you need **alerts** when the level of dry bulk material in the bin reaches a certain threshold? Does your plant require a **continuous monitoring model** that can keep up with recurrent vessel emptying and refilling? Will your operations require **integration with existing system controls**?

For level alerts, **point-level sensors** are ideal—and often most cost-efficient—for applications where exact level measurements and inventory reporting aren't required.

Point-level sensors are installed at the top, middle, bottom, or cone of a storage vessel for **high-, mid-, or low-level alerts**. When solids interact with the sensor, an alarm is triggered—typically via horn, light, or local display, depending on how the sensor is wired.

- Effective for overfill and dry run prevention
- Also utilized for plugged chute detection
- **Examples:** Rotary paddle indicators, capacitance probes, vibrating rod sensors, and pressure switches

Where inventory control is essential, **continuous sensors** provide accurate reporting. These sensors collect measurements at frequent intervals, enabling **real-time level monitoring**. They offer consistent, reliable performance, even in harsh conditions where dust, steam, or condensation is present.

- Reports inventory levels continuously, from the top to the bottom of the vessel
- Sensors that **measure multiple points**—such as BinMaster’s 3DLevelScanner—account for surface irregularities to offer volume calculations, in addition to level
- **Single-point continuous technologies** include non-contact radars, plumb-bobs, ultrasonic, laser, and guided wave radar sensors

Components of an IIoT System

Local access to level measurements may be sufficient for a single worksite’s inventory management, but for operations with multiple sites—especially when located far from one another—a remote monitoring approach makes more sense.

Cisco defines **IIoT** as an “ecosystem of devices, sensors, applications, and networking equipment that work together to collect, monitor, and analyze data from industrial operations.” This definition encapsulates the importance—and impact—of remote monitoring systems, especially when the **success of all sites** depends on connectivity and visibility **between** them.

When investing in an IIoT system, simplicity is key. Wireless modules reduce the potential for over-the-air interference. Output conversion devices tend to be a reliable—and economical—option. Based on capacity needs, an effective IIoT buildout often includes:

- **Level Sensors:** Gather inventory measurements; can convert readings to pounds or gallons using strapping tables
- **Network Gateways:** The heart of your IIoT system; seamlessly receives and transmits data over the cloud to your software service, typically via LoRa, Wi-Fi, or cellular connections
- **Transceivers:** Long-range data delivery with low power requirements; eliminate long spans of wiring by using radio technology for line-of-sight transmission of information
- **Consolidators:** Easily connect multiple sensors to a gateway; daisy-chain sensor network configuration supports time, wiring, and cost savings
- **Expansion Modules:** Simplifies setup or expansion of a sensor network, or the upgrade of an existing system to a cloud-based model; highly scalable for large facilities with many vessels and sensors
- **Local LED Displays:** Desirable for local, real-time level monitoring; offers walk-up access to site and plant workers
- **Inventory Management Software:** Interface that displays both current bin levels and comprehensive site data, accessible anywhere and anytime from internet-connected devices: phones, tablets, laptops, or PCs; options like [BinCloud®](#) include automatic push notifications, historical reporting, and multi-site management



Automation's Role During Labor Shortages

A key standard of IIoT implementation is **automation**. From level measurements to process controls to automatically generated reports, these systems help operators work more efficiently and safely. This becomes increasingly important as plants experience worker shortages.

The Associated General Contractors of America (AGC) and National Center for Construction Education and Research (NCCER) reported in their 2025 Workforce Survey that 45% of survey respondents experienced project delays due to shortages of their own or subcontracted workers. In addition, 84% of firms with openings for salaried workers report that employees are as hard—or are harder to find—than just a year ago.

In production environments, there is little workaround when it comes to a lack of labor, but sensors and software can alleviate the burden of tedious tasks, hands-on monitoring, and end-of-month or year reporting.



Here's how connected systems benefit specific industries:

- **Agriculture:** Sensors measure grain bins, provide flow/no-flow visibility in gravity chutes, feeders, pipelines, or bucket elevators, and monitor conveyors to prevent overloading; all level readings can be delivered to software for real-time monitoring
- **Energy:** Ensure continuous supply of bulk materials, oversee ethanol production and dried distilled grain processing, and anticipate orders to utilize the full capacity of bulk storage
- **Cement:** Workers can safely remain in controlled areas; sensors provide distance from high temperatures, excessive dust and noise, and heated materials that need to be measured in clinker silos and during cement production
- **Food & Beverage Processing:** Monitor ingredient supply to ensure continuous material supply in mixers or tanks; enable pump controls to control liquid levels in process vessels
- **Plastics:** Reduce downtime with continuous feeding of resin pellets into hoppers, monitor levels in regrind vessels, utilize Vendor Managed Inventory in resin procurement, and verify flow of resin through pneumatic conveyors in plastic injection molding operations
- **Mining:** Prevent overfills to keep equipment operational, monitor irregular piling of mined material in storage silos, and streamline logistics for truck or railcar deliveries

These advantages are not unique to a specific application, but are applicable to nearly any processing industry with a need for automation. Personalized inventory management systems enable workers to **boost their bandwidth** during labor shortages, ensuring quality and traceability are not compromised.

Embracing a Human-Centric Industry 5.0

The leading principle of Industry 4.0 is **innovation in automation**. The next concept, Industry 5.0, builds on this by emphasizing a **sustainable, resilient future**.

IIoT systems contribute to the human-centric standards specified by Industry 5.0. Ultimately, there is no replacement for skilled labor, but it is possible to run leaner—and maintain efficiency—with the assistance of automation and artificial intelligence.

However, implementing AI in industrial applications is not without its limits.

Human oversight is crucial to guide machine learning models throughout the development process, which often begins with the upload of historical data. **Inventory management software** often fulfills this requirement, providing additional insights that can be inputted and cultivated for further analysis.

By improving safety and simplifying inventory tracking for workers worldwide, sensor and software systems are inherently human-centric. A sustainable future may well include the partnership of people and machines as they work together to make the world more resilient—and perhaps more efficient, too.

To learn how BinMaster makes this outlook achievable, visit [BinMaster.com](https://www.binmaster.com) today.

