Advanced **Material Traceability** Revolutionizes **Digital Transformation**

ThinkIQ

www.thinkiq.com
contact@thinkiq.com
65 Enterprise, 3rd Floor, Aliso Viejo, CA 92656 USA

Introduction

Material is the most important element of any manufacturing production operation, just like money and capital is the heart of banking and finance. So why does every manufacturing company measure and track material differently while monitoring and analyzing their money using standard tools like income and balance sheets? This e-book will explore the role of material flow and traceability analytics and its effect on digital transformation in the modern manufacturing enterprise.

The current state of **digital transformation** and **IoT in manufacturing**—Equipment analytics-only focus is not enough.

Digital transformation and IoT have been around for many years now. At the same time, only a subset of total IoT projects pass from the initial pilot stage to large-scale adoption and the return on investment has been less than expected. According to Microsoft, more than 25% of organizations find that IoT solutions take too long to implement and are too technically complex to complete in house. Predictive and prescriptive analytics have mostly been leveraged for equipment monitoring purposes. While successful for optimizing maintenance, this falls short of the promises of AI in process manufacturing, which is to reduce business risk and waste while improving yield and profitability. The ultimate goal is to have more cost savings and improved brand loyalty for your products.

But we live in a world where process automation is not enough. Attempts to leverage data for managing the manufacturing enterprise have focused on Manufacturing Operations Management (MOM) which is largely plant centric.

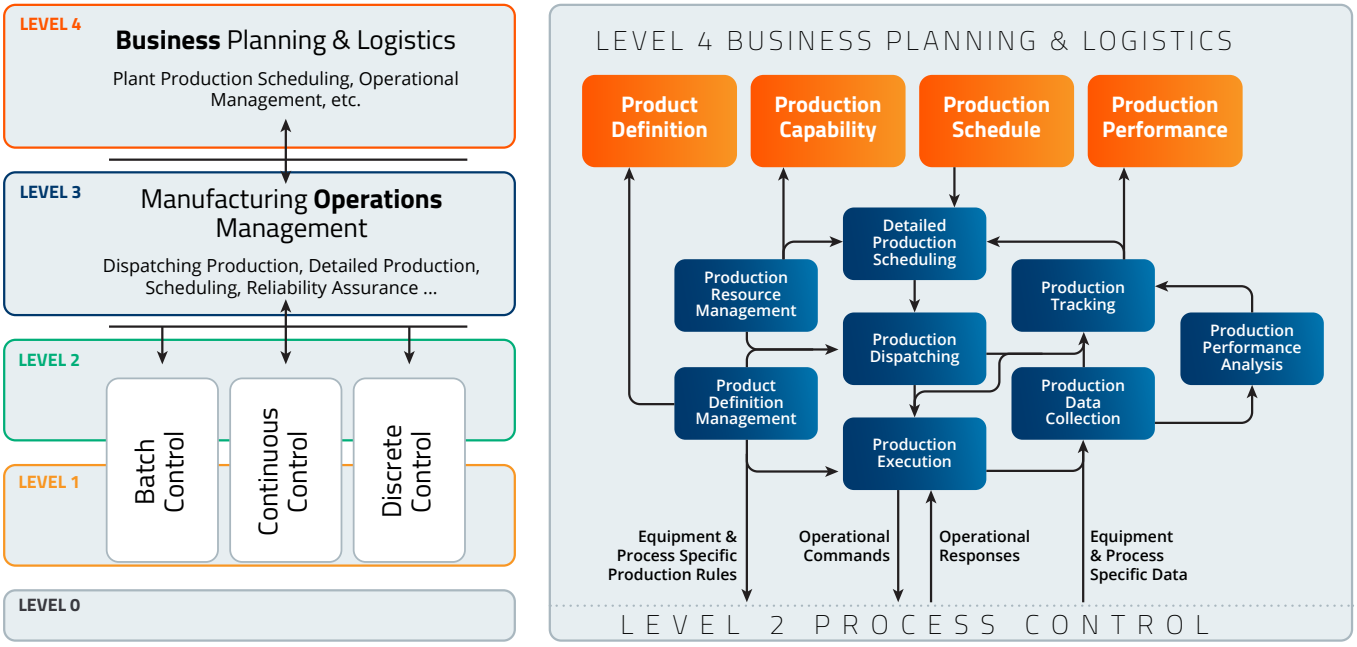
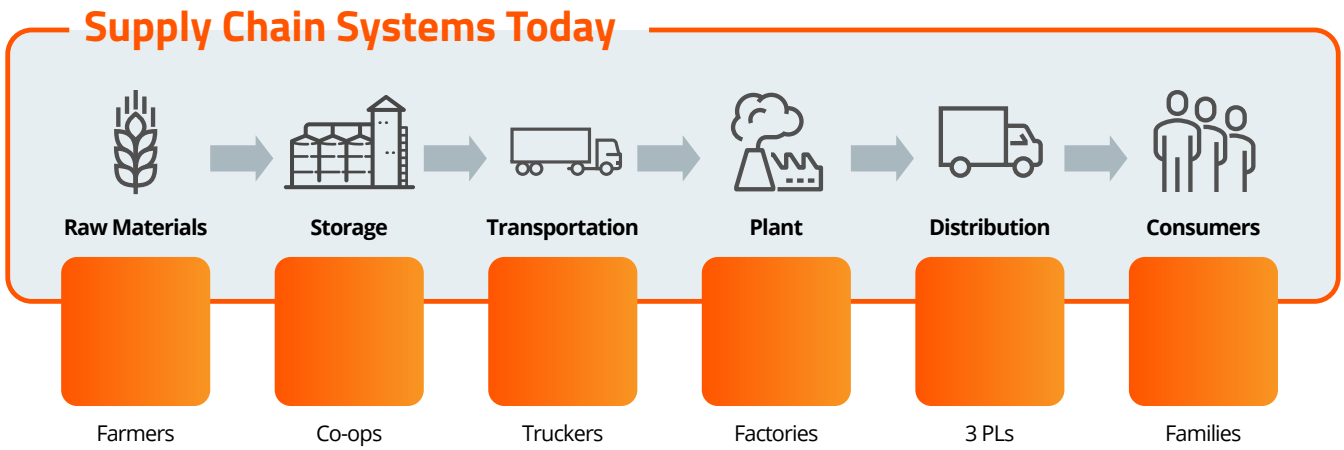


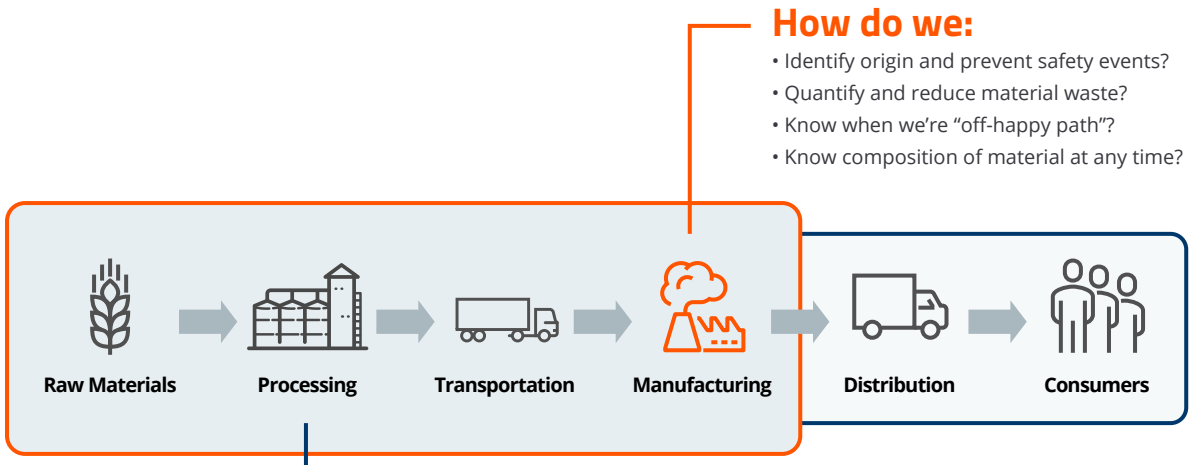
Figure 01

While there have been great productivities and operations agility achieved by leveraging this structure, it falls short of the needs of a modern enterprise where customer satisfaction, optimization, waste, and safety must be looked at across the entire ecosystem and lifecycle of products from farm or mine to customer. Take for example a food manufacturing value chain shown below.



More visibility across the entire Value Chain is needed

The problem is that each step of the chain is a data solo and involves multiple organizations and even separate companies. The common digital thread of information is with the material, parts and sub-products that combine, have operations done on them, are subjected to environmental and handling systems while travelling through the chain. How do we understand all of these state changes, track events and understand the composition of material anywhere and at any time within the chain?



Problems upstream in the supply chain have a significant cost impact on production

The Factors that **Material Traceability** Influence in **your Business**

There are several business factors in manufacturing value chains that material traceability influence. They include:

Regulatory Safety

Material traceability is important in industries such as aerospace, food & beverage, and pharmaceuticals due to the regulatory requirements around public safety and wellbeing. But because of connected value chains, and the many actors across raw material to customer, not having a good ability to search and troubleshoot up and down the chain can induce a great deal of risk and cost in running your business. For example, contaminations at different stages of processing as well as temperature and humidity exposure can cause material to be unsatisfactory for final production. Identifying material composition changes along the path can more quickly eliminate a bad actor and reduce the number of products that must be recalled or turned into waste in the future.

Environmentally Conscious Customers

Environmentally friendly retailers may choose to make information regarding their supply chain freely available to customers, illustrating the fact that the products they sell are manufactured in factories with safe working conditions, by workers that earn a fair wage, using methods that do not damage the environment. For example, furniture manufacturers may want to show that wood used in their products

did not come from amazon rain forests or other non-sustainable sources.

Quality and Environmental Effects

Across a transportation system, products can be exposed to varying environmental conditions that can cause a product to lose potency or spoil. One example is the cold chain required for vaccine's where precise temperature control is required to not lose potence.

Counterfeit Materials

Some industries that use heat treated metals such as aluminum or steel parts in aerospace need to track back to the original ingots to prove the integrity of manufactured parts. This information must also be shared within trading partners without performing destructive testing to confirm original quality.

Security and Crime Fighting

Material can also "disappear" or be blended with sub-standard or "cut" with fillers along the route, which can indicate criminal activity. The QR serial number code for a product may appear in two separate locations at the same time. Traceability can help with identifying the area this happens and countermeasures taken to eliminate the behavior.

Operations Intelligence and **Continuous** Intelligence—Past is Very **Batch Driven**

According to Gartner, Continuous Intelligence is a design pattern in which real-time analytics are integrated into business operations, processing current and historical data to prescribe actions in response to business moments and other events. Currently, custody transfers of material across a manufacturing value chain are very "batchy". For example, the information from a supplier is available as a data file or the production record from an MES system must be exported, introducing a delay. This is further problematic in big data or IoT solutions where the analytics end up waiting for information to be available before insights are visible. This Provenance Data is key, and it needs to be continually updated to be useful in timely decision making.

Understanding **Provenance Data Management** in Manufacturing

There are 4 questions we must be able to answer to realize material traceability in a supply chain:

1. Where did components come from (ingredients/packs)?
2. What is in it?
3. Where was it made and under what circumstances?
4. Where did it go?

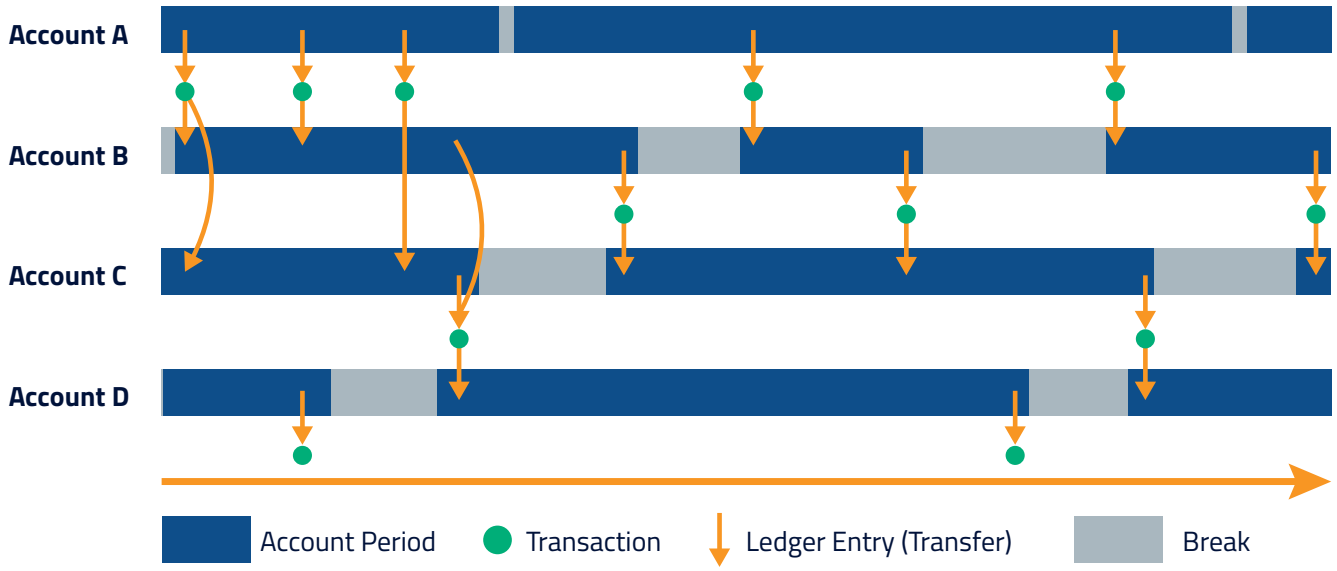
Today we can take advantage of IIoT, big data, data analytics, and cloud computing to take data from sensors and business systems and deduce across the entire manufacturing supply chain, in a non-invasive, operationally efficient, and cost-effective way, exactly how products are made and moved.

A good way to manage this provenance data is by using a material ledger concept. In continuous or batch manufacturing process, the data elements include:

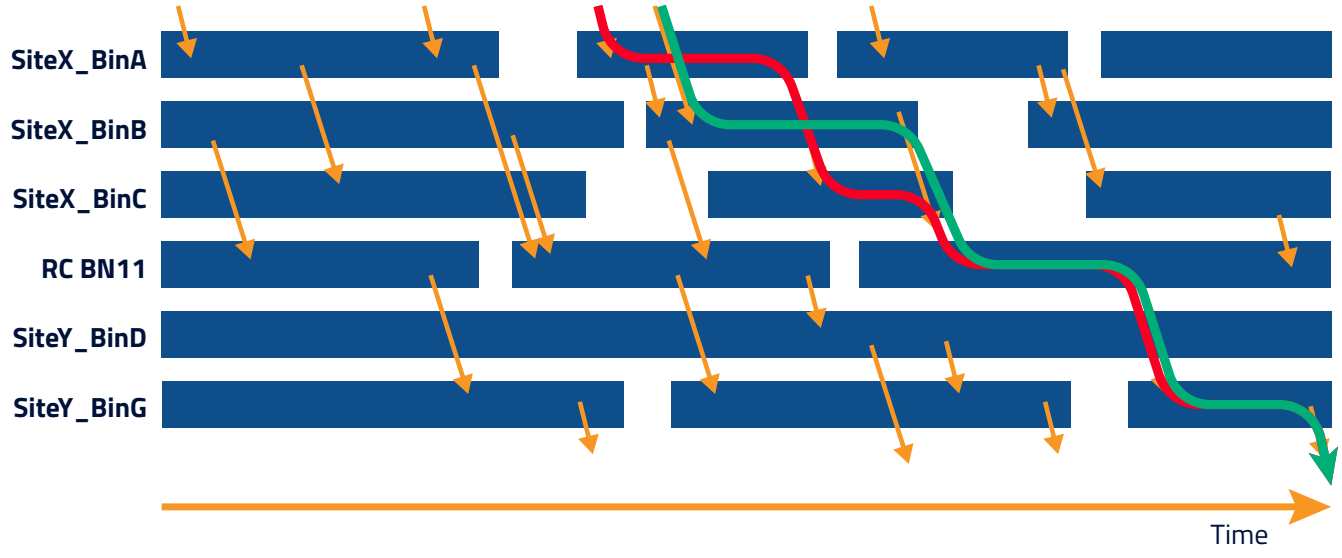
- **Equipment** — Anything physical that processes, stores or transports materials or energy.
- **An Account** — A place where material is stored and tracked. Accounts can be associated with equipment. An account can also be a lot (or bag) that only exists for a short period of time.
- **A Ledger Entry** — A movement of materials into or out of an account.
- **A Transaction** — A collection of ledger entries for double entry bookkeeping. If the ledger entries are correct, then the sum will be 0.

- **The Influence Ratio** — The influence that the material in an account at a point in time had on material movements flowing into the account.
- **State of a Vessel** — Empty indicates a break in the genealogy path. Clean indicates a break in the contamination path.

Material flows across accounts, or places where material is stored such as a bin, tank or silo in food or chemicals or a pile on the ground as in mining, or maybe a truck, railcar, barge, or airplane. Accounts are long-lived, where they can be filled and emptied multiple times. Things moving between accounts can be uniquely identified. These materials, in the form of a lot or batch, can move location or account. A unique id is attached to the whole lot/batch and we know where it is stored. An individual item has a serial number at a location, which is used to track individual items.



Material movement in a supply chain.

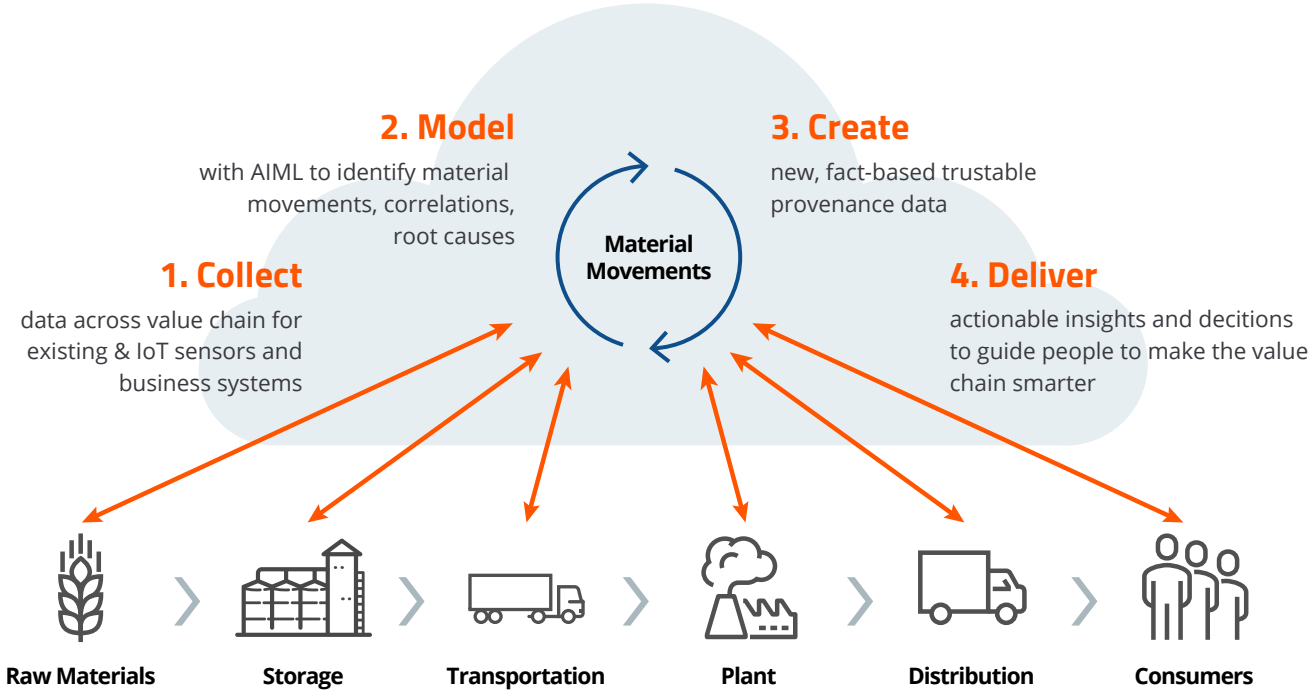


Food Manufacturing Use Case and **Potential Savings**

As an example, let us take a manufacturing enterprise that processes cereal grain-based products for consumers. Here is how ThinkIQ was able to help.

The Problem: Having no visibility of raw materials from the source through finished goods, at either the individual plant, region, or enterprise levels, costs 1-2 points of margin/COGS.

The Solution: The ThinkIQ platform with mobility extension, and integration of a customer legacy quality system, enabled standardization and validation of raw material data from farm to finished goods. This facilitated optimal raw material production scheduling and enabled traceability analysis and performance optimization from raw material to finished goods to simplify the achievement of contractual requirements.

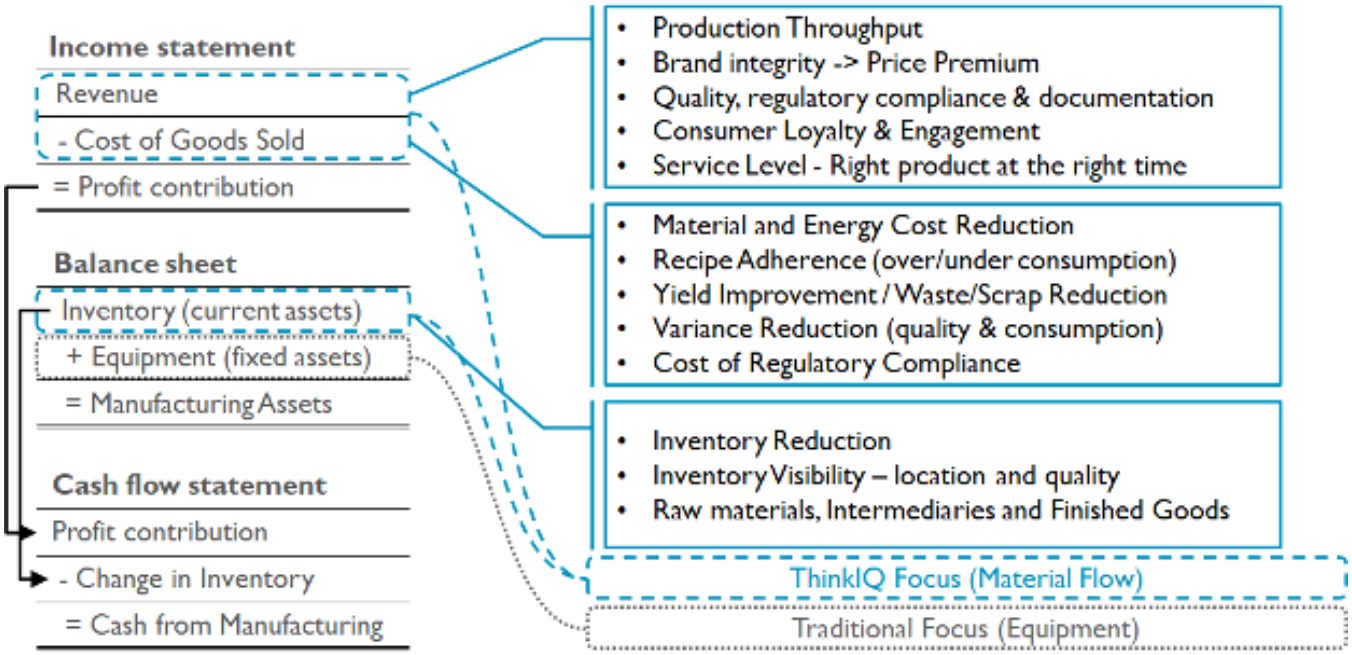


Resulting Impact: This enabled standardization across plant, region, and enterprise with unprecedented raw material visibility and the ability to see problems across the business. The scheduler was able to see information that ensured the right raw material(s) made it to the right facility at the right time. Receiving and production departments were provided real-time raw material visibility for critical manufacturing parameters, for example specific gravity, moisture, etc. to optimize individual production runs. This provided a single source of truth for all raw materials.

How **Enterprise-Wide** Insights in **Material Flow** Provides a Competitive **Advantage**

A lot of traceability solutions in supply chains today are focused on maintaining compliance information vs economic benefits. Furthermore, tracking of equipment information at operations sites lacks the full context of what happens to materials and the true genealogy in the context of how it affects operations and financial aspects of running the business.

Let us think of material flow in the context of the financial documents we use to manage our manufacturing busines. The cost of goods sold is what we want to minimize to increase our profit contribution. Material and energy, along with regulatory reporting costs are the biggest contributors. Eliminating waste, minimizing the cost of processing steps and ability to keep a highly accurate record of material content and history can help to keep the cost of goods down.



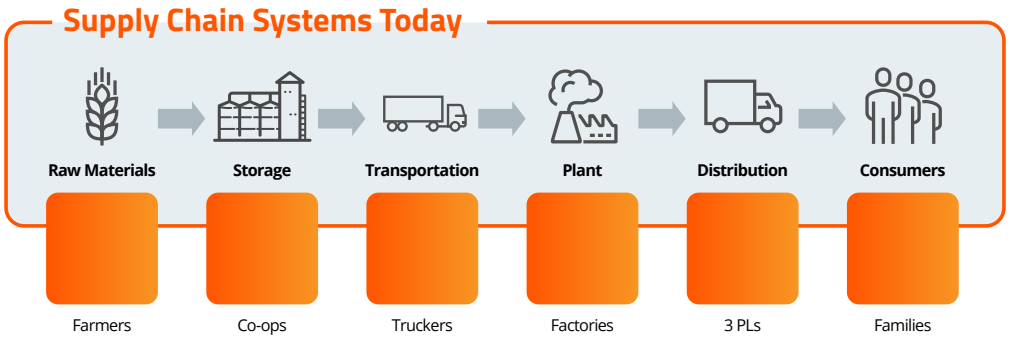
Conversely, some direct contributors to revenue attainment are the ability to increase throughput through material consistency and quality, which also affects customer satisfaction, brand reputation and agility in product changeovers. Here continuous material intelligence can also help.

On the Balance Sheet side, inventory carrying costs are a significant factor to profitability. Creating off-spec or having to re-blend or "waste" inventory is a carrying cost that can be eliminated if better information on material origin, content, age, and state is available.

Traditional methods of manufacturing optimization primarily focus on asset costs such as equipment replacements and maintenance. This is something that can be controlled and is comforting in its ability to predict failure and is fundamental to getting a process under control and maximizing availability. But the real savings is in the things that affect variable costs because when production increases, these costs can also potentially increase proportionally, with a greater impact on profit. This is where Think IQ focuses the effort on understanding material flow up and down the value chain. Material efficiency problems do not just happen in your factory where MES systems can catch them. They can happen anywhere the material exists in the value chain. You need a system that can track that.

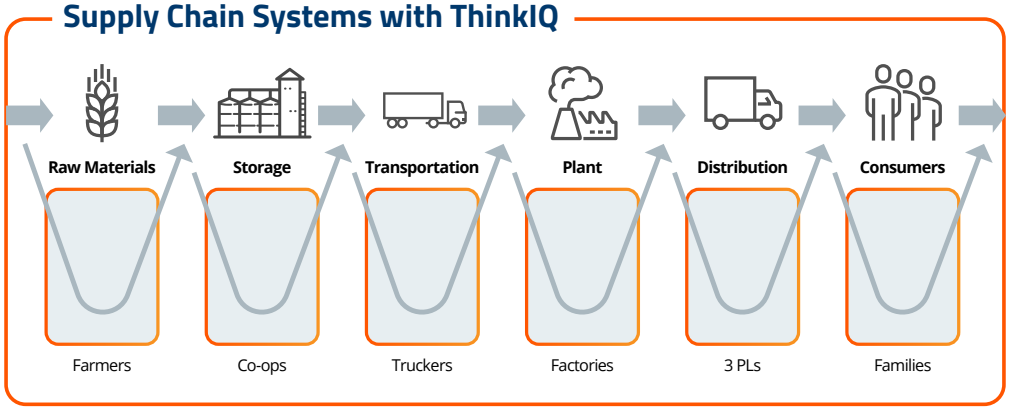
What **Thinkiq** Does and Why It Is **Revolutionary**

ThinkIQ is the leader in Transformational Intelligence for Manufacturers, contextualizing data — both in-plant and across your supply chain — to improve yield, safety, quality, and compliance. This therefore enables manufacturers to drive revenue, improve margins and increase the bottom line. ThinkIQ is an enterprise cloud-based software platform that combines existing disparate and siloed supply chain data with a unique modeling technology to detect material movements. ThinkIQ provides context for your data, and correlates events over time to enable end-to-end granular supply chain visibility. As a result, you can improve yield and quality like never before, while mitigating the risk of recalls, saving costs and harmonizing operations.



- Black boxes
- Superficial
- Fragmented
- Manual integration
- Coarse
- Open Loop
- Untrusted
- Blind

Your supply chain is, in reality, made up of siloed systems that only deliver information intermittently and require time to assemble a meaningful view of what is happening on a wholistic level. ThinkIQ provides a fact-based granular and data-centric contextualized view of material flows and related providence attribute data, integrating into existing OT and IT infrastructure and crossing supply chains to manufacturing processes and beyond. This results in unprecedented material traceability and insight into ways to improve yield, quality, safety, compliance, and brand confidence while reducing waste and environmental impact.

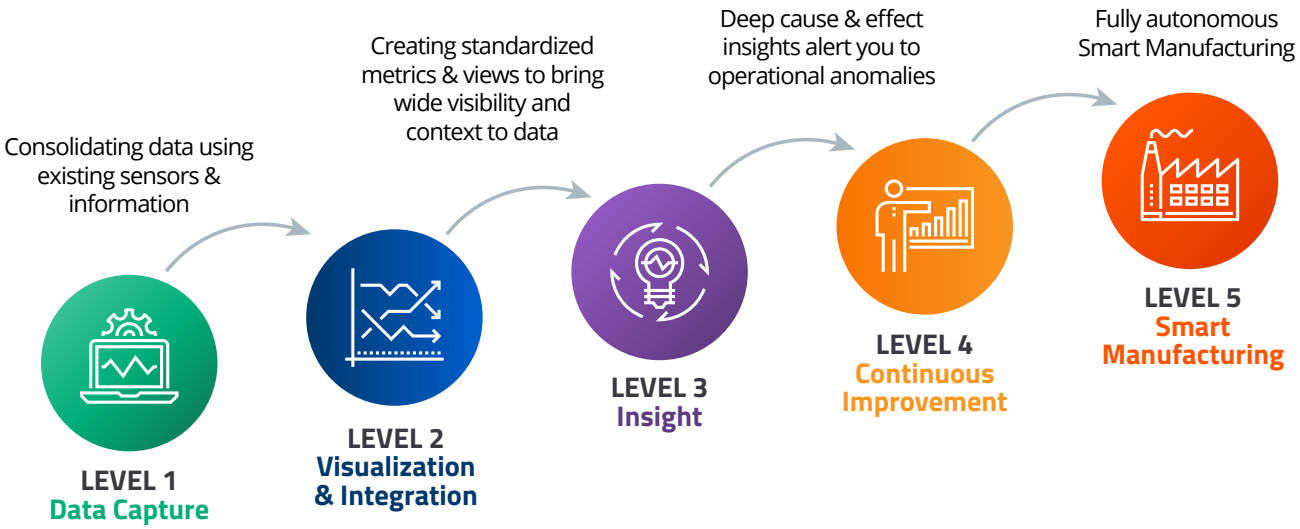


- Enlightened
- Integrated
- Sensor Driven
- Granular
- Autonomous
- Trusted
- Multi Enterprise

This allows you to capture material attributes in the context of process data while identifying risk, quality, and waste. Providing easily configured traceability in material ledger context from creation to customer.

Meeting you at your stage of **Digital Transformation**

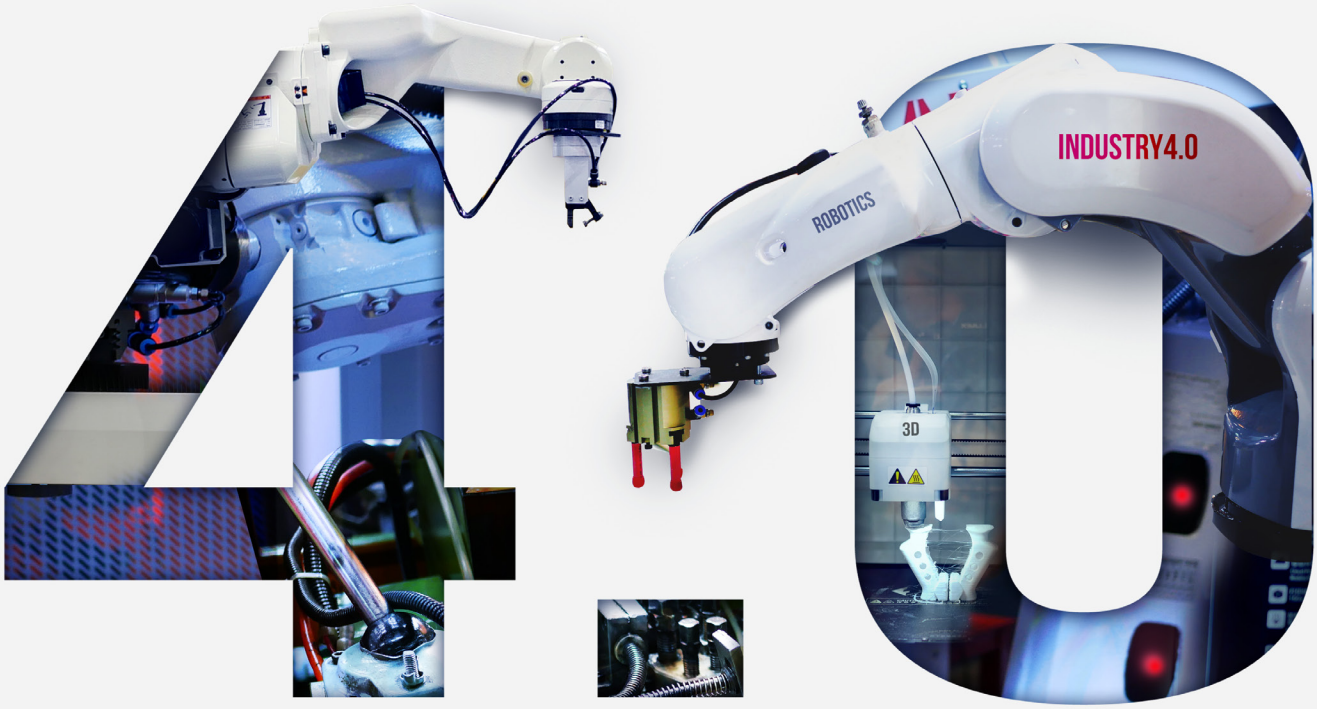
With ThinkIQ's Transformational Intelligence platform, you will finally have a complete overview of all manufacturing operations. We do this by transforming your process through the 5 steps required to reach Industrial 4.0 Manufacturing capabilities. Each stage offers valuable improvements to manufacturers, by optimizing the supply chain or asset traceability, or by supplying predictive analytics. Taken together, this creates a true transformation to Industry 4.0.



ThinkIQ aligns the 5 maturity stages, creating a clear path to Smart Manufacturing

This includes:

1. Data Capture: consolidating data using existing sensors and information, including IoT, HMIs, PLCs, ERPs, CRM, and digitizing manual data captures. All information can be seen on one screen across many locations and data silos.
2. Visualization & Integration: creates standardized metrics & views to bring wide visibility and context to the data. This empowers data scientists, mitigates recall risks, improvements yield, and provides alerts & notifications.
3. Insight: advanced AI and ML enable a material-centric view with advanced visualizations, cause & effect identification, industry benchmark reporting, and cross-plant KPIs.
4. Continuous Improvement: utilizes the results of the first 3 stages to implement continuous improvement procedures at the enterprise level. This provides deep cause & effect insights alerting you to operational anomalies, early problem spotting, and surfacing opportunities for improvement.
5. Smart Manufacturing: fully autonomous Smart Manufacturing includes raw-material-to-product-delivery traceability, optimized supply chains, and fully transparent, real-time contextualized data. Results are enhanced product safety, early problem spotting, and reduced costs, making you more profitable and more competitive.



How to **Get Started** and **Next Steps**

Your company is unique, and your specific processes and value chain need to be considered for any solution. The ThinkIQ process starts with an initial assessment from one of our material traceability experts to understand your operation and some of the major issues you are experiencing today and then to explore outcomes that are possible based on our experience. We can coordinate discussions across your businesses, plants, and supply chain partners to come up with a structured approach and potential savings. Then we work with you to design a roadmap with key milestones to achieve the results you are looking for. Please contact us today to begin your journey to total material traceability.

info@thinkiq.com

Or visit us here to learn more about the ThinkIQ advantage.