

WHERE TO PLAY:

SUPPLY CHAIN TRACEABILITY



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This report provides an overview of supply chain traceability, presents some of the key **trends** and **technologies** influencing its future, and serves as a springboard for further exploration.

It is interlinked with the **ITONICS Innovation OS**, where you can find a collection of **analyst-curated insights** related to supply chain traceability.

Use this collection to help build and refine your foresight intelligence, identify opportunities for innovation, and **future-proof your supply chain**.



Introduction

Industrialization powered progress in the world, while globalization brought the world together through complex, integrated supply chains that enabled raw materials sourced in one part of the world to be manufactured in another and consumed in yet another.

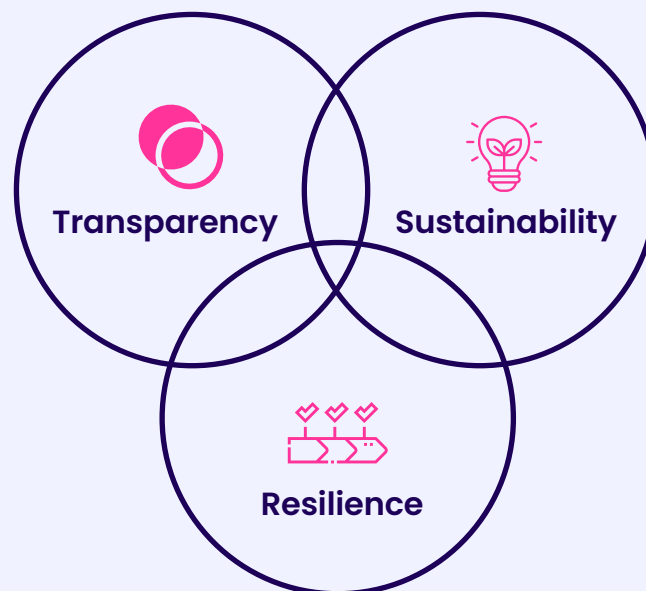
The modern age of consumerism, volatile economies, and prolific population growth has increased production across industries. The increasing demand for goods and the commercial profit model have resulted in increased adulteration of products, exploitation of labor, and the production of goods with cheaper alternatives that are likely harmful to the environment and the human body.

This progression has, in turn, led to a laser focus on sustainability in various forms as a measure to combat rising carbon levels. Growing calls for compliance to meet ESG requirements and reduce carbon emissions have also led to increased greenwashing by companies seeking to ensure optimal profits and shareholder returns.

However, greenwashing ultimately sets out to deceive customers and damages brand value when companies are eventually found out. Supply chain traceability can eliminate the possibility for companies to engage in greenwashing while also enabling consumers to make empowered purchasing decisions.

The need for supply chain traceability has grown out of this progression and seeks to identify and track every aspect of manufacturing and distribution across the supply chain. Notable industries impacted by traceability include automotive, chemicals & materials, healthcare & pharmaceutical, food & drink, and retail.

Supply chain traceability promotes business resilience and better management of partner ecosystems. It boosts sustainability, compliance, and transparency, helping consumers make informed buying decisions and hold brands accountable. Ultimately, supply chain traceability can be a mechanism for managing risks and gaining a competitive advantage in the market.



*The growth of the conscious consumer alongside the introduction of disruptive technologies has led businesses to strategically prioritize **transparency** (how was this product created?), **resilience** (what contingencies can we create to ensure that this product arrives at its destination in light of unforeseen variables?), and **sustainability** (how will this product affect the environment?). Supply chain traceability capabilities can help answer all of these questions.*

Implications for Innovation

Critical oversight of the chain of custody, a detailed repository of risk factors in the movement of goods, and the environmental impact of operations are some of the key capabilities enabled by supply chain traceability.

The matrix below provides an overview of the potential challenges and opportunities associated with supply chain traceability. These implications for innovation highlight how transparency and the ability to monitor and act on supply chain information are critical for globally-oriented businesses.

	Challenges	Opportunities
 Transparency	Limited insight into supply chains creates uncertainty that can impact brand perception and destroy value.	Embedding full operational transparency into business models enables strategic evolution.
 Risk management	Lack of visibility can lead to multiple risk failures in supply chains, resulting in potential disruptions like product recalls.	Traceability can improve the ability to identify and respond to risks pre-emptively, while balancing strategic investments into potential opportunities.
 Brand reputation	Lack of supply chain insights can lead to customer mistrust and damage brand reputation.	Providing supply chain visibility can positively impact customer purchasing decisions and brand reputation, leading to increased brand equity.
 Value creation	Lack of investment or over-investment in traceability can hinder value creation through misaligned financial resources.	Traceability can add value across the supply chain and enables sustainable growth through optimized vendor ecosystems and trusted customer relationships.

68%

of executives view traceability as “very or extremely important.”

Bain Global State of Traceability Survey, Bain & Company, 2021

	Challenges	Opportunities
 Supply chain resilience	Opaque supply chains are more vulnerable to market disruptions and lack the flexibility to respond timeously and effectively.	Traceability provides organizations with data to make informed decisions, project growth, and plan for potential disruptions.
 Sustainable sourcing	An inability to verify sustainability claims can result in perceived greenwashing or noncompliance with regulators.	The ability to verify sustainable and ethical sourcing builds customer loyalty and promotes ESG compliance.
 Minimizing waste	Lack of insight into supply chain sources enables unabated waste of resources with little accountability.	Better insight into supply chain sources can help to minimize the waste of limited resources such as raw materials, water, and energy.
 Regulation & compliance	Harmful ingredients, additives, and chemicals in supply chains can cause widespread damage to customers and the environment.	Thorough compliance reporting provides evidence to regulators and confidence to investors and customers.

Drivers of Change

The topic of supply chain traceability is highly complex and continuously influenced by change happening in the world across social, technological, economic, environmental, and political (STEEP) spheres. Understanding this context of change—and the trends and technologies shaping the future of supply chain traceability—can help organizations take more decisive and strategic action. Trends and technologies build the foundation of foresight intelligence needed to respond to the demand for traceability and design transparent, tech-enabled supply chains for the future.

Explore the [trends](#) and [technologies](#) shaping the future of supply chain traceability. **Click on the trend or technology below to view it on the [ITONICS Radar](#)** and read more about its implications for innovation, how it relates to other drivers of change, and what organizations are doing to respond.

[Trends](#)

Trends are demand drivers that represent emerging consumer attitudes, expectations, behaviors, or other market shifts that drive change. Trends are an indication of market pull, guiding innovators in knowing what consumers need, desire, and occasionally demand. The trends below correspond closely with the topic of supply chain traceability.



Circular Economy

Supply chain traceability can enable circular practices. This is because a Circular Economy requires understanding the usage of materials, resources, and goods to identify opportunities for efficiency and waste reduction. Traceability can help companies identify opportunities for reuse, repair, refurbishment, or recycling.



Distributed Manufacturing

With Distributed Manufacturing, production is often more closely aligned with demand which can reduce the number of intermediate steps and players involved in the supply chain. Less complex supply chains can make tracing the movement of goods and materials easier, ensuring proper and practical handling and use.



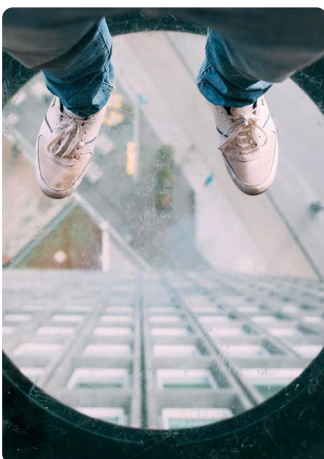
Green and Lean

Green and Lean supply chains rely on the ability to trace inputs and processes, leverage data insights, and identify areas that can be made more sustainable, efficient, and compliant. Reducing waste, ensuring sustainable and ethical materials sourcing, and optimizing inventory and distribution management require a high degree of visibility throughout the supply chain.



Localized Production

Like Distributed Manufacturing, Localized Production often occurs nearer the sources of supply, demand, or both. This proximity can give rise to shorter and simpler supply chains along which goods are easier to track and trace.



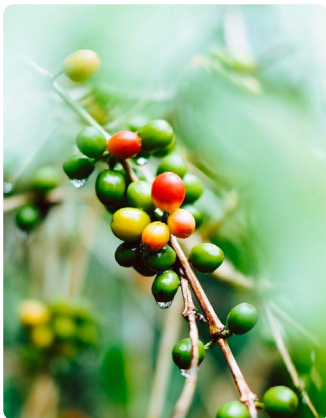
Radical Transparency

Radical Transparency is inherent in supply chain traceability. It allows for relevant stakeholders—including employees of an organization, suppliers, partners, and customers—to access information related to all steps, materials, and contributors required to bring a product to market, end users, and eventually the end-of-life stage. This approach can help build trust with stakeholders.



Recommerce Revolution

Supply chain traceability can ensure that used products are accurately tracked and accounted for as they are bought, sold, and re-sold. This increases efficiency and accountability in the recommerce process and can help recommerce retailers and customers verify the authenticity and condition of used products.



Tracing Origin

Consumers, regulators, and certifying bodies are a few of the stakeholders calling for the ability to trace goods back, through the supply chain, to their origin. Knowing and trusting a product's origin and supply chain story can help forge a connection between the consumer and the manufacturer, maker, or grower.



Value-Driven Delivery

Consumer expectations around same-day and on-demand delivery are rising and transforming logistics ecosystems. This transformation requires traceability throughout the supply chain, enabled by technology solutions like dynamic routing, predictive analytics, automation, and real-time tracking.



Trend Spotlight: Blockchain Track-and-Trace

Blockchain Track-and-Trace utilizes distributed ledger technology (DLT) to keep a detailed account of the origin, movement, and delivery of products and goods across the supply chain. DLT provides the technological infrastructure to facilitate the simultaneous access, validation, and updating of records to create a secure, decentralized, and immutable digital database. This trend is enabled by advancing technological capabilities in the Internet of Things (IoT) and intelligent sensors and by consumers who wish to understand their products' provenance, chain of custody, and environmental impact. The adoption of Blockchain Track-and-Trace is accelerating across industries due to its potential to ensure transparency in supply chains.

The global Product Traceability Software Market size is forecasted to reach \$28.2 billion by 2026, growing at CAGR 8.8% during the forecast period 2021–2026

[IndustryARC, 2022](#)

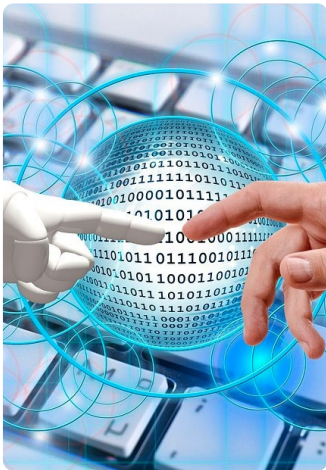
Technologies

Technologies are solution drivers that represent tools designed through R&D and innovation in response to new consumer needs or desires. Technologies are an indication of market push, enabling new business models, products, and services. The technologies below correspond closely with the topic of supply chain traceability.



Autonomous Freight

Autonomous Freight will likely play a significant role in the future of supply chain management, including the digitalization, automation, and traceability of end-to-end supply chains. This will have an impact beyond transportation and logistics, catalyzing change in policy, infrastructure, labor markets, and the way cities function.



Digital Twins

Digital Twins can simulate scenarios of how a product may travel in different territories and conditions, what potential issues or inputs may affect the product performance or distribution, and how the carbon footprint can be minimized at each stage of the supply chain. The technology supports continuous optimization, reducing operational costs and improving service efficiency.



Distributed Cloud

Distributed Cloud is a solution for storing, processing, and managing the vast amount of data generated by traceability technologies. With on-demand accessibility and greater flexibility, this technology can play an essential role in deriving real-time insights as products move through the supply chain.



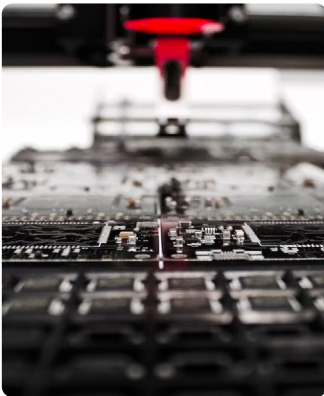
Edge Computing

Edge Computing can pair with the Internet of Thinking to provide valuable data within the supply chain process and communicate where blockages exist. This ability allows teams to anticipate issues, detect patterns, and respond accordingly.



Geofencing

The use of Geofencing supported by intelligent planning systems can help optimize supply chain management. Geofencing enables tracing, tracking, and securing information of goods during warehousing and shipment. This enables preemptive identification and mitigation of supply chain weaknesses or blockages, thereby enhancing the overall management of inventory, time, and resources.



Intelligent Manufacturing

Intelligent Manufacturing incorporates several different technologies, including artificial intelligence (AI) and machine learning to optimize supply chain traceability. It can refine product creation processes to be more productive and energy efficient through iterative improvements.



Internet of Thinking

The Internet of Thinking enables real-time monitoring and analysis of supply chain operations. AI-equipped sensors can track the condition and location of products as they move through the supply chain. The data collected from these intelligent IoT devices can be leveraged to pre-empt potential problems and optimize the supply chain in real-time.



Unmanned Deliveries

Unmanned Delivery technology like drones and autonomous vehicles can be equipped with sensors and GPS capabilities to monitor the real-time location, condition, and status of packages and products as they move through the supply chain. This data can be integrated with supply chain management systems to provide better visibility and tracking of products as they move from one location to another.



 **TECHNOLOGY:** 

Technology Spotlight: DNA Traceability

DNA Traceability is a method used to ensure product integrity and quality across the supply chain. DNA Traceability can occur by extracting DNA directly from organic products such as cotton and meat or by adding synthetic DNA onto or in materials, including liquids such as fuel, without affecting the characteristics or performance of the product. The DNA is then analyzed, often using polymerase chain reaction (PCR), DNA sequencing, or DNA barcoding. The analysis of DNA can provide critical information about the product's date of manufacture, origin, and chain of custody. With applicability across multiple industries, this technology is an efficient alternative to radio frequency identification (RFID), often used to track items along a supply chain.

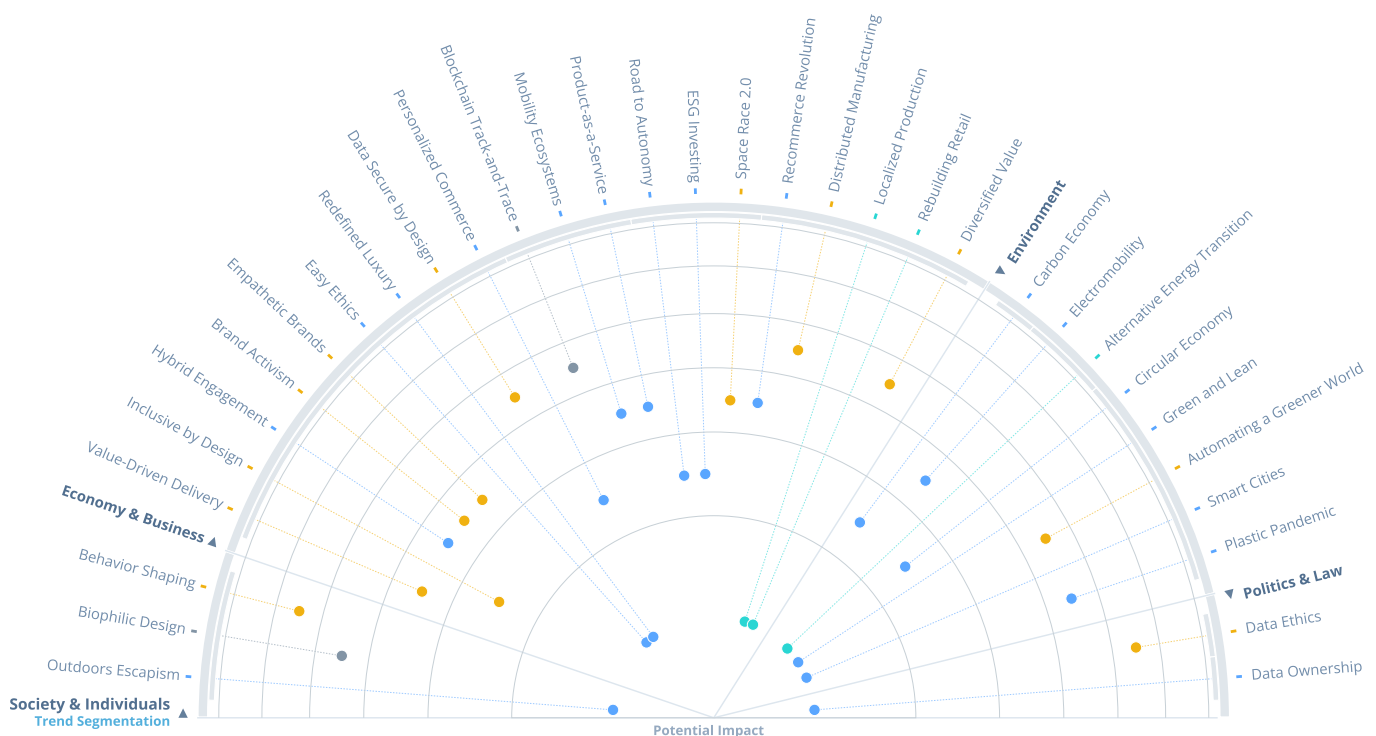
Industry Insights

Supply chain traceability is highly consequential for nearly all industries that produce and distribute goods and materials—however, some industries more than others.



Automotive

As a significant contributor to carbon emissions, the automotive industry is working hard to clean up its act, with the electrification of the industry at the center. The success of electric vehicle production has much riding on it as the industry balances advancing technologies and sustainability imperatives. As a result, automakers bear intense scrutiny across their automotive supply chains. Greater industry collaboration and transparent blockchain technologies are features of shifting automotive supply chains that seek to ensure traceability, robustness, and resilience as the foundation for the automotive industry's future.

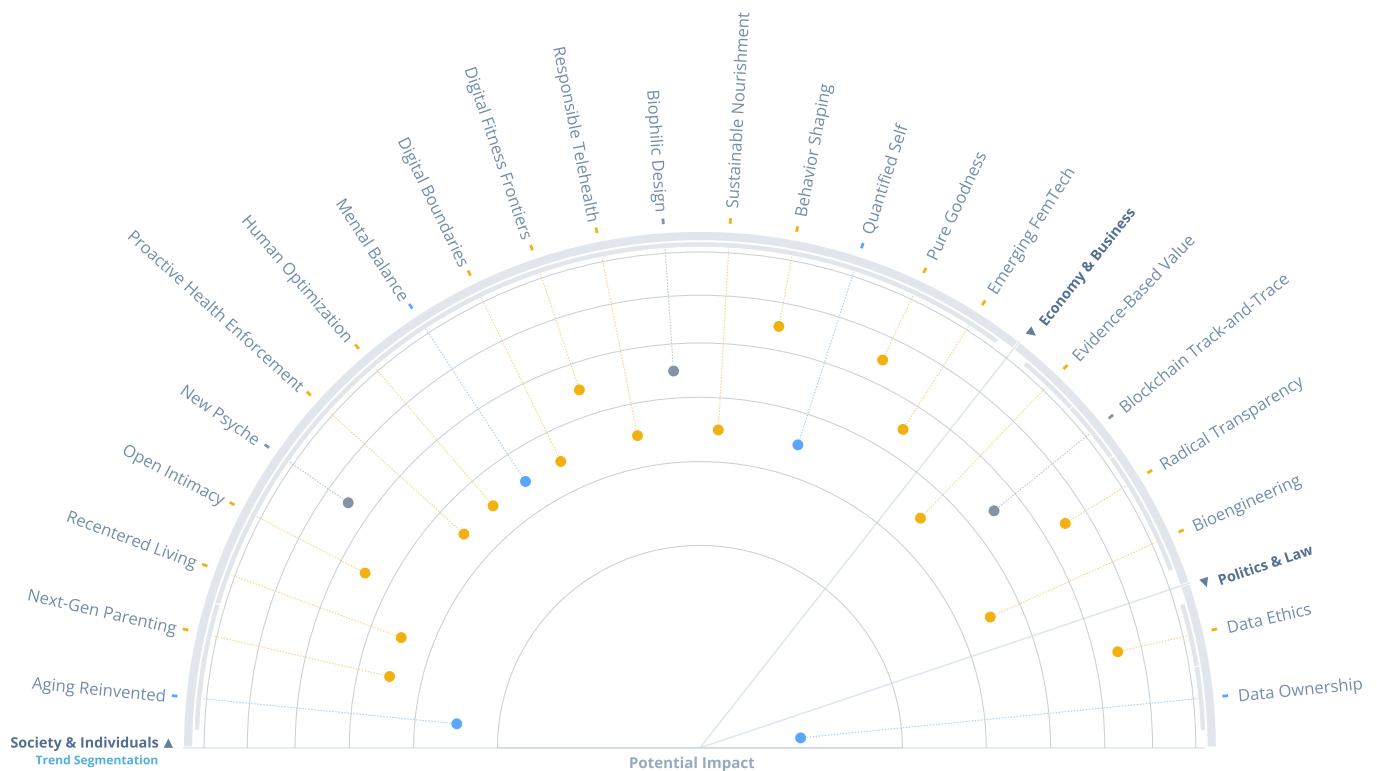




Chemicals & Materials

The chemicals & materials industry is foundational to several other industries. The International Council of Chemical Associations (ICCA) estimates that **95%** of all manufactured goods depend on chemical inputs and processes. As such, there is a massive scope associated with the ability to trace chemicals and materials through the supply chain—from raw materials and feedstock to processing, distribution, use, and eventually end-of-life recovery for reuse or recycling. For producers of chemicals and materials, supply chain traceability can improve yield, throughput, safety, and specifications while complying with tightening regulations. Moreover, it can be a vehicle for transitioning from fossil-fuel-based feedstocks, minimizing waste, and designing new circular and renewable products.





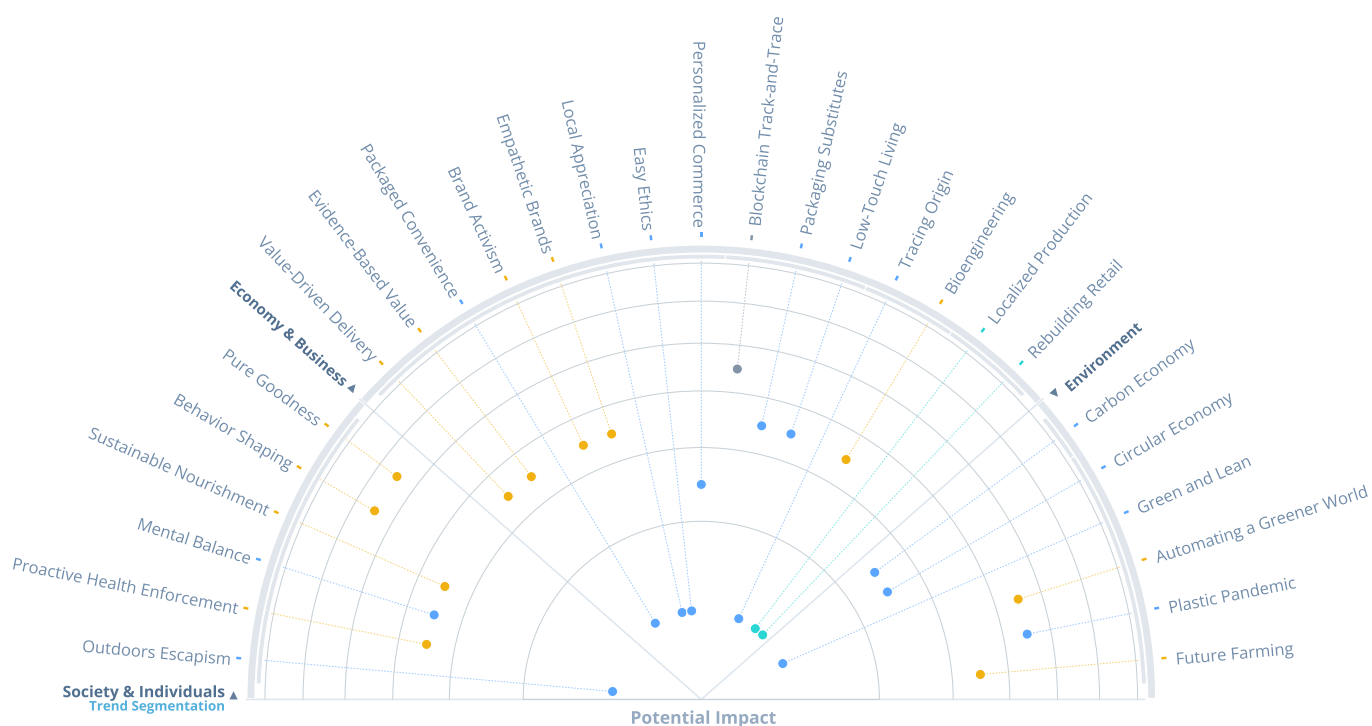
⊕ Healthcare & Pharmaceutical

In the highly regulated healthcare & pharmaceutical industry, monitoring every aspect of the product development lifecycle can yield numerous benefits. As suppliers are solely responsible for the end product, traceability is crucial for several reasons, including the ability to recall products safely and swiftly when required without negatively impacting brand value. Traceability processes within workflows can also assist in managing expiring stock and reducing waste, which can positively impact financial metrics and customer relationships. The most significant impact of traceability is the elimination of counterfeit healthcare products, which are harmful to consumers and extremely damaging to company reputations.



Food & Drink

Traceability in the food & drink industry enables companies to monitor and track the movement of goods in the supply chain from their agricultural origins through various suppliers to the consumer. In addition to enhanced visibility into the supply chain via delivery metrics, supply chain traceability offers multiple benefits, notably food & drink safety. Traceability is vital in reducing contamination, disease, and spoilage by identifying hazards early, ensuring correct labeling, and eliminating the possibility of undeclared allergens through supplier accountability. Further benefits of supply chain traceability in food & drink include financial risk mitigation, product recall management, opportunities for enhanced customer relationships, and heightened brand equity.



If you downloaded this report from [ITONICS Innovation Management Resources](#), you will receive a follow-up email containing deep dives into each of the above industries. Read about how each of these industries are responding to the demand for supply chain traceability. Gain an understanding of the forces shaping the future of supply chain traceability and gather real-world evidence of how business leaders are harnessing new digital tracing technologies and innovations. Use these industry insights to enhance your own foresight intelligence to move from opaque and inflexible supply chains to transparent and future-fit supply chains.

Check your inbox for industry insights related to the future of supply chain traceability.

Across industries, sustainability—and the supply chain traceability on which it depends—is the cost of entry for companies today. Traceability depends on companies figuring out how to collaborate within and across industries.

[World Economic Forum, 2021](#)

The Way Forward

While supply reliability and leveraging ecosystem efficiencies appeal to businesses, the transparency facilitated through supply chain traceability systems offers a window into companies' sustainable and ethical procurement practices and production processes. The benefit of greater transparency translates to improved brand value and can yield increased loyalty from increasingly aware customers. Adopting supply chain traceability through various technologies can be game-changing in its ability to identify supply chain risks and loss-prevention measures, reduce costs, and ensure regulatory compliance in sourcing and manufacturing. While the benefits to business abound, ethics are at the heart of supply chain traceability, encouraging companies and brands to do better for society and the planet.

A traceable, structured, and end-to-end approach to supply chain management enables organizations to mitigate risks, identify opportunities for improvement, and maintain a competitive advantage in their respective industry and market.

Applying the same approach to **innovation management** sees many of the same benefits. Having a systematic, **end-to-end solution** to serve as a single point of truth unifies your company's innovation activities, providing transparency to all relevant stakeholders. The ITONICS Innovation OS brings foresight intelligence together with the power of collective intelligence to accelerate opportunity discovery and nurture fresh ideas. With the ability to align, prioritize, and monitor your most valuable initiatives, the ITONICS Innovation OS drives transformation and shapes future growth.

Interested in deepening your foresight intelligence?

ITONICS analysts engage in continuous environmental scanning to bring you a dynamic collection of drivers of change and inspiring real-world examples of innovation. Rigorously researched, evaluated, and assimilated into the ITONICS Innovation OS, our trends and technologies are backed by a trusted methodology combining human and machine intelligence.

Kickstart your continuous foresight journey using [ITONICS Trends & Technologies](#) and empower your own scouting teams with [ITONICS Insights](#) for structured and scalable signals scanning.

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