**Inventory, Labor
and Sustainability:**

How RFID Solves Today's Supply Chain Challenges

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Optimism is growing among supply chain professionals now that pandemic-related disruptions have mostly passed. Still, concerns remain, including optimizing supply chains, managing labor shortages and meeting sustainability goals.

Optimization is a key focus for supply chain companies in the wake of everything they experienced over the past few years. From ongoing COVID-19 restrictions to the onset of two major intercountry wars to the collapse of a bridge at a key port, a range of events have slowed the bounce-back of resources from the worst of the disruption caused by the pandemic.

Fortunately, the wider implementation of Internet of Things (IoT) technologies such as radio-frequency identification (RFID) provides organizations with better end-to-end supply chain visibility than ever before. As a result, they're well-positioned to optimize their processes and get more done with the same or fewer resources.

Meanwhile, labor is in especially short supply, and sustainability is rising to the top of many company agendas. Finding a new normal for the supply chain industry will rely heavily on implementing tools and technologies that help the remaining workers do their jobs more quickly and efficiently while reducing operational emissions and waste.

RAIN RFID is particularly suited to solving these and other supply chain challenges. For example, by simplifying processes, it can help reduce time spent on manual tasks and shorten the employee onboarding process. By providing visibility across the supply chain, it can help reduce product waste and cut CO_2 emissions.

The technology's capabilities are proving attractive to supply chain companies, as our 2023 survey showed. **Just 3% of respondents indicated their company had no plans for adopting RFID.**

What is RAIN RFID?

RAIN RFID is a passive, battery-free IoT technology that can identify up to 1,000 items per second within a range of a few centimeters to multiple meters — all without requiring a direct line of sight. By adding RAIN RFID tags — consisting of a battery-free RAIN RFID tag chip and an antenna — to individual items, packages, pallets and more, supply chain organizations can use tag reading devices or readers to wirelessly track things across their supply chain and communicate that data to the system software. The software then aggregates and transforms the data, offering real-time visibility into operations. This provides businesses with valuable information for managing and improving processes to save time and money.

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As senior vice president of enterprise sales at Impinj, a leading RAIN RFID provider and IoT pioneer, Todd Farley is well aware of the industry's challenges and changes. He offers reasons for optimism and caution today.

> "The COVID-19 disruption shone a spotlight on existing inefficiencies in the supply chain, so those challenges are being addressed now. However, the core challenges of trying to get more done with either the same or fewer resources won't change."

TODD FARLEY
Senior Vice President of Enterprise Sales at Impinj

The supply chain industry has reached a critical turning point in how it operates, says Hunter Abbey, account executive at global enterprise technology solutions provider Velociti: "Things we're experiencing today will continue to be a challenge as fewer people come back to the workforce. It'll improve, but it may not ever be the same as it was before 2019."

In 2023, Impinj and Supply Chain Dive's studioID surveyed 100 U.S. supply chain professionals across a range of industries, from automotive to transportation to warehousing to wholesale/retail trade. The results uncovered some of the supply chain industry's biggest challenges and concerns. The findings also revealed how IoT/RFID implementation trends changed over the previous year, and how these technologies can help supply chain professionals now and in the future.

The State of the Supply Chain Industry in 2023:
Key Concerns & Challenges

The 2023 survey found that the majority of supply chain professionals were optimistic that the supply chain industry challenges would improve in the near future (63%) and confident in their organization's ability to meet the issues and pressures (96%). However, concerns remain about many specific supply chain issues.

Most respondents indicated they were somewhat, very or extremely concerned about:

• Labor shortages (96%)
• Current economic conditions (92%)
• Meeting sustainability/carbon emissions goals (86%)
• Regulations/restrictions on freight movement (84%)
• Geopolitical issues (82%)

MANAGING LABOR SHORTAGES

Labor worries dominated supply chain concerns among respondents, with nearly all saying their organization was at least somewhat concerned about finding enough workers.

How concerned is your organization about labor shortages in your supply chain? — All Respondents

	Not at all concerned	Not very concerned	Somewhat concerned	Very concerned	Extremely concerned	Not sure
%	0%	4%	28%	30%	38%	0%
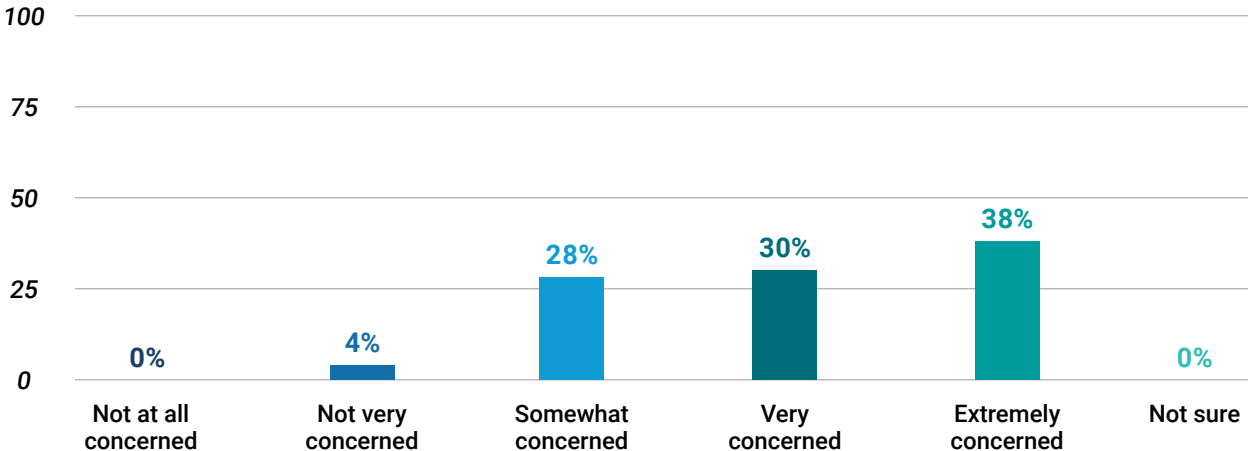
The crux of the labor problem is that workloads aren't decreasing in line with the lack of workers. This situation leaves organizations trying to manage more throughput with less labor, as well as highlights the need for greater efficiency throughout the entire supply chain.

If you are a supply chain professional, that need for efficiency is especially apparent when onboarding the employees you *are* able to find. The more optimized your processes are, the easier they are for new employees to understand and the shorter the training time you need to get those workers up and running.

Fortunately, Impinj's Farley and Velociti's Abbey highlight this area as one where IoT technologies like RAIN RFID can deliver the greatest benefit.

"When you simplify processes through technology [such as RAIN RFID], your ability and speed at which you can onboard new employees are significant," says Farley.

Abbey agrees, detailing how the technology can improve training operations and enable companies to do more work with fewer employees.

"When you use IoT/RFID solutions, you shorten the training cycle. New employees learn faster how to intelligently do the job."

HUNTER ABBEY
Account Executive at Velociti

Abbey notes that even if you're not adding new workers or are having trouble filling those positions, IoT/RFID technology makes your existing team more efficient. It helps reduce the time you spend figuring out where your inventory is and, if you need to replace items, contacting suppliers and determining which one has the shortest lead time.

Survey respondents agreed with this sentiment, with labor listed as one of the business operations they felt would see the biggest impact from adopting an RFID solution. **Among those who have implemented RFID for supply chain management, 19% said it had already reduced their labor costs.**

MEETING SUSTAINABILITY GOALS

Another top supply chain concern for respondents was sustainability, with 86% saying their organization was at least somewhat concerned about meeting sustainability and emissions goals.

**How concerned is your organization about meeting sustainability/carbon emission goals?
— All Respondents**
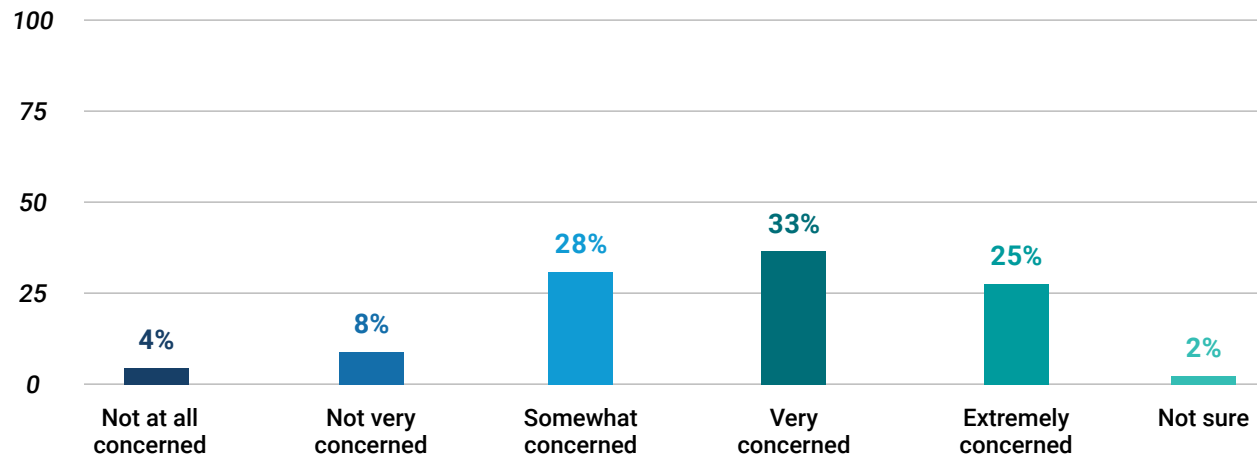
Forward-thinking companies have placed sustainability near the top of their agendas for two main reasons: *It's good for the planet, and it's good for business.* However, even the most well-meaning organizations shifted their focus during the past few years when major supply chain disruptions forced them into reactive mode. Just maintaining daily operations became a struggle for many companies.

Abbey believes that we are coming out of those tough times and that companies will refocus on sustainability. "The past couple of years have been challenging. As we reach a new normal, sustainability will become more top of mind."

Companies bringing sustainability initiatives back to the forefront see IoT solutions, particularly RFID, as a factor in the success of those initiatives.
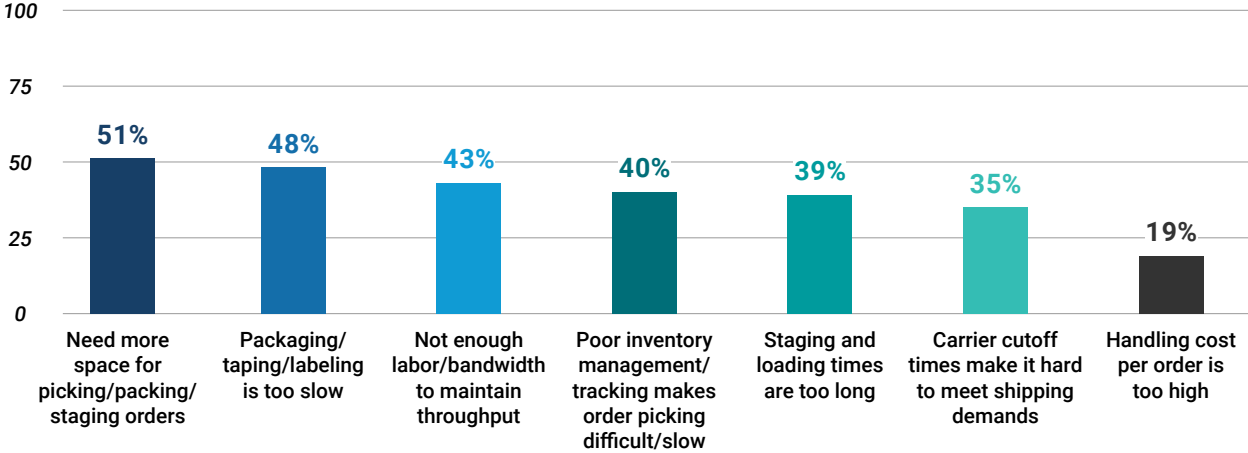
Our survey revealed that **21% of respondents believe RFID will have the greatest operational impact on sustainability initiatives.** In fact, 21% indicated they already use RFID to track perishable or expiring goods, while 8% already use it for waste reduction.

By providing visibility into "things" across the supply chain, RFID systems can help improve inventory management, shipping and other parts of operations. For example, the technology helps reduce product waste by enabling supply chain professionals to track inventory so it doesn't get lost or expire. It also can lead to reductions in carbon emissions by giving the visibility needed to plan better routes and minimize the number of trips each truck takes.
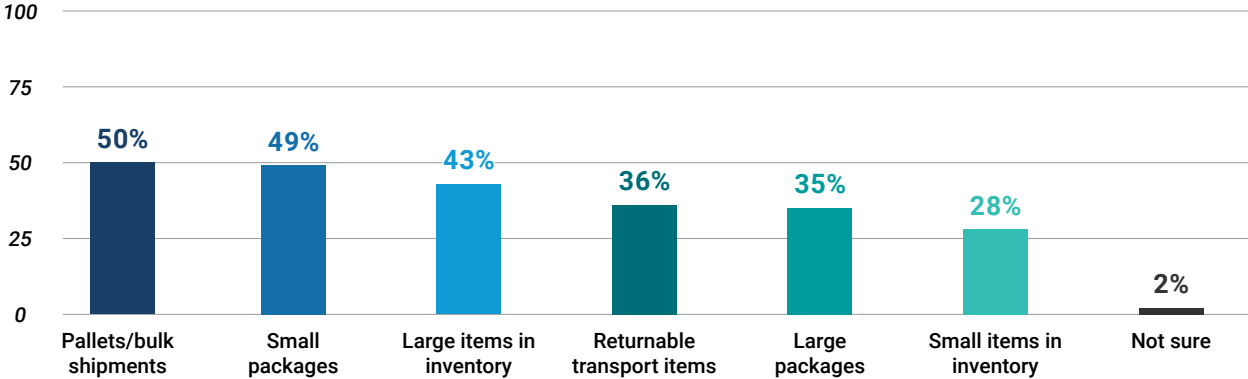
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SHIPPING AND TRACKING CHALLENGES

In addition to asking respondents about overall supply chain concerns, the 2023 survey also asked about challenges specific to shipping and tracking. Labor and visibility were again among the issues highlighted, with 43% of respondents reporting that labor shortages affected their ability to maintain throughput. Meanwhile, 40% reported that order picking was slowed because of trouble managing inventory tracking.

What challenges do you face when preparing and shipping packages? — All Respondents

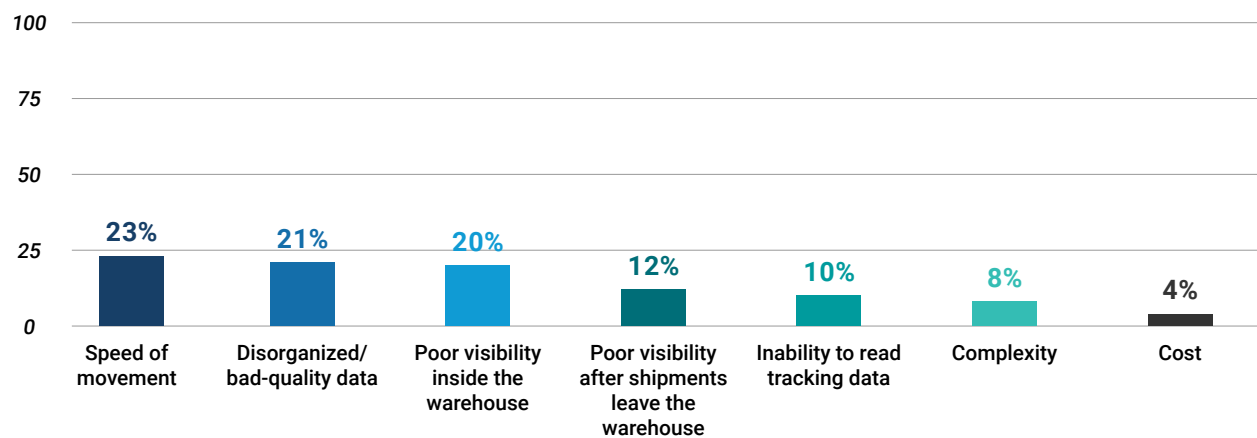|						
51%	48%	43%	40%	39%	35%	19%
Need more space for picking/packing/ staging orders	Packaging/ taping/labeling is too slow	Not enough labor/bandwidth to maintain throughput	Poor inventory management/ tracking makes order picking difficult/slow	Staging and loading times are too long	Carrier cutoff times make it hard to meet shipping demands	Handling cost per order is too high

Respondents also detailed their difficulties with real-time tracking at the item, package and pallet levels. Their biggest real-time or near-real-time tracking issues were with the following:

50%	49%	43%	36%	35%	28%	2%
Pallets/bulk shipments	Small packages	Large items in inventory	Returnable transport items	Large packages	Small items in inventory	Not sure

The biggest challenges respondents faced in tracking these difficult items were:

These areas can be improved using IoT technologies like RFID. By implementing a RAIN RFID system for supply chain management, your organization can experience:

- **Better operational efficiency.** Automating inventory management cuts down on the time your team has to spend on finding inventory, tracking down misplaced items and scrambling to get more inventory due to stockouts.

- **Real-time tracking for better inventory management.** Having real-time information about current inventory stock levels and locations reduces the chance of stockouts and makes picking and packing easier and faster.

- **Automated, more accurate data collection.** Automatic RFID tag scanners eliminate the need for manual data entry, saving your team time and reducing errors.

However, if a company gains visibility into parcel or pallet shipments at an earlier step in the supply chain, the operations manager can plan product flows to leave the facility more efficiently and on better-optimized routes. This approach saves the company money, improves sustainability by decreasing the overall distance driven and reducing the number of trips to the same or similar locations, and cuts down on shipping time to better meet or exceed customer expectations.

As organizations understand more about RFID and its capabilities, the granularity of tracking is increasing, with more companies moving from pallet-level tracking to package- and item-level tracking. While 60% of respondents indicated they were tracking at the pallet level in 2021, 58% indicated they were tracking at the pallet level in 2023, and 48% indicated they would be tracking at the pallet level in 2025.

By contrast, 38% of respondents indicated they were tracking by the item in 2021. That percentage jumped to 52% for respondents employing item-level tracking in 2023, and 56% expected to employ item-level tracking in 2025.

While the most granular level of tracking supply chain companies could achieve with accuracy in the past was pallet level, today's technology enables accurate tracking down to the package or item level. Farley explains that organizations are trending toward more granular tracking for a variety of reasons, namely improving visibility and reducing mistakes.

"If I'm a manufacturer building pallets of cases of all the same item," he says, "it's most important to know how many cases I need to build a full pallet. But at the distribution level, I'm likely breaking up that pallet to make mixed pallets to meet the needs of retail partners — 50 of this item, 30 of the next, and 20 of another. If the pallet goes to the right spot but has the wrong mix, that can be a costly mistake."

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A Solution to the Biggest Supply Chain Challenges

Getting real-time visibility across the supply chain is crucial to avoiding or minimizing major impacts from the next big disruption. But to be effective, the supply chain management solution has to be lightweight enough to deploy without significant resources and intelligent enough to provide the data necessary for making business decisions.

RAIN RFID ticks those boxes. It can read 1,000 items per second at a distance of up to several meters away without needing a direct line of sight, giving operations a major efficiency boost.

While the initial investment in RFID infrastructure (particularly the readers) can be large depending on the use case, the individual tags are inexpensive. This low cost makes it more affordable for companies to tag more things, allowing them to optimize processes and scale up operations over time.

Additionally, the tag data can be sent to the cloud, enabling all major stakeholders — manufacturer, freight carrier, customer and more — to have the visibility they need to make decisions at their step of the supply chain.

With labor and sustainability among the top concerns for supply chain professionals, RFID's ability to boost efficiency is another selling point. For example, tracking an item's entire journey through the supply chain can highlight inefficiencies. If items tend to sit for a long time on a loading dock, for instance, the operations manager can adjust processes and routing to keep products flowing.

Overall, the many benefits of RFID technology enable companies to have better confidence in the resilience of their supply chains.
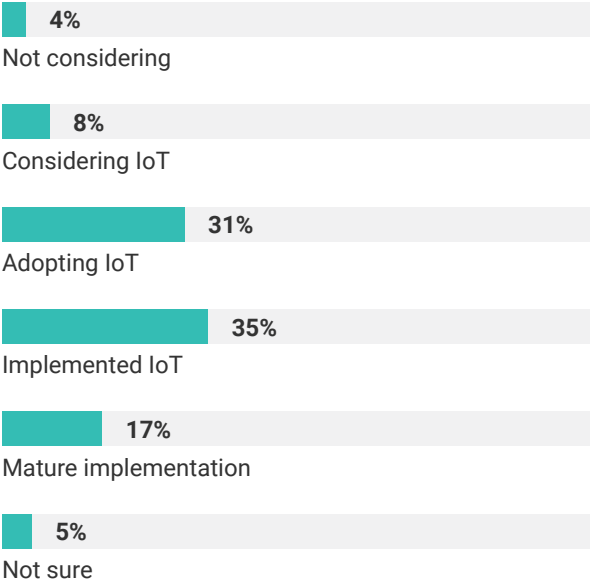
The 2023 survey found that 75% of survey respondents from companies that implemented RFID indicated they were very or extremely confident in their organization's ability to meet supply chain issues/pressures in the next two years, given their current technological toolkit. In contrast, 51% of survey respondents from companies that had not implemented RFID indicated the same.

Why Companies Are Using IoT/RFID Technology for Supply Chain Operations

Many of the benefits of RAIN RFID are reflected in the real-world use cases that respondents reported in the survey. Labor management, inventory management and sustainability are among the top uses for RFID in respondents' organizations.
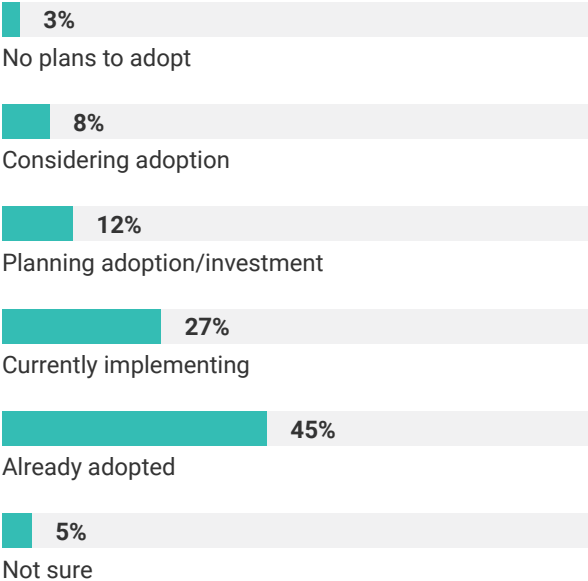
While overall IoT implementation has remained about the same year over year (83% of respondents with some level of implementation in 2023 vs. 84% in 2022), mature implementation increased — from 14% in 2022 to 17% in 2023.

Interest in RFID technology, specifically, has risen dramatically. **While the 2022 survey found that 17% of respondents indicated no plans to adopt RFID, just 3% said the same in the 2023 survey.** Additionally, more respondents in 2023 said their organizations are considering, are implementing or have already adopted RFID.

Which of the following best describes your organization's evaluation of Internet of Things (IoT) solutions? — All Respondents

4%
Not considering

8%
Considering IoT

31%
Adopting IoT

35%
Implemented IoT

17%
Mature implementation

5%
Not sure

Please indicate your organization's plans for adopting RFID, specifically for supply chain management. — All Respondents

3%
No plans to adopt

8%
Considering adoption

12%
Planning adoption/investment

27%
Currently implementing

45%
Already adopted

5%
Not sure

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Not only are companies moving toward RFID, but more have already succeeded. Nearly twice as many respondents said their organization had mature RFID implementation in 2023 than in 2021, and more than double that number expect to have it by 2025.
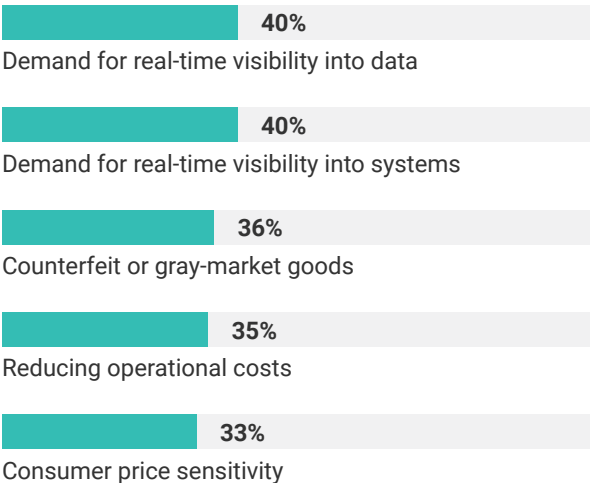
Which of the following best describes the stages of your organization's RFID adoption for supply chain management in each of these time periods? — All Respondents

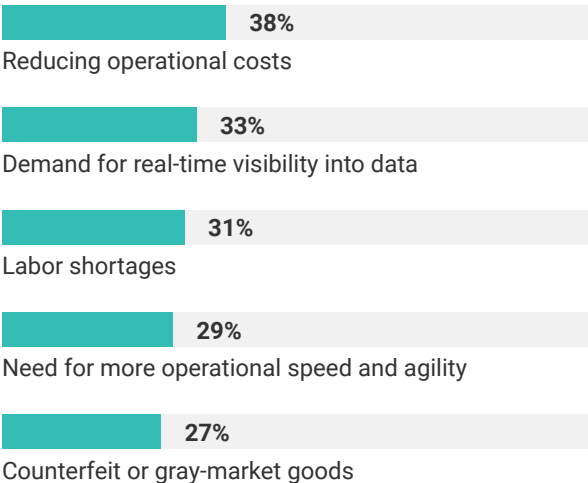| Field	Not Considering RFID	Considering RFID	Adopting RFID	Implemented some RFID	Mature implementation	Not sure/Not Applicable
Two years ago	13%	15%	29%	30%	11%	2%
Today	4%	11%	28%	35%	20%	2%
Two years from now	2%	3%	9%	33%	48%	5%

WHY ARE COMPANIES INTERESTED IN RFID?

A variety of concerns are driving the current interest in RFID — and those concerns differ between companies that have implemented the technology and those that haven't.

Among respondents from RFID-enabled companies, the biggest drivers they see for interest in the technology include:

40%
Demand for real-time visibility into data

40%
Demand for real-time visibility into systems

36%
Counterfeit or gray-market goods

35%
Reducing operational costs

33%
Consumer price sensitivity

Respondents from companies that haven't implemented RFID have a somewhat different set of concerns:

38%
Reducing operational costs

33%
Demand for real-time visibility into data

31%
Labor shortages

29%
Need for more operational speed and agility

27%
Counterfeit or gray-market goods

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What business operations would realize the greatest possible impact from adopting RFID systems and solutions for supply chain management? — RFID Implementers vs. Non-RFID Implementers
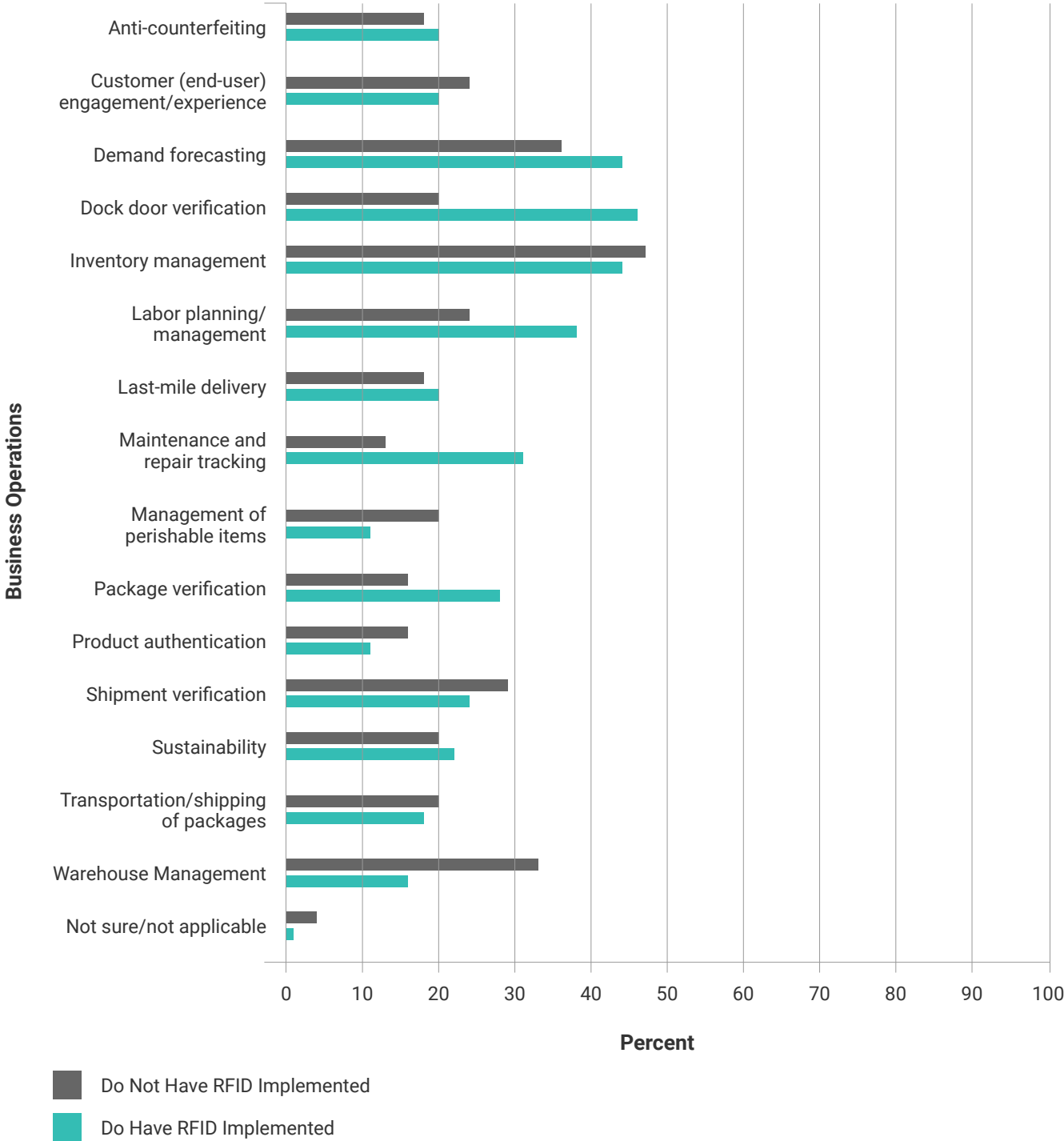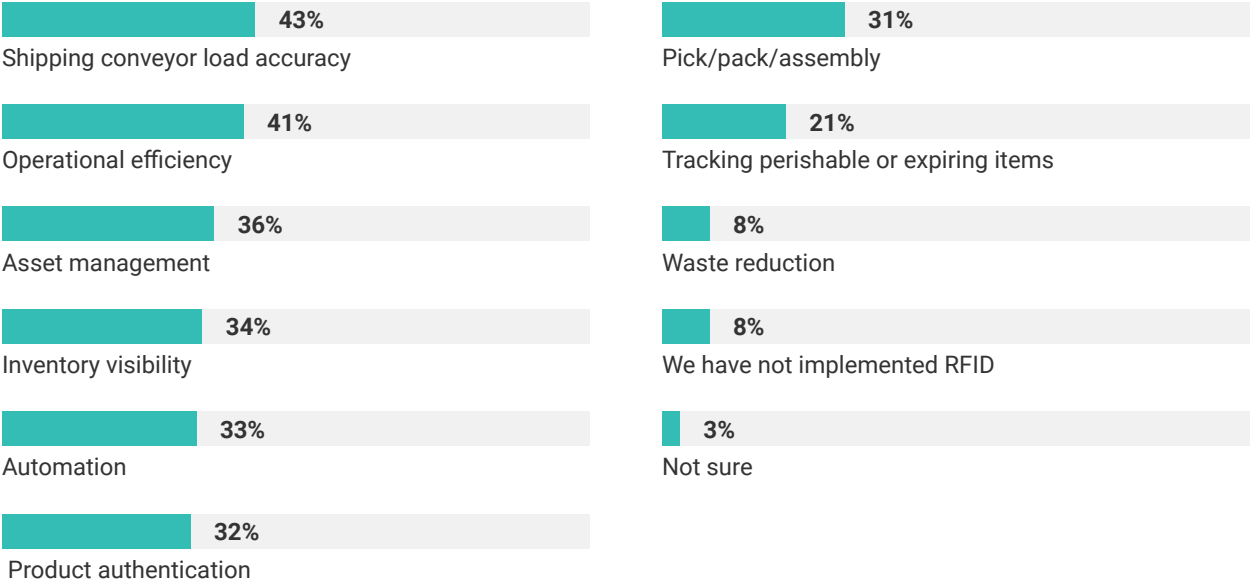
BENEFITS OF IOT/RFID — EXPECTED VS. REALIZED

The survey also highlighted differences between RFID technology's expected and realized benefits/uses. For example, 20% of companies without RFID named dock door verification as an area of great possible impact, whereas 46% of RFID adopters did.

Which of the following benefits would you expect to achieve/have you achieved with RFID systems and solutions for supply chain management? — RFID Implementers

Horizontal bar chart comparing Expected (gray) and Realized (teal) percentages by benefit.
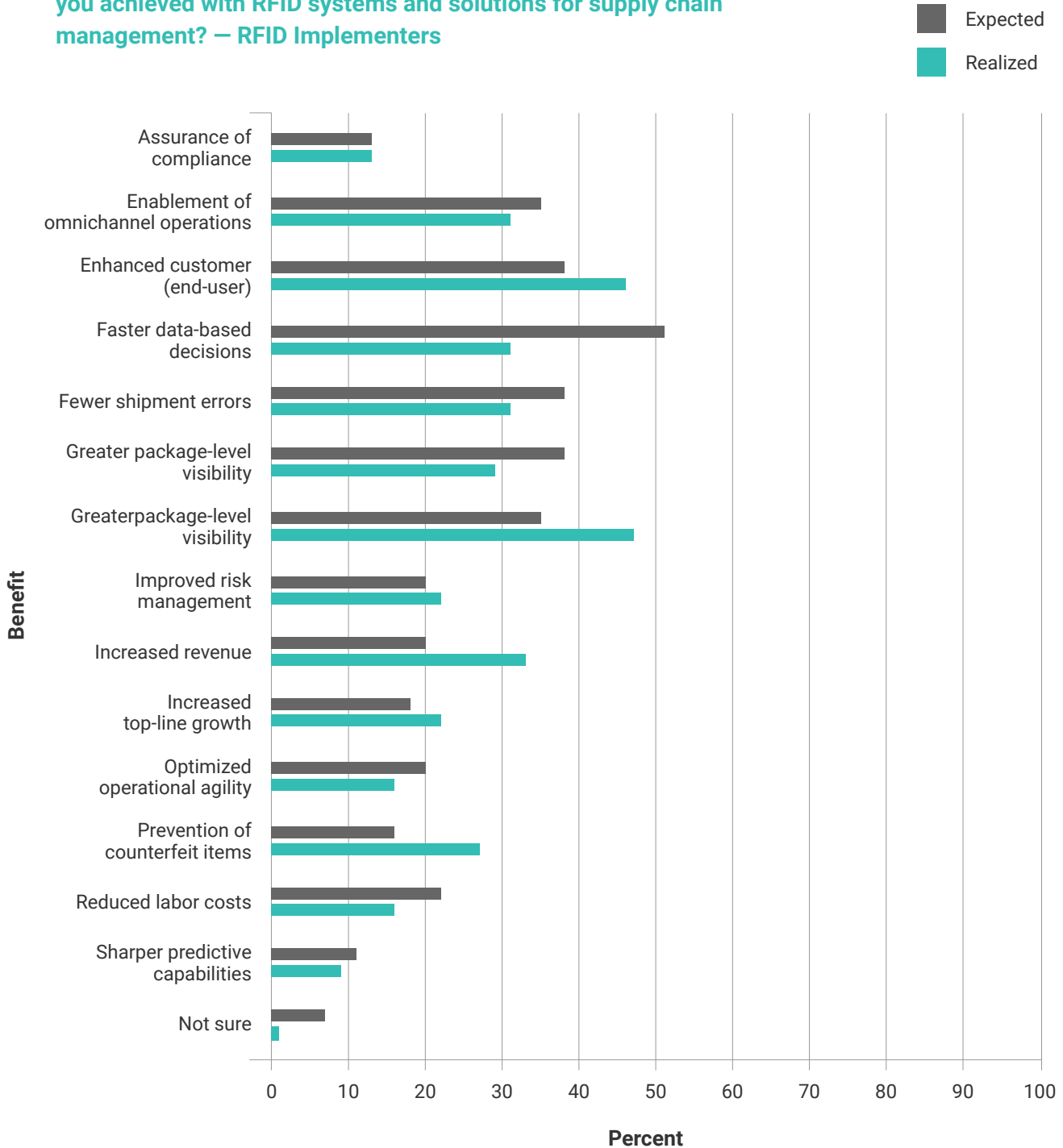
USES FOR IOT/RFID – ALL RESPONDENTSS

If you've implemented RFID systems or solutions for supply chain management, what are the technology's primary uses in your organization?

43% Shipping conveyor load accuracy

41% Operational efficiency

36% Asset management

34% Inventory visibility

33% Automation

32% Product authentication

31% Pick/pack/assembly

21% Tracking perishable or expiring items

8% Waste reduction

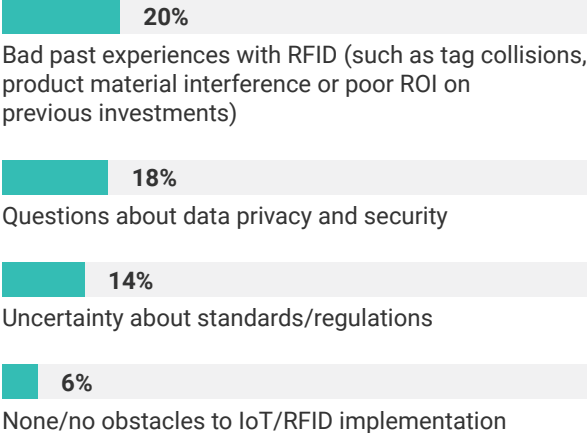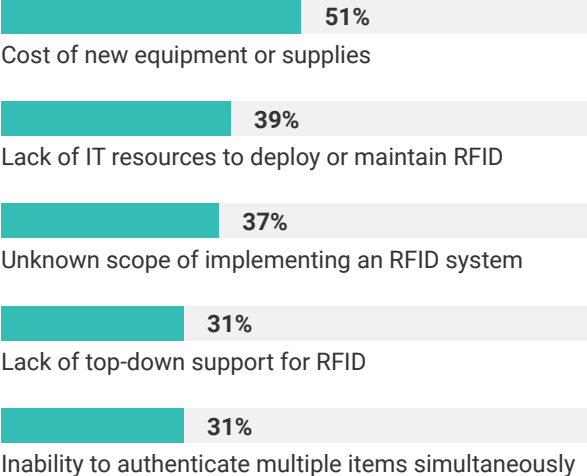**8%** We have not implemented RFID

3% Not sure

Product authentication is especially noteworthy since creating fake luxury items and pumping them into the market is a huge business — to the tune of hundreds of billions of dollars a year. But with the latest RAIN RFID technology, companies can automatically authenticate products in real time at steps along the supply chain. In fact, **16% of respondents in the 2023 survey expect RFID systems and solutions for supply chain management will help in preventing counterfeiting.**

Obstacles to IoT/RFID Adoption

As with any investment in tools or technology, supply chain professionals face several challenges to adopting IoT/RFID technologies, including getting leadership buy-in. Respondents reported that the biggest obstacles to implementing IoT/RFID technologies were:

51%
Cost of new equipment or supplies

39%
Lack of IT resources to deploy or maintain RFID

37%
Unknown scope of implementing an RFID system

31%
Lack of top-down support for RFID

31%
Inability to authenticate multiple items simultaneously

20%
Bad past experiences with RFID (such as tag collisions, product material interference or poor ROI on previous investments)

18%
Questions about data privacy and security

14%
Uncertainty about standards/regulations

6%
None/no obstacles to IoT/RFID implementation

Perceived costs associated with new technology is the leading concern, which is understandable when an industry is still in recovery mode. But if you're a supply chain professional making a case for IoT/RFID implementation in your organizations, know that you don't have to deploy a huge tech infrastructure all at once. RFID is highly scalable and repeatable, so you can choose a smaller initial deployment and build on it as you see the return on investment (ROI).

RFID's benefits can also address the next leading concern among respondents: the lack of IT resources to deploy or maintain a system. RFID is a relatively low-intensity solution from an IT standpoint.

In some use cases, you may not even have to rely on your IT team for installation. Hardware is relatively easy to deploy, and communication between tags and readers can be handled via cloud software outside your network, preventing costly IT integration projects.

The relatively easy deployment and use of RFID solutions mean your company can quickly generate ROI from greater visibility and the ability to drive more powerful automation. Faster ROI makes RFID a much easier sell to cost-conscious or effort-sensitive leadership.

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Get Control of Your Biggest Challenges with IoT/RFID

If you're looking to improve inventory tracking, do more with less and meet your organization's sustainability objectives, you can embrace the power of IoT technologies, including RFID. Highly scalable RFID solutions enable you to start small and build as your organization or deployment grows.

The key is to define an initial project with a specific goal in mind. To realize the greatest return on your RFID investment in the shortest amount of time, ask yourself a few crucial questions:

- What's the business problem we're trying to solve?
- What impact does that problem have on the company?
- What would solving that problem do for our company? How much more could we get done?
- How much money could we save by using technology to solve this problem?

For example, if your biggest business challenge is a labor shortage, your business problem may be optimizing and automating processes to make jobs easier for your workforce. By using RFID, you can spot pinch points in your system, automate repetitive tasks such as data entry and speed up inventory movement without burdening your workforce.

Using IoT technologies like RFID gives you a better handle on your biggest supply chain challenges and bolsters your resilience, so you can meet your business goals and grow more successful — even in the midst of disruption.

Impinj helps businesses and people analyze, optimize and innovate by wirelessly connecting billions of everyday things — such as apparel, automobile parts, luggage and shipments — to the internet. The Impinj platform uses RAIN RFID to deliver timely data about these everyday things to business and consumer applications, enabling a boundless Internet of Things.

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