RAIN RFID

# Bridging the Gap

## Connecting Corporate Sustainability with RAIN RFID

01

# Welcome: About this report

**As a society, we are confronting significant and varied challenges posed by a changing climate.**

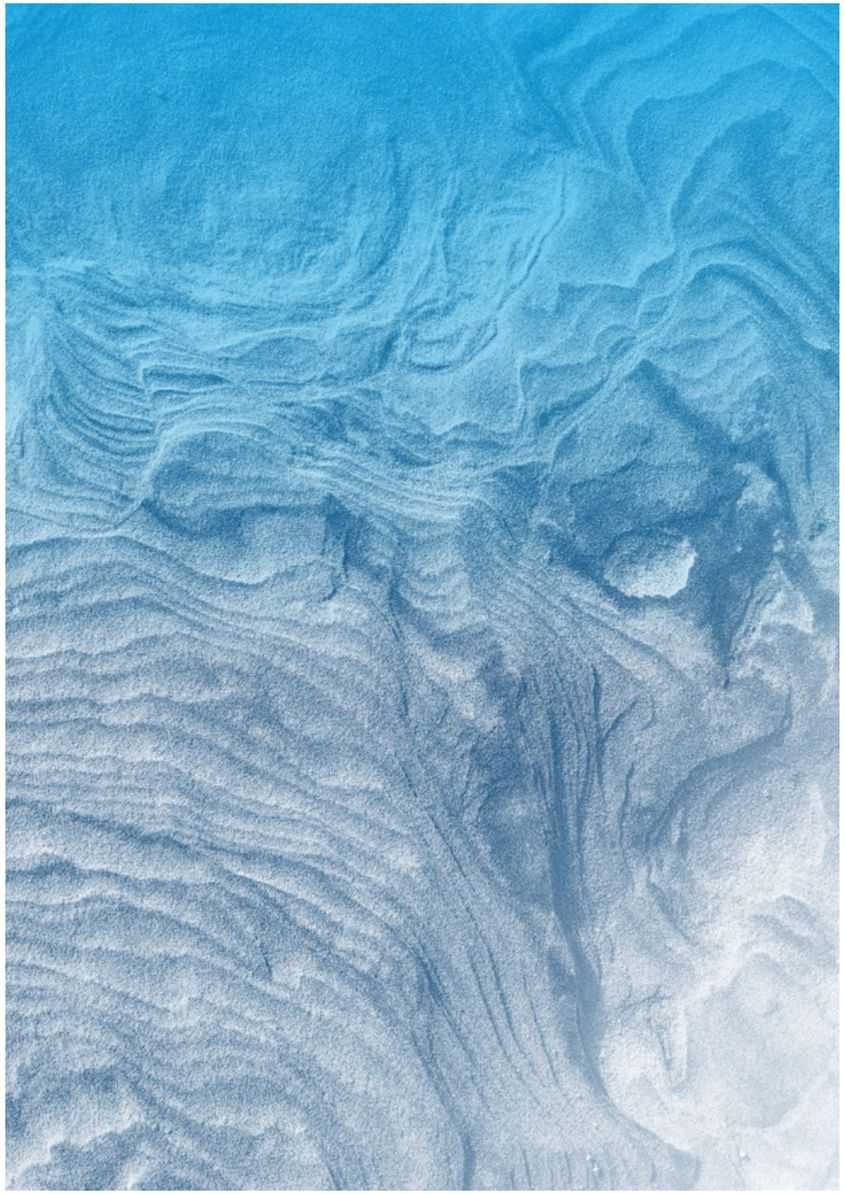
Severe weather events leading to sourcing difficulties, supply chain disruptions and rising costs are just a few examples of how this is manifesting for businesses. As a response to these challenges and growing uncertainties, **companies are becoming increasingly focused on setting sustainability targets and finding tools to create more resilient enterprises.**

RAIN RFID is a brand name that represents passive ultra-high frequency (UHF) RFID technology. It is successfully reshaping how we identify and track products in our complex global supply chains and can be a key enabler for companies to successfully manage both their operations and sustainability objectives.

**RAIN RFID is one of the most pervasive technologies in the world** and is used in many markets to efficiently identify, locate, and authenticate products. Among various IoT technologies, RAIN RFID stands out for its unparalleled combination of cost-effectiveness, simplicity, and availability. **RAIN RFID's power lies in boosting visibility and providing accurate data, making it a transformative force in the digital age.** The technology and its uses continue to evolve, delivering innovation and efficiency in our interconnected world where sustainability is of vital importance.

RAIN RFID empowers companies to collect necessary impact data on topics such as supply chain transparency, product composition, and proper end-of-life and waste management.

**Indeed, in a world battling to cope with climate change, where production and consumption are on the fast track, RAIN RFID is a critical technology for decisions that balance people, the planet, and profit. But not everyone realizes this, yet...**



Although RAIN RFID is widely used across many industries, **the connection between RAIN RFID and sustainability is still in its early stages**. The aim of this report is to demonstrate the current state-of-play when it comes to using RAIN RFID for sustainability purposes.

## About RAIN Alliance and its Sustainability Work Group

The RAIN Alliance is a non-profit membership organization of like-minded companies that have come together to create a smarter and more sustainable world for the billions of people on the planet using RAIN RFID technology to interconnect trillions of objects simply and inexpensively. This report is an initiative of the RAIN Alliance's Sustainability Workgroup, whose mission is to uncover opportunities for RAIN RFID to deliver sustainability benefits and to accelerate implementation. The Sustainability Workgroup is also taking steps to bridge the gap between the technology and market awareness through identifying new use cases and market segments.

### Methodology Summary:

The findings in this report reflect a comprehensive methodology approach, including an industry literature review, a survey with RFID experts and end-users, and qualitative expert interviews with industry leading companies. A detailed description of the methodology can be found in the appendix of the report.

**We hope that the insights contained in this report, which include findings from an industry survey and case studies, will encourage you to unlock the potential of RAIN RFID as a leading technology to support action towards a sustainable future.**

RAIN Alliance Sustainability Workgroup

02

# Executive Summary

01

## Bridging the Gap

The link between RAIN RFID and sustainability use cases is still in its early stages with untapped potential. This will require a new level of collaboration, investment and business model adaptation to bridge the gap. However, it will also create new opportunities for companies to achieve both their business and sustainability objectives.

02

## Breaking Down Silos

There is a clear disconnect between those setting sustainability goals (e.g. C-suite or sustainability teams) and those implementing RAIN RFID (e.g. IT or supply chain teams) as 10% of survey respondents identified their role as Sustainability/Corporate Social Responsibility, however only 1% of these respondents are involved in using RAIN RFID in their daily work. This underscores a significant opportunity to integrate sustainability departments into the RAIN RFID strategy, fostering collaborative projects and improving data collection efforts.

03

## The Data Already Exists

The survey results reveal that despite 36% of respondents not actively collecting sustainability-related data through RAIN RFID initiatives, existing data gathered for operational related purposes such as inventory management and stock control can still be harnessed to advance sustainability objectives. The survey findings indicate that the data gathered via RAIN RFID primarily supports two critical business objectives: supply chain traceability (20%) and inventory management (21%), both of which are intertwined with sustainability use cases such as informing LCA methodology to provide a more accurate understanding of a product's footprint.

**The Maturity Curve**

**18%** Median level of integration between RFID and sustainability teams when engaged with RAIN RFID for less than **3 years**

**80%** Median level of integration between RFID and sustainability teams when engaged with RAIN RFID for longer than **5 years**

## 04

### The Maturity Curve

There is a correlation between a company's RAIN RFID program maturity and the level of integration between the RFID and sustainability teams. Our survey findings show that when a company has been engaged for fewer than 3 years with RAIN RFID, the average level of integration between RFID and sustainability teams is at 22%.

When RAIN RFID has been used for longer than 5 years the average level of integration between the RFID and sustainability teams increases to 63%. This highlights that there is a maturity curve when adopting RAIN RFID, with business objectives as the focus at the beginning and more objectives including sustainability included as the program develops over time.

## 05

### Increasing Regulatory Pressure and the Traceability Imperative

'Improving Supply Chain Traceability' was identified as the highest priority within surveyed companies' sustainability strategies for 2023 with 47% selecting traceability as an important regulatory driver. With increasing global regulatory pressure across industries to disclose climate risks and provide supply chain transparency, RAIN RFID holds the potential to transform regulatory challenges into opportunities for innovation and market leadership.

## 06

### Urgency of Sustainability

As businesses increasingly prioritize sustainability objectives alongside their business objectives within frameworks such as the Science Based Targets (SBTs) and Sustainable Development Goals (SDGs), RAIN RFID emerges as a valuable tool capable of supporting both sustainability objectives and broader business goals. With only 15% of the SDGs on track for 2030, businesses need to address their sustainability objectives with more urgency than ever. RAIN RFID technology can help companies achieve their sustainability goals.

**With only 15% of the SDGs on track for 2030, businesses need to address their sustainability objectives with more urgency than ever.**

03

# Introduction

**“We are excited about the possibilities for RAIN RFID to help companies attain their sustainability objectives. This report is a first step in understanding how leading companies are approaching the use of RAIN RFID for sustainability purposes and where opportunities lie ahead. The RAIN Alliance wants to play a key role as we move forward to harness the power of RAIN RFID to create solutions to the challenges of climate change.”**

Aileen Ryan,
President and CEO of RAIN Alliance

**In today’s fast-evolving landscape of technological innovation, RAIN RFID stands out as a transformative force, unlocking new opportunities for companies to align their operations with sustainability objectives and contribute significantly to more holistic frameworks such as the United Nations 2030 Sustainable Development Goals (SDGs).**

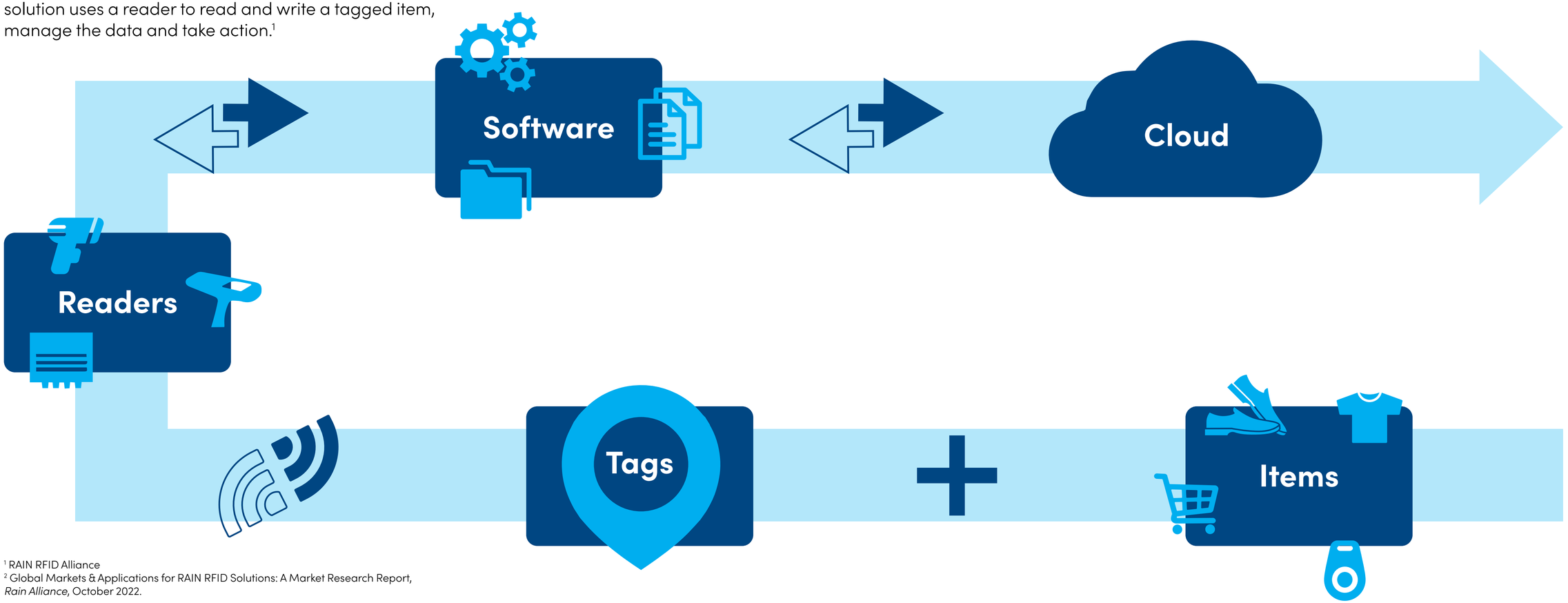
Today, RAIN RFID has predominantly been used to tackle business objectives related to inventory management and supply chain efficiencies. The progress that can be made to ensure that RAIN RFID enables a more sustainable future to drive positive change across global industries is promising and inspiring.

# Now is the time to accelerate utilization of RAIN RFID to achieve corporate sustainability objectives.

# RAIN RFID

RAIN RFID refers to battery-free UHF radio-frequency identification (RFID) products and technology that comply with the ISO/IEC 18000-63 standard and/or the GS1 EPC UHF Gen2 protocol. The word RAIN—an acronym derived from RAdio frequency IdentificatioN—is intended as a nod to the link between UHF RFID and the cloud, where RFID-based data can be stored, managed and shared via the Internet. A RAIN RFID solution uses a reader to read and write a tagged item, manage the data and take action.[1]

## RAIN RFID is a technology experiencing significant growth, with projected cumulative tag shipments surpassing 300 billion units between 2021 and 2026.[2]




[1] RAIN RFID Alliance
[2] Global Markets & Applications for RAIN RFID Solutions: A Market Research Report, *Rain Alliance*, October 2022.


# UN Sustainable Development Goals

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet. At its heart are 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries.

The SDGs recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests.[3]

As identified in the 2021 RAIN Alliance White Paper *'Defining Sustainability for RAIN RFID Importance, Challenges, and Potential'*, the following SDGs are most relevant for RAIN RFID.

- **SDG 3 – Good health and well-being**
- **SDG 7 – Affordable and clean energy**
- **SDG 9 – Industry, innovation, and infrastructure**
- **SDG 11 – Sustainable cities and communities**
- **SDG 12 – Responsible production and consumption**

[3] The 17 Goals, Sustainable Development United Nations

# 04 RAIN RFID & Sustainability

**Many drivers exist today to incentivize companies to take a more proactive approach in tracking products through their value chains, to be explored in more detail below.**

As a result, companies are looking for technologies to support their efforts. RAIN RFID is a powerful technology that enables companies to tag and track individual products through the supply chain and at end of life by collecting key information that can be accessed virtually.

# An exploration of market drivers demonstrates why RAIN RFID is a perfect solution for companies to gather and analyze not only critical business information, but also data that allows them to achieve their sustainability objectives

**Driver 1:**

# The Urgency of Sustainability:

The urgency to act and accelerate the adoption of RAIN RFID to achieve sustainability use cases is underscored by the fact that the UN's 2030 SDGs are just six years away. Despite being a guiding framework for numerous private companies, the progress made so far falls short of the necessary milestones needed to ensure the ultimate goals are met. In fact, a recent report by the United Nations Global Compact and Accenture shows that 85% of the 169 SDG targets are showing either limited or no progress or a reversal in progress.[4]

In addition to the SDGs, as the race to keep our planet within 1.5 degrees in accordance with the Paris Agreement continues, many companies have also committed to science based targets. As of December 2023, 4088 companies globally had set science based targets, with 2673 companies putting net-zero commitments in place.[5] This means that they are committing to focus on materially reducing their emissions by 2050.



In the report, *The Missing Billions: The Real Cost of Supply Chain Waste*, Avery Dennison found that of those global businesses surveyed, "an average of 29% say that their organization's overall sustainability impact comes from supply chain operations. However, three quarters of businesses are investing 5% or less of their technology budget to supply chain sustainability improvement."[6] The findings in this report confirm the disconnect between operations and sustainability objectives, a missing opportunity that remains to be seized.

As companies strive to meet ambitious sustainability targets, RAIN RFID emerges as a pivotal tool for collecting and transferring critical data, thus facilitating traceability, transparency, and accountability in supply chains and beyond to a product's end-of-life. There remains a considerable opportunity to connect sustainability with the use of RAIN RFID.

## But the critical question remains: Are companies making tangible progress toward their sustainability goals?

[4] UNGC, SDG Stocktake: Through the eyes of the private sector
[5] Science Based Targets, Companies Taking Action
[6] The Missing Billions: The Real Cost of Supply Chain Waste, Avery Dennison

## Driver 2:

# Increasing Regulatory Pressure:

**Another driver pushing the adoption of RAIN RFID includes a wave of new regulation, especially in Europe, that will require companies to disclose climate risks to regulators and transparently communicate critical information to consumers on product labels.**

The volume and scope of incoming legislation is vast and evolving, making it impractical to comprehensively cover in this report. Nonetheless, it is crucial to be informed about a select few key regulations, outlined below.

### → Value Chain Risk Disclosure

The Corporate Sustainability Reporting Directive (CSRD) in the European Union and California's new Climate Disclosure Act further detailed below are examples of new legislation that create a need for companies to rapidly understand and be more transparent about the risks in their supply chains. The CSRD aims to strengthen the rules concerning the social and environmental information that companies have to report. It aims to support investors, consumers, policymakers, and various stakeholders in assessing the non-financial performance of large companies.

### → Product and Packaging Design

There are also new regulations requiring better product and packaging design which require recycled content and recyclability in order to move toward a more circular economy. Non-compliance results in penalties through Extended Producer Responsibility (EPR) schemes. The Ecodesign for Sustainable Products Regulation (ESPR)[7] and the Packaging and Packaging Waste Regulation (PPWR) are two such examples in the European Union.[8] These are driving real change in businesses as they search for ways to prepare for compliance.

As companies grapple with complex and globalized supply networks, the ability to manage the lifecycle of products becomes virtually impossible without a technology like RAIN RFID, which offers visibility into the movement of goods, enabling companies to monitor and optimize their supply chain and provide necessary data to comply with regulatory requirements.

[7] Ecodesign for Sustainable Products Regulation, European Commission
[8] Proposal for a revision of EU legislation on Packaging and Packaging Waste, European Commission

**European Green Deal and the Circular Economy Action Plan (CEAP):**

The European Green Deal is a set of policy initiatives designed to support the EU's green transition, targeting carbon neutrality by 2050. At its core is the new CEAP, adopted in March 2020 to promote circularity across product life cycles, spanning from manufacturing to end-of-life management.

**ESPR and Digital Product Passports:**

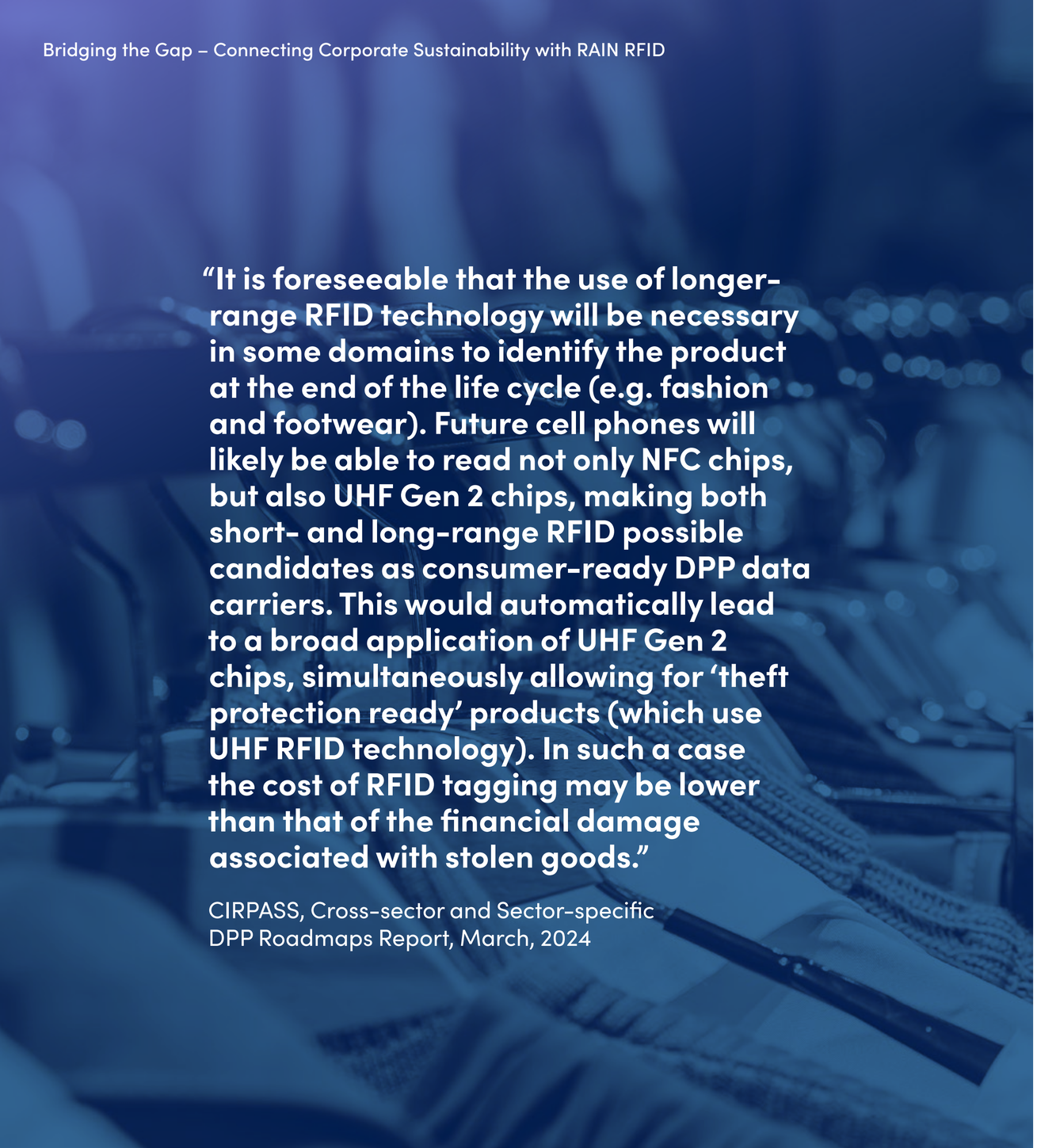
In March 2022, the European Commission presented a proposal for the Ecodesign for Sustainable Products Regulation (ESPR). Included in the proposal was the introduction of the Digital Product Passport (DPP). According to the ESPR, '*Digital Product Passports will be the norm for all products regulated under the ESPR, enabling products to be tagged, identified and linked to data relevant to their circularity and sustainability*'.[9] The DPP intends to be a digital identity that links to the physical product providing information such as material composition, origin, repair, and disassembly options, as well as how to handle it at its end-of-life. A critical criteria of the DPP includes a "data carrier" that must be affixed to all products that fall under the ESPR. The data carrier may take the form of a QR code or RAIN RFID tag. Key product priority areas include batteries, textiles and electronics, with the implementation timeline ranging from 2027 to 2030.

The European Commission funded an 18-month project called CIRPASS composed of 31 partners to develop the concept of the Digital Product Passport (DPP) in line with ESPR requirements. At the conclusion of the project in March 2024, the CIRPASS consortium published a draft report for public consultation outlining a cross-sector roadmap for the DPP system as well as sector-specific roadmaps for batteries, electronics and textiles.[10]

[9] On making sustainable products the norm
[10] Cross-sector and Sector-specific DPP Roadmaps, CIRPASS

**"We look at the use of RAIN RFID as an opportunity for things like the Digital Product Passport which will necessitate this transparency. So when people choose to not look at this work from the long term view we have to remind them that we are likely to disclose this information, whether it be for customer or regulatory requirements, such as Digital Product Passports or something else."**

Peter Ramirez, Michelin, Industry Standards and Government Regulations Manager



**“It is foreseeable that the use of longer-range RFID technology will be necessary in some domains to identify the product at the end of the life cycle (e.g. fashion and footwear). Future cell phones will likely be able to read not only NFC chips, but also UHF Gen 2 chips, making both short- and long-range RFID possible candidates as consumer-ready DPP data carriers. This would automatically lead to a broad application of UHF Gen 2 chips, simultaneously allowing for ‘theft protection ready’ products (which use UHF RFID technology). In such a case the cost of RFID tagging may be lower than that of the financial damage associated with stolen goods.”**

CIRPASS, Cross-sector and Sector-specific DPP Roadmaps Report, March, 2024

**The United States is Following A Similar Path:**

At the Federal level, the SEC Climate Disclosure Rule was issued on March 6, 2024. The rule requires US public companies to disclose climate-related risks in Scopes 1 and 2 of their supply chains within their annual reports and registration statements. At the state level, a significant development occurred in October 2023 when California enacted the Climate Corporate Data Accountability Act, also known as SB 253, marking the first climate disclosure law in the United States. It will require companies with revenues over $1B annually that do business in California to report emissions across their entire value chain. Once signed, mandatory Scope 1 and 2 emission reporting begins in 2026 and Scope 3 emissions reporting is set to begin in 2027. California’s legislation goes further than the SEC’s climate disclosure rule, which excludes Scope 3 emissions and only applies to public companies. This law also gets California closer in line with recent Scope 3 legislation and anti-greenwashing laws in the EU. Another bill slated for a vote in the Assembly, California SB 261 Climate-Related Financial Risk Act would require companies to report on climate-related financial risk and the measures they have adopted to reduce and adapt to those risks. Given California’s influential market, these laws have the potential to set standards nationwide.

**"RAIN RFID was there for efficiency but in fact it brings much more value as it's a very big enabler for the new business models. We're exploring various models like long-term renting and subscriptions to find the best fit. Recycling is a big focus for us, and we're also prioritizing product repairs. Our 100% RAIN RFID implementation means each product has a specific unique ID. We are the first company with an internal Digital Product Passport (DPP), which is already storing about 30 billion events. Internally, we use the DPP to track the life cycle of all our products. This is crucial for understanding how often a product is rented and determining when it's ready for a second life. We want to know everything about the product that is returned by our customer to decide whether they should be recycled, repaired, or sold again."**

Hervé D'Halluin, Decathlon, Leader RFID United

## Driver 3:

# Sustainability as a Competitive Advantage:

Beyond compliance, RAIN RFID gives companies a competitive advantage as we progress to a world where sustainability leadership becomes a key indicator of market leadership. For example, a 2022 study performed by the Carbon Disclosure Project (CDP) finds that **companies with strong carbon-related performance and disclosure practices had higher stock market returns with the financial benefits of climate action outweighing the risks by at least 15 times**.[11] Additionally, a study by MSCI ESG Research found that companies with higher environmental, social, and governance (ESG) ratings have lower costs of capital, indicating that investors perceive them as less risky.[12] Across the research we conducted, it remains consistent that there is a positive correlation between sustainability-related corporate action and financial performance.

**Further, consumers and investors are asking more from companies in terms of sustainability-related strategy and action**. In a recent study, Credit Suisse surveyed 10,000 Gen Z customers and found that almost 80% of them intended to buy only sustainable products.[13] Similarly, regarding Environmental, Social and Governance (ESG) reporting, a recent McKinsey survey of Chief Investment Officers found that about 85% stated that ESG is an important factor in their investment decisions.[14] RAIN RFID can help empower companies to offer additional value to their consumers. For example, many companies are now exploring new business models that go beyond just selling products through traditional retail. They are finding ways to connect and engage with consumers through service models as well (see Decathlon case study below). **One thing is certain in an uncertain future: companies need to start understanding, prioritizing and communicating their impacts to stay ahead of the competition.**

[11] The Future of Corporate Climate Action, CDP
[12] ESG and the Cost of Capital
[13] The young consumer and the path to sustainability, Credit Suisse, 2022
[14] Investors want to hear from companies about the value of sustainability

## Example:

# Early Indications of RAIN RFID Enabled Environmental Sustainability

**The utilization of RAIN RFID presents significant opportunities for enhancing environmental sustainability within supply chains, as evidenced by several peer-reviewed academic studies.**[15]

Two well-known opportunities for RAIN RFID to positively impact environmental sustainability are to reduce excess inventory (also known as safety stock) and to clearly convey the expiration of perishable goods, both of which in turn can reduce emissions related to inventory production.

RAIN RFID enables the reduction of safety stock by providing inventory visibility, be it within a single company or along an entire supply chain. An analysis of an Italian fast-moving consumer goods supply chain found that RAIN RFID reduced inventory bullwhip by up to 86% at the manufacturer and 55% at the distribution center.[16] A simulation of a two layer supply chain found that implementing RAIN RFID enabled optimized inventory levels and replenishment order frequency, resulting in a decrease of retail inventory by 72%. Further, this simulation found that inventory variability– a driver of safety stock size– was reduced at the retailer by 35% and at the distribution center by 17%.[17] Reducing safety stock means that eventually excessive production, and its associated emissions, can be reduced.

**RAIN RFID reduced inventory bullwhip at the manufacturer by up to**

**86%**

[15] The role of RFID to improve supply chain sustainability: A systematic literature review and key informant survey, 2023
[16] The impact of RFID and EPC network on the bullwhip effect in the Italian FMCG supply chain, 2010
[17] Inventory Replenishment Policies for a Grocery Supply Chain Using RFID to Improve the Performance Frontier, 2021

RAIN RFID can also reduce the expiration of perishables by enabling more effective inventory management policies. In a four-month pilot of 30,000 cases of RAIN RFID-tagged perishable goods at the warehouse of the large-scale logistics retailer Auchan, another study found that RAIN RFID enabled the optimization of safety stock levels. This resulted in extended shelf life of perishables goods from 34 days to 40 days, meaning fewer expired goods going into the trash.[18] Another study found that using RAIN RFID-enabled first-in-first-out inventorying improved replenishment practices and decreased the volume of discarded expired goods by 2.6%, resulting in carbon savings that exceed the carbon expense of the RAIN RFID tags themselves by more than five times.[19] **These studies underscore the crucial link between RAIN RFID and sustainability in the supply chain, demonstrating its indispensable role in promoting environmentally conscious practices and contributing significantly to a more sustainable future.** Despite these strong drivers behind the sustainability benefits of RFID, the sector is still relatively immature in exploring these links and possibilities as will be explored below through survey findings.

**RAIN RFID enabled the optimization of safety stock levels, resulting in extended shelf life of perishables goods from 34 days to 40 days**

[18] Reducing out of stock, shrinkage and overstock through RFID in the fresh food supply chain: Evidence from an Italian retail pilot
[19] Life cycle assessment of RFID implementation in the fresh food supply chain, 2014

## Examples of RAIN RFID Sustainability Use Cases

- → Traceability of products through the supply chain
- → Environmental data collection and transfer
- → CO2 emissions reduction by gaining efficiencies
- → Waste reduction through better inventory management
- → Product composition detection for sorting and recycling
- → Consumer behavior insights in secondary markets
- → The enablement of new sustainable business models

## Expert Insights

# Sustainability a growing RAIN RFID investment driver.

**"Minimizing carbon emissions and eliminating waste are high priority supply chain initiatives for organizations across most industries. Utilizing digital ID solutions – such as RAIN RFID – in combination with connected product cloud-based solutions and Artificial Intelligence and Machine Learning tools to analyze and alert on anomalies are providing brand owners and their partners the necessary infrastructure to make data-driven decisions regarding the carbon footprint of their products.**

**In addition, as organizations transition from disposable to reusable totes, crates and other modes of conveyance, the need for (RAIN RFID-enabled) tracking solutions to manage that inventory is growing."**

Global Markets & Applications for RAIN RFID Solutions: A Market Research Report, RAIN Alliance, October 2022.

**"RAIN RFID a lot more clarity, and therefore a much more constructive conversation because you are actually talking about data and clarity of data and therefore you can drive conclusions and obviously put in place actions and initiatives to help run the business in a better way. This can be internal, but it can also be customer facing as well. It makes the conversation and the relationship with the customer a lot better and a lot easier."**

Inigo Canalejo, IFCO, Vice President of ESG

**"Many tyre manufacturers are looking at services and service offerings as a way to round off their product-oriented business. RAIN RFID provides a standardized way to uniquely identify tyres and build data-driven services and solutions"**

Peter Ramirez, Michelin, Industry Standards and Government Regulations Manager

**"RAIN RFID was there for efficiency but in fact it brings much more value as it's a very big enabler for new business models."**

**"We're exploring various business models like long-term renting and subscriptions to find the best fit. Recycling is a big focus for us, and we're also prioritizing product repairs. Our 100% RAIN RFID implementation means each product has a specific unique ID. We are the first company with an internal Digital Product Passport (DPP), which is already storing about 30 billion events. Internally, we use the DPP to track the life cycle of all our products. This is crucial for understanding how often a product is rented and determining when it's ready for a second life. We want to know everything about the product that is returned by our customer to decide whether they should be recycled, repaired, or sold again."**

Hervé D'Halluin, Decathlon, Leader RFID United

# RAIN RFID and the Apparel Industry's Sustainability Goals

**In recent decades, the retail apparel industry has emerged as a leader in the adoption of RAIN RFID, to enhance operational efficiencies.**

In retail alone, approximately 13.5 billion RFID labels were needed to meet the needs of the market in 2019.[20] Simultaneously, many retailers are shifting to align with future sustainability legislation, such as the aforementioned EU laws that aim to address ecodesign for products, transparency, waste and circularity. However, the 2023 Circularity Gap Report by the not-for-profit, Circle Economy reveals a concerning trend of shrinking global circularity, down from 9.1% in 2018, to 8.6% 2020, and now 7.2% in 2023, emphasizing the urgency for industries to embrace sustainable alternatives.[21] In the apparel industry, four business models (resale, rental, repair, and remaking) – all of which have the potential to decouple revenue streams from production and resource use – currently represent a $73 billion market.[22] Collectively, they have the potential to grow from 3.5% of the global fashion market today to 23 percent by 2030, a $700 billion opportunity.[23] This growth trajectory underscores the apparel industry's upcoming mandatory requirements and commitment to addressing the challenges of a linear economy.


As the industry transitions to circular business models, the need for comprehensive product information becomes critically important. Thus, Digital Product Passports emerge as a key driver of the apparel industry's journey towards circularity. Digital Product Passports can enable the management and sharing of data related to the entire lifecycle of a product. This includes information on materials and end of life pathways.

RAIN RFID in this context becomes instrumental as a data carrier, facilitating the tracking and tracing of apparel products.

The connection between the apparel industry's existing integration of RAIN RFID and increasing adoption of Digital Product Passports has the potential to enable the industry to transition from a 'take-make-waste' linear model to a circular future.

For mature applications like apparel tagging, VDC Research estimates that of the 80+ billion items produced each year approximately 20% are tagged. Among less mature applications – such as automotive parts (600+ billion items per year) less than 1% are being tagged with RAIN RFID today. The success of RAIN RFID in various retail categories is opening the door for much wider adoption not just in retail but across the supply chain in addition to other industries, further diversifying RAIN RFID's application base.



[20] RAIN Alliance VDC Market Report, 2022
[21] Circle Economy (2023). The Circularity Gap Report
[22] McKinsey and GFA (2020). Fashion on Climate
[23] McKinsey and GFA (2020). Fashion on Climate

Global Markets & Applications for RAIN RFID Solutions: A Market Research Report, *RAIN Alliance*, October 2022.

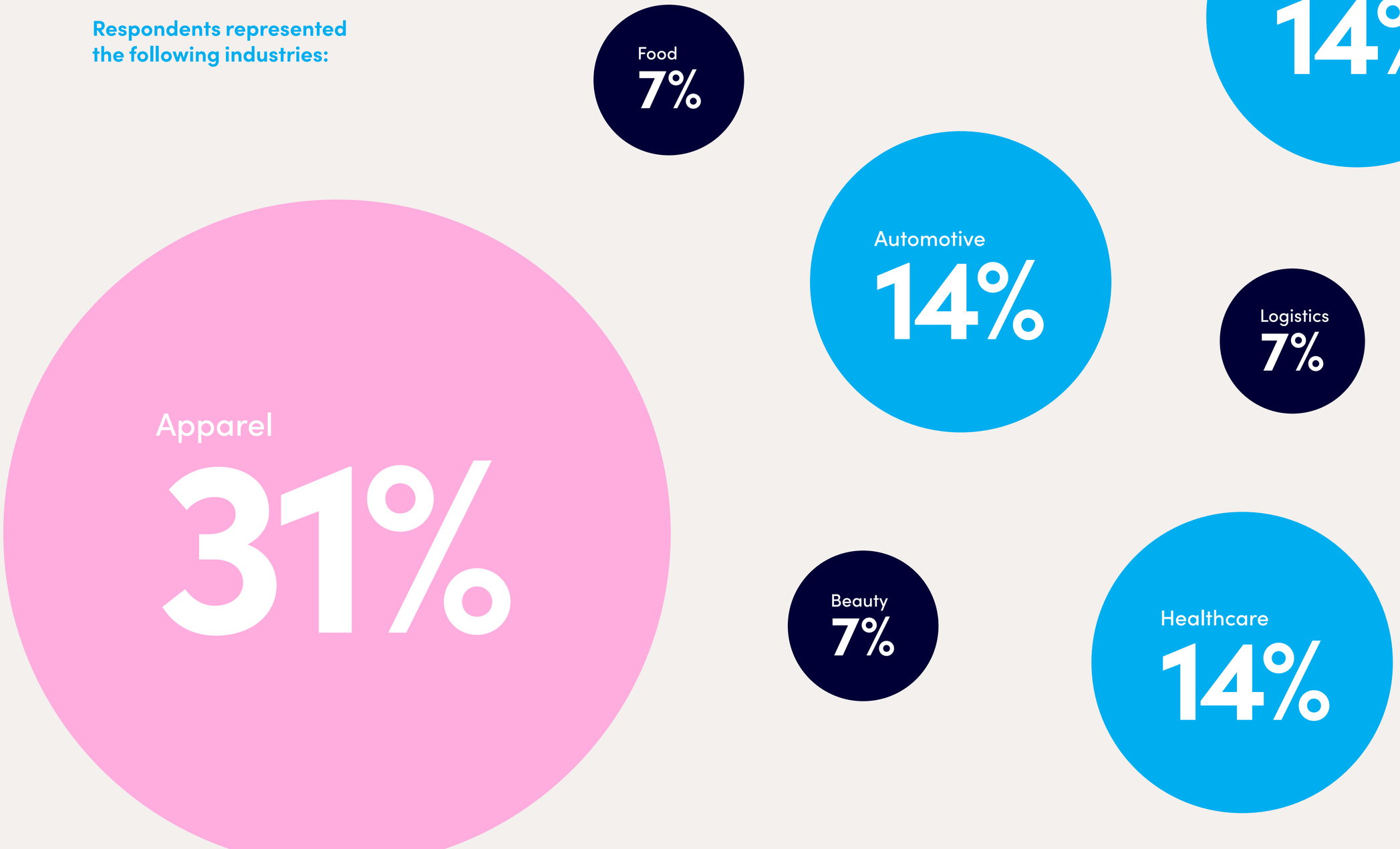
05

# Survey Spotlight: Key Findings

**To support the findings in this report, the RAIN Alliance conducted a survey of RFID experts and end users to gather information on the ways in which RAIN RFID is currently being used across industries, and to understand the existing link between RAIN RFID and sustainability.**

## The size of the entities that responded:

**Respondents represented the following industries:**



## They spanned markets across the globe including:

- 6% Oceania
- 6% Middle East
- 8% Africa
- 12% Global
- 12% Asia
- 16% United States
- 16% Latin America
- 24% Europe

## Respondents roles within the company included:

- 4% Sustainability/CSR
- 24% Other (including the following roles; engineer, management, standards and operations)
- 24% Innovation
- 24% IT
- 24% Supply chain

## All survey respondents are users of RAIN RFID

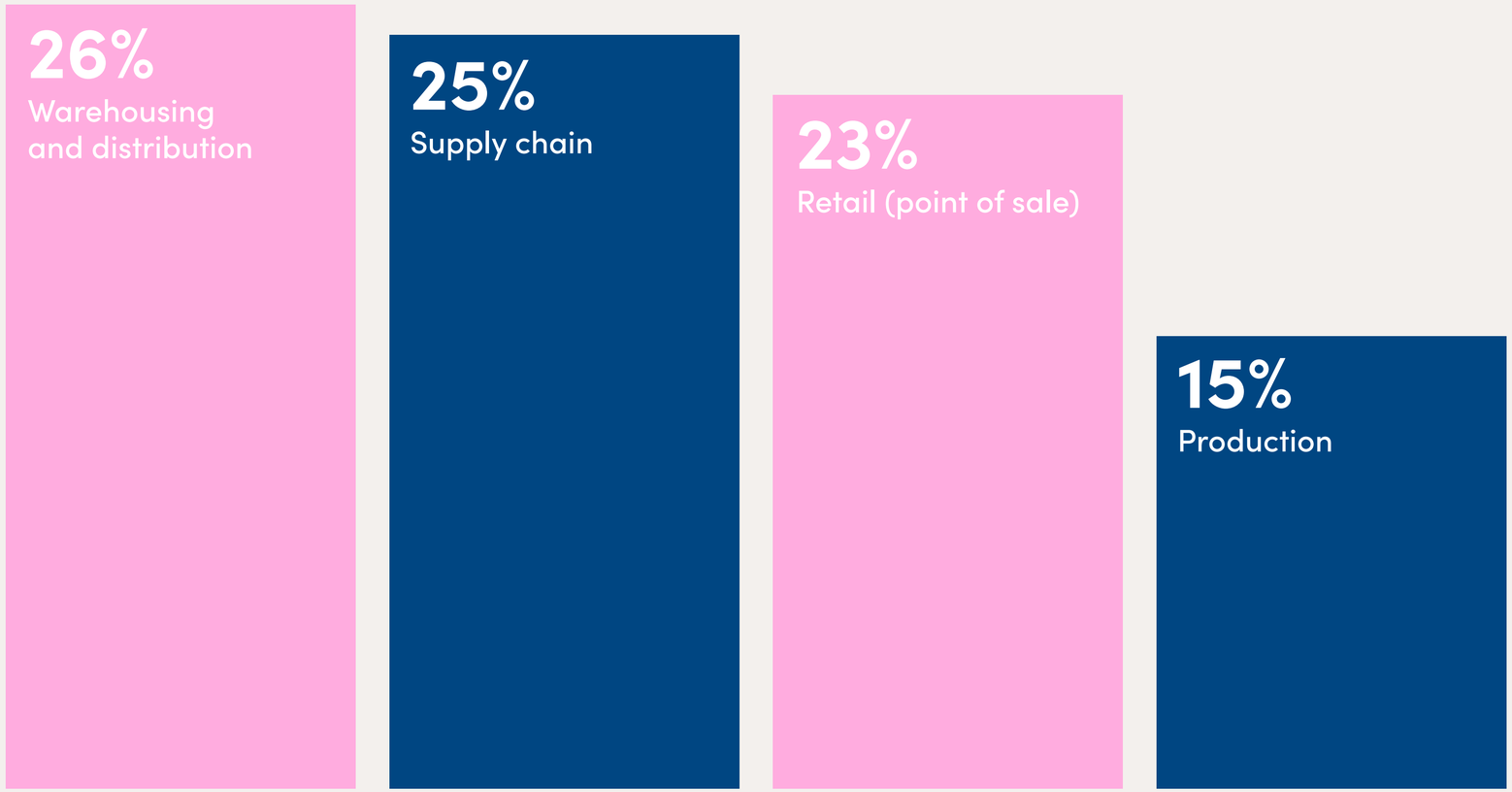
- 21% Using RAIN RFID for 3–5 years
- 26% Using RAIN RFID for 1–3 years
- 47% Using RAIN RFID for over 5 years

# How and Why Are Companies Using RAIN RFID?

## Respondents are leveraging RAIN RFID in diverse ways.

Presently, the applications are focused on business-related objectives such as inventory management and stock control, whilst 36% of survey respondents do not collect any type of sustainability related data through their RAIN RFID initiatives.

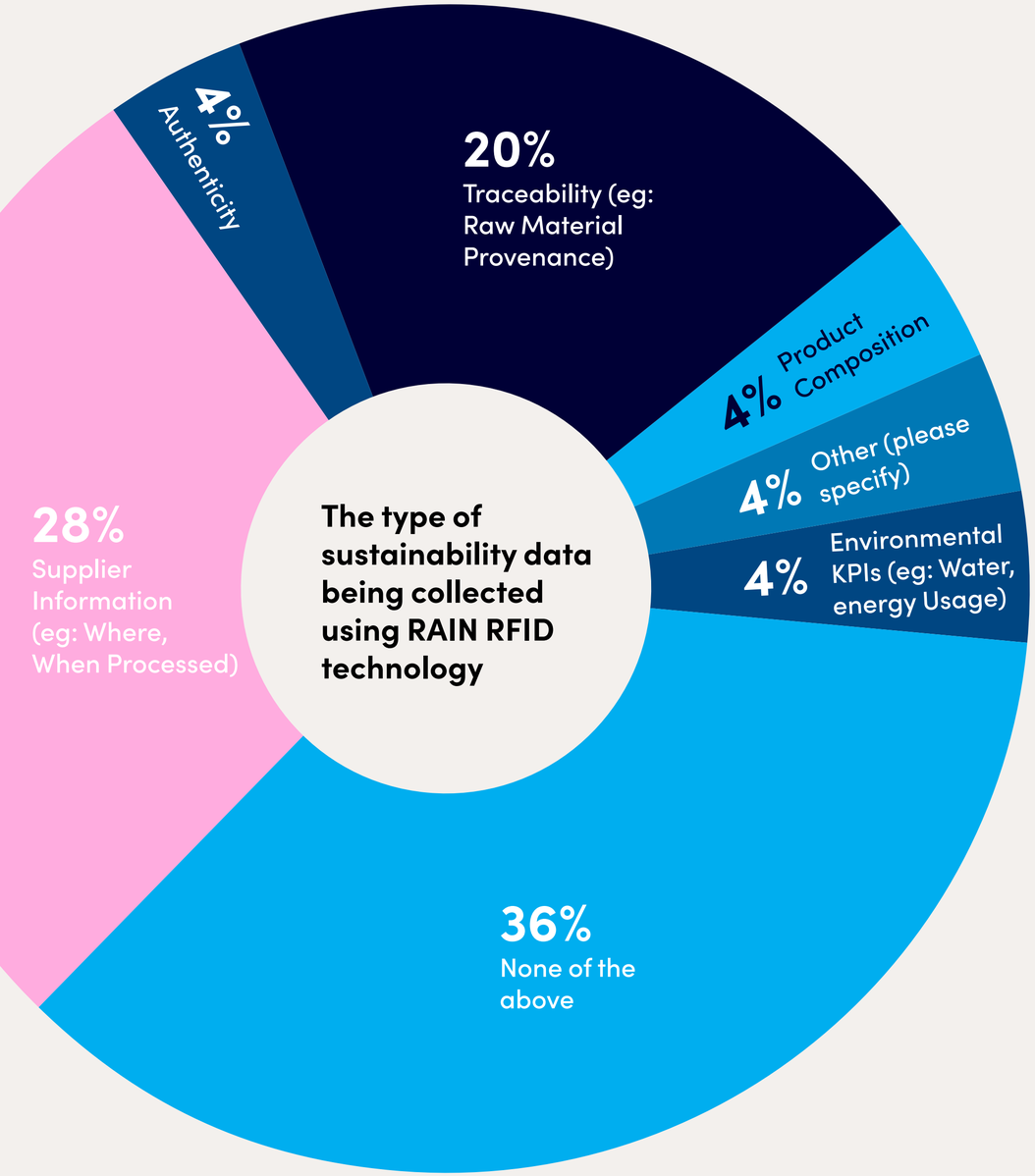
The areas in the value chain where most of the respondents are employing RAIN RFID include:




## Survey Insight: Top priorities for company sustainability strategies in 2023

When asked about their sustainability priorities, survey respondents answered as follows, in order of priority:

1. **Improve Supply Chain Traceability**
2. **Circularity (Improved Re-use, Recycling)**
3. **Broad Environmental Data (Energy Use, Water Use, Waste, etc)**
4. **Legislative Compliance**
5. **Customer Transparency (Informing Customers)**
6. **Net Zero (CO2 Emissions)**
7. **Tracking Human Rights / Fair Labour Practices Related Data**




# Aligning Business and Sustainability Data

The survey findings indicate that the data gathered via RAIN RFID currently supports two critical business objectives: inventory management (21%) and supply chain traceability (20%) , both of which are intertwined with sustainability goals. This correlation is consistent with the survey results highlighting the high priority of improving supply chain traceability as a key focus within companies' sustainability strategies for 2023 with 47% of surveyed companies selecting traceability-related regulation as relevant.

Recognizing this connection reveals that the data collected for business purposes, specifically in supply chain traceability, can also contribute valuable insights to shape and inform sustainability strategies.

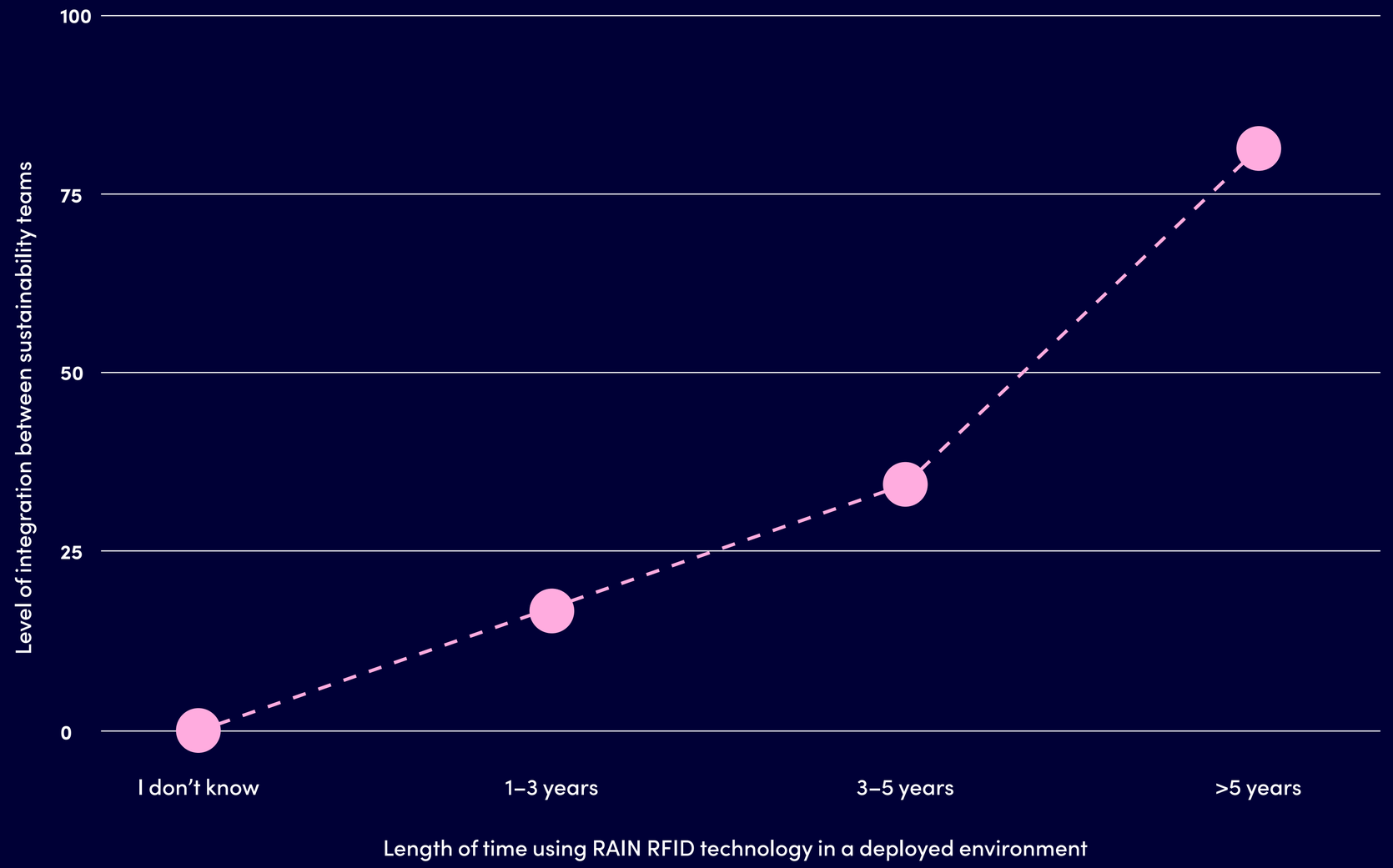
**The emphasis can be not only on acquiring new or distinct data but on directing already existing business data towards sustainability objectives in a strategic manner.**

# RAIN RFID Program Maturity

**There is a correlation between a company's RAIN RFID program maturity and the collection of sustainability data.**

As seen in the graph, respondents that have been using RAIN RFID for more than five years are more likely to have RAIN RFID and sustainability teams working together on projects. Our findings show that when a company has been engaged for less than 3 years with RAIN RFID, the median level of integration between RFID and sustainability teams is 18%. When RAIN RFID has been used for longer than 5 years the median level of integration between the RFID and sustainability teams increases to 80%. This seems to show that there is a maturity curve when adopting RAIN RFID, with business objectives as the focus at the beginning and more objectives including sustainability integrated as use increases.

## Length of time using RAIN RFID and level of integration between RFID and Sustainability teams



# Integrating Internal Departments

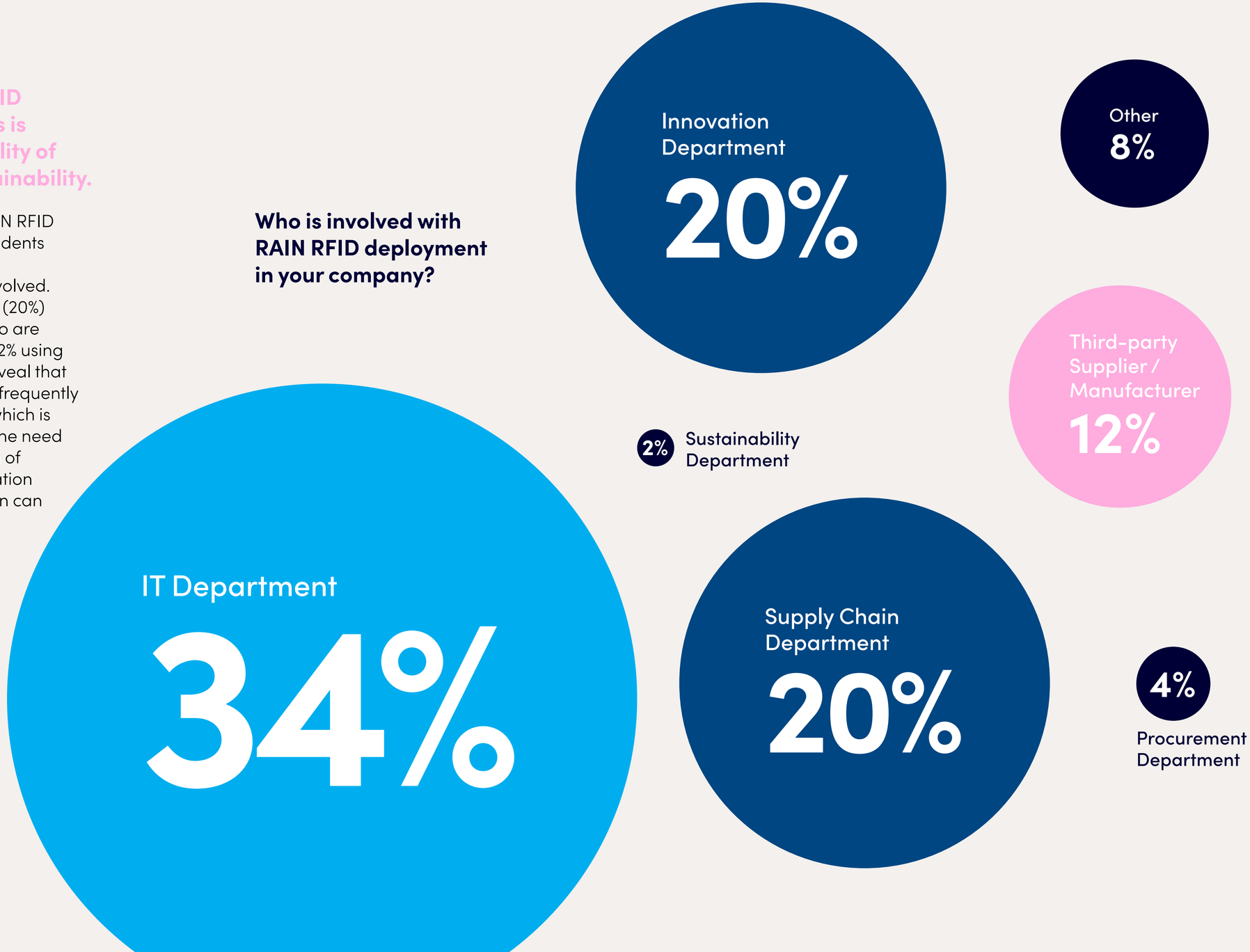
The survey responses reveal that, in many companies, there is a clear disconnect between those setting sustainability goals (e.g. C-suite or sustainability teams) and those implementing RAIN RFID (e.g. IT or supply chain) which could explain why there is a lack of sustainability data being collected. For example, 10% of respondents' identified their role as Sustainability/Corporate Social Responsibility, however only 1% of these respondents are involved in using RAIN RFID in their daily work. This highlights a large gap and potential for integration of sustainability departments more effectively into the broader RAIN RFID strategy.

**Who sets the sustainability goals within your company?**

## The responsibility for RAIN RFID deployment within companies is predominantly the responsibility of departments other than sustainability.

When asked who is responsible for RAIN RFID deployment within a company, respondents indicated that only a small minority of sustainability professionals (2%) are involved. By and large, it's IT (34%), supply chain (20%) and innovation departments (20%) who are leading RAIN RFID deployments with 12% using third party suppliers. These findings reveal that departments other than sustainability frequently take the lead in RAIN RFID initiatives, which is to be expected, but also underscores the need for greater collaboration and inclusion of sustainability expertise in these integration strategies to ensure that data collection can be directed to sustainability-related company initiatives.

**Who is involved with RAIN RFID deployment in your company?**



## Survey Insight: Use cases of RAIN RFID

When survey respondents were asked how RAIN RFID has helped their companies to achieve sustainability objectives, the following examples were cited:

- **Minimizing single use transport packaging**
  Through documentation of our closed loop process (each individual crate is RFID tagged) we are able to use our old plastic crates into the production of new ones
- **Replenishing and data accuracy has improved immensely from 70% to 90%**
- **Computing accurate CO2 footprint at item level**
- **Tracking apparel suppliers for legal working conditions**
- **Detecting fraud in our supply lines**
- **Understanding the product location, product composition, and stocks details**
- **Enabling valuable products key traceability while in use (beyond point of sale) and potentially until recycling**
- **Getting accuracy of maintaining stock with zero complaints from customer as we have full traceability**
- **Providing traceability, leading to improved productivity and reduced wastage**
- **Using embedded RAIN RFID tags in tyres for better sorting and to optimize retreading**
- **Supporting social sustainability resulting from management of narcotics in hospitals**
- **Enabling animal feed supplement trials specifically to measure methane reduction**

### Survey Insight:

**Survey Question: If applicable, can you share information about any common projects between the Sustainability and RFID teams?**

**"None. There is no connection and definitely an opportunity for us to connect and align on goals and how to achieve them. There is no direct link between us, them and sustainability."**

## Survey Insight:

When asked for the top reasons why their companies are not collecting sustainability data currently through RAIN RFID usage, Respondents answered as follows:

- **Limited team resources**
- **Cost of RAIN RFID**
- **RAIN RFID performance**
- **Don't know how**
- **Different priorities**
- **RAIN RFID is used only to identify a product, other data is elsewhere**
- **RAIN RFID captures data until purchase, but as it's on the price tag, it is not able to track additional information after sale**
- **Initial phase of project, so sustainability will come later**
- **Supply chain is not under our control so hard to collect this additional data**

# Insufficient Resources Hindering Sustainability

Interestingly, respondents' answers show that **a lack of team resources, RAIN RFID cost, lack of understanding, conflicting priorities and a lack of control are all contributing factors to the absence of sustainability-related data collection in their use of RAIN RFID**. This underscores the existence of several hurdles yet to overcome. However, if the correct tools are put in place to lower the burden and educate teams and partners, many of these friction points could be addressed. Through the survey we see that most companies already gather the majority of the necessary data to support sustainability goals therefore educating teams about how to strategically utilize this existing data could significantly advance sustainability goals.

# Regulations and the Traceability Imperative

Traceability-related regulations lead the charge as an important regulatory driver with 47% of surveyed companies selecting traceability regulations as the most relevant for them. Investor demands for ESG data is another high priority for respondents. Other respondents also cited security legislation, specifically regarding privacy, and product safety regulation related to their specific industries.

## Most relevant regulations

**Which regulations are the most relevant to you in 2023?**

# How can RAIN RFID support companies to achieve their sustainability objectives?

06

# Case Studies

**Beyond the survey results, we sat down with experts at three leading companies to delve deeper into how they are reshaping their business operations through RAIN RFID. These case studies offer valuable insights into the transformative power of RAIN RFID to enable circular business models, collaborative partnerships, and customer-centric approaches. The experiences of these industry frontrunners offer insights to companies on the journey to integrating RAIN RFID into their operations.**

## Case study:

# RAIN RFID Enabling New Circular Business Models at Decathlon

**In 2008, Decathlon, the world's largest sports retailer, embarked on a transformative journey by implementing RAIN RFID.**

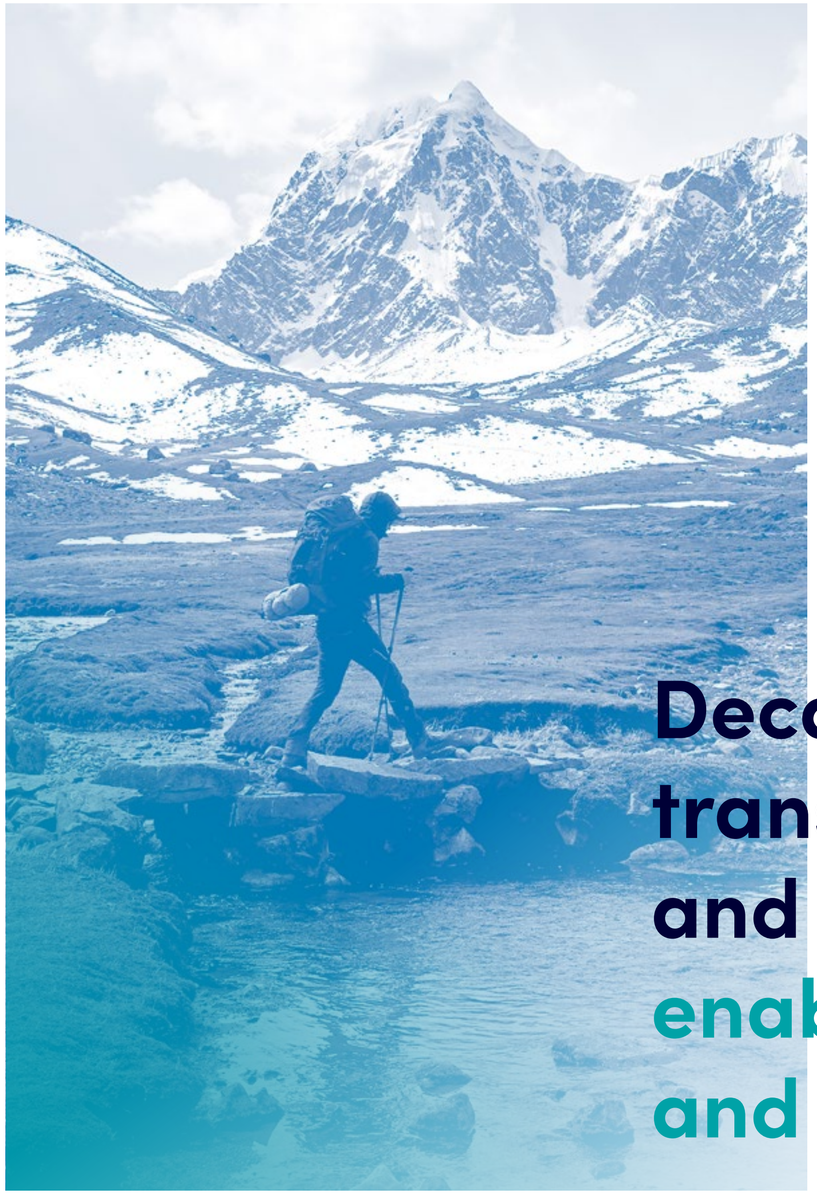
The initial drivers for Decathlon's RFID pilot program was based on the desire for a more transparent inventory, efficient supply chain operations, and a proactive approach to combat shrinkage (the loss of inventory due to circumstances such as shoplifting, vendor fraud, employee theft, and administrative error). In conversation with the Leader of RFID United at Decathlon, Hervé D'Halluin, he highlighted **"We did the roll out in 2012 – 2014 to the stores, so the technology was there in 4-5 years...and we achieved 100% of the products source-tagged in 2019"**.

In the years following deployment, Decathlon found that the adoption of RAIN RFID offered far-reaching benefits beyond its initial objectives. In a shift towards sustainability, **Decathlon has developed a robust strategy and 2020-2026 Transition Plan[24], which includes the integration of RAIN RFID to enable a shift towards circular business models**. These include promoting second-life products, developing rental and subscription services, investing in recycling initiatives, and prioritizing product repairs. Decathlon recognizes the value in giving their products a more effective second life to minimize their overall environmental impact, which aligns with their commitments to reduce their carbon footprint and achieve zero product waste by 2026.

**"So in the end, when you deal both with circularity and efficiency then the only solution will be to use RAIN RFID."**

Hervé D'Halluin, Decathlon Leader RFID United

[24] Decathlon Transition Plan 2020-2026



Decathlon's dedication to sustainability extends to the very fabric of its products. In 2022, 23% of Decathlon products sold were ecodesigned (compared to 10% in 2021).[25] **The integration of RAIN RFID tags at the product manufacturing stage since 2013 has become a fundamental aspect of ensuring traceability**. Additionally, Decathlon is actively seeking to use durable RAIN RFID tags that stay with a product until its eventual recycling. The tags are envisioned, not merely as identifiers, but also as carriers of essential data, providing information on product composition crucial for efficient recycling processes. Hervé stated, **"We want to know everything about the product that is returned by our customer to be able to understand if it has to be recycled, or if it has to be repaired or sold as a second life product."**

While the overarching goal is to contribute to Decathlon's sustainability strategy, the company recognizes the potential for economic gains through the integration of RAIN RFID in new circular business models. This involves seizing the opportunity to recycle products and derive value from recyclable materials. As Decathlon continues to pioneer RAIN RFID integration, the company is actively testing and implementing recycling and sorting initiatives. With incoming European legislation such as the Ecodesign for Sustainable Products Regulation (ESPR) which includes Digital Product Passports, **focusing on circularity and traceability of products through unique product identification will place Decathlon in a favorable position ahead of the regulatory curve**. As early adopters with over a decade of experience, Decathlon further supports the industry to transform, as Hervé highlighted "we also are helping a lot of other companies on their journey".

**Decathlon's journey with RAIN RFID has transformed from a tool for efficiency and inventory visibility to a central enabler of new circular business models and sustainable practices.**

[25] Decathlon 2022 Performance

## Case study:

# The Power of Collaboration in the Tyre Industry with Michelin

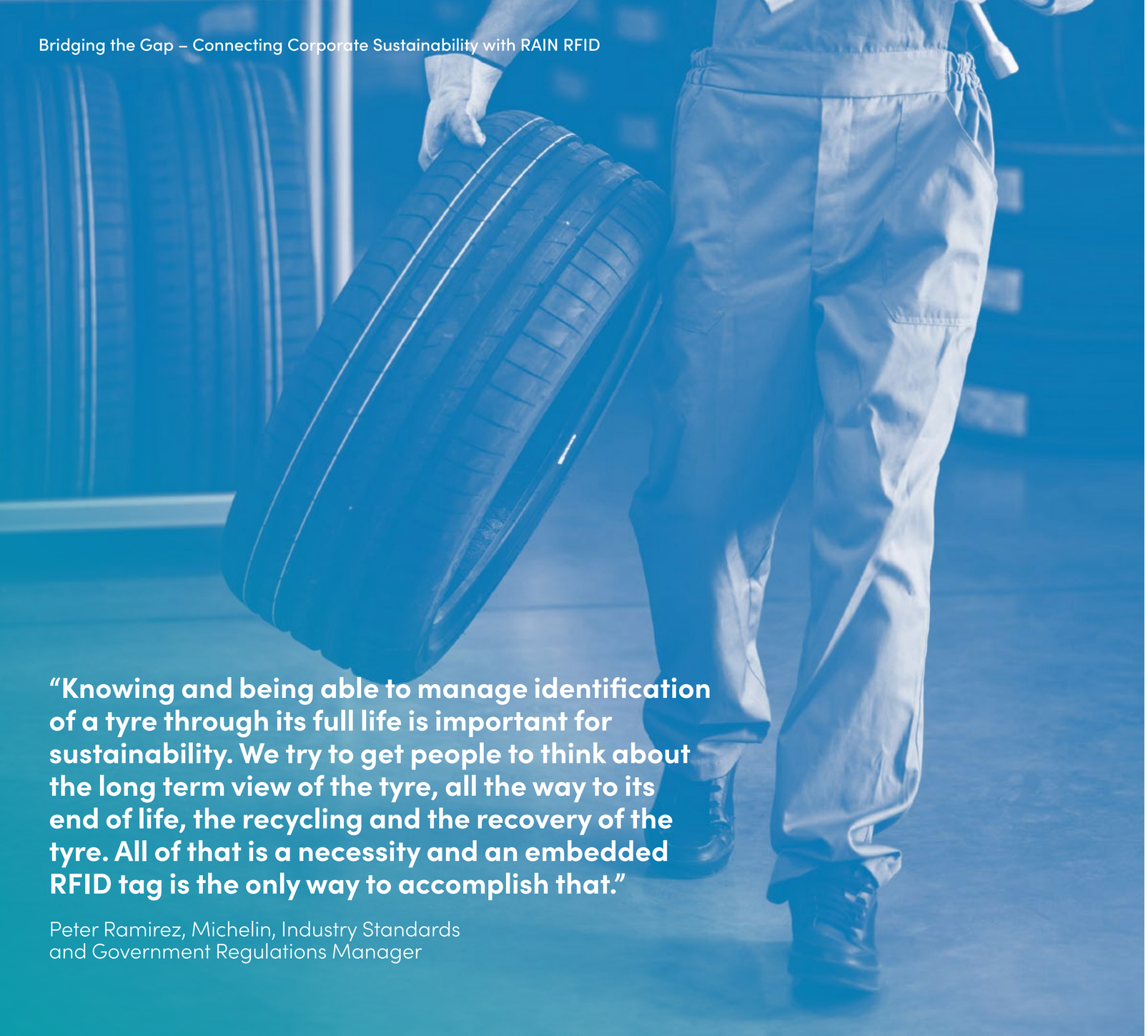
**“The first and most important best practice is to have broad industry adoption and collaboration across the tyre industry. This is how we will make things such as EU Digital Product Passport and RAIN RFID in tyres possible”**

Peter Ramirez, Michelin, Industry Standards and Government Regulations Manager

**In response to the need for standardizing tyre identification data and enhancing the traceability of tyres across their lifecycle, the tyre industry has undergone a transformative shift from competition to collective action in recent decades.**

This shift was shaped by the widespread adoption of RAIN RFID, selected as the leading data carrier technology and embraced not only by Michelin but by the entire tyre industry.

Starting in the early 2000s as discussions about electronic tyre identification, the push for RAIN RFID and data standardization across the tyre industry has gained traction in recent years. Major tyre manufacturers saw **the value in RAIN RFID for traceability and obtaining accurate compliance data** in anticipation of changing regulations. The technology however has become more than just a traceability and compliance tool; it now symbolizes the tyre industry’s commitment to a long-term view on sustainability, extending from tyre production to end-of-life circular economy practices.



**“Knowing and being able to manage identification of a tyre through its full life is important for sustainability. We try to get people to think about the long term view of the tyre, all the way to its end of life, the recycling and the recovery of the tyre. All of that is a necessity and an embedded RFID tag is the only way to accomplish that.”**

Peter Ramirez, Michelin, Industry Standards and Government Regulations Manager

In a groundbreaking collaboration, major players in the global tyre industry, including Michelin, teamed up to set the standards for tyre data. This collective effort officially launched the Global Data Service Organisation for Tyres and Automotive Components GDSO in January 2022. The integration of RAIN RFID embedded tags into tyres and the launch of GDSO are key enablers in the digitization of the tyre industry, supporting the development of new services connecting tyres from different companies. For Michelin, the integration of RAIN RFID technology into tyres has improved various facets of their operations, including logistics, inventory management, as well as end-of-life, retreading, and recycling operations through enabling more efficient sorting.

## Global Data Service Organisation

Established in January 2022 the Global Data Service Organisation for Tyres and Automotive Components, abbreviated to GDSO, is an international non-profit association. The purpose of the organization is to develop solutions tackling online tyre data access and standardize data related to tyres, whilst defining solutions to access and exchange data without compromising competitor data. Founded by leading tyre manufacturers Bridgestone, Continental, Goodyear, Michelin and Pirelli, the organization now welcomes membership from all tire manufacturers, as well as associations or organizations that unite tire manufacturers.

RAIN RFID has emerged as a cornerstone of the tyre industry's growing commitment to sustainability. Michelin, in particular, has harnessed **the power of RAIN RFID to bridge the gap between physical tyres and the virtual data** associated with them. By embedding RAIN RFID tags into each tyre, Michelin ensures **traceability, reliability of data, and efficiency throughout the entire lifecycle to be good stewards of the materials it uses**. RAIN RFID tags do not have batteries, are approximately 40 mm in length, under 2 mm in diameter, and weigh less than 0.2 grams. The tags are specifically designed to survive the full life-cycle of the tyre, including the retread process. Materials in the tags do not present challenges for tyre recycling and in fact support sorting at the tyres' end of life, contributing to the industry's circular economy efforts and reinforcing its commitment to environmental sustainability.

The RAIN RFID embedded in Michelin's tyres plays a role in achieving their strategic 2030 environmental sustainability ambitions. **It acts as a bridge, connecting unique tyres or families of tyres to data that supports life cycle assessments and monitoring data for sustainability goals related to recyclable materials**. The technology ensures efficient identification for recycling, facilitating proper sorting and processing, which is an essential element in Michelin's pursuit of a circular economy through the 'Michelin 4R' strategy, which is designed to address the challenges of resource preservation and end-of-life product management by activating four levers: **Reduce, Reuse, Recycle and Renew**.

Beyond its immediate industry impact, the tyre industry's collaborative journey serves as a compelling example for other sectors. The alignment on RAIN RFID, data standards and implementation in this pre-competitive space demonstrates how collective action can drive transformative change towards sustainability goals.

**The tyre industry's journey stands as an inspiration for other sectors to unite, align, and collectively adopt RAIN RFID and use the power of collaboration to drive positive social and environmental impact.**

**“Our customers expect value creation from us. Historically, they mainly focused on cost savings but now companies are also expecting value from a sustainability point of view”**

Iñigo Canalejo, IFCO, Vice President of ESG

## Case study:

# Providing value to customers and reducing food waste with IFCO

**In the world of circular business practices, IFCO stands out as a leader of innovation.**

As a B2B company offering reusable packaging as a service, IFCO’s model revolves around the concept of shared resources and global collaboration. With a pool of 380 million Reusable Packaging Containers (RPCs), commonly known as crates, IFCO operates on a global scale in over 50 countries. The company’s Vice President of ESG, Iñigo Canalejo, shared insights regarding their circular business model, emphasizing the significance of maintaining a continuous flow of crates within their network and the role of RAIN RFID.

Iñigo describes IFCO’s concept succinctly: instead of each customer independently manufacturing and managing their packaging, IFCO provides a standardized system where clients share and reuse the same type of packaging in the fresh produce supply chain. The key to success in their business model lies in the sheer scale of their operation. With customers utilizing their reservoir of reusable crates 2 billion times annually, managing such an extensive network poses significant challenges. As Iñigo highlights, the economy of scale is crucial for the efficient operation of their reusable model, emphasizing the importance of tracking and managing the crates within this vast network.

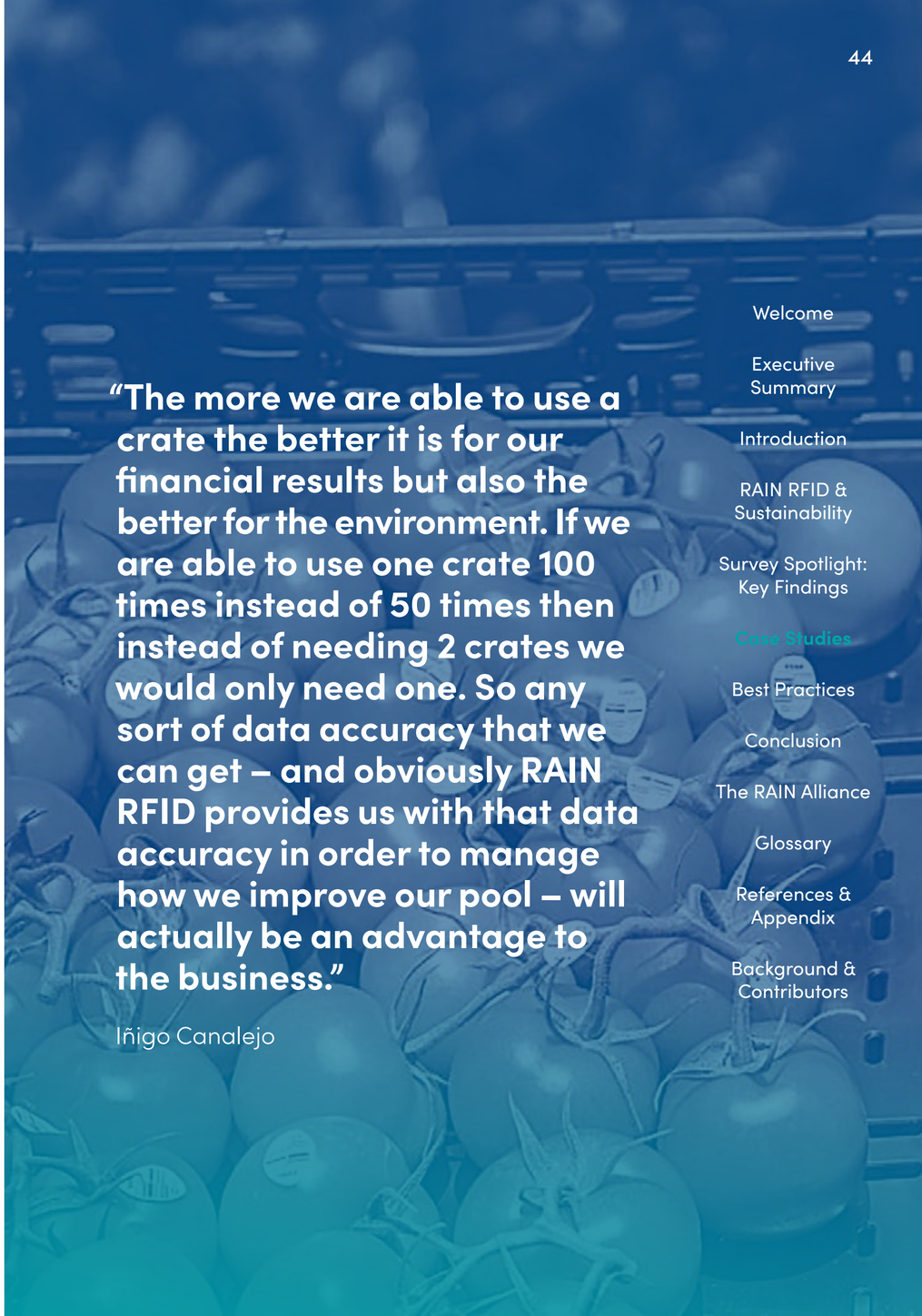
To address this, IFCO has in recent years turned to RAIN RFID technology. Equipping the reusable crates with an RFID tag alongside other technologies allows for the automation of tracking processes. **By precisely tracking the movement and usage of each crate, IFCO can measure and improve their turn rate – the frequency with which a crate is used within a specific timeframe. This metric is not only vital for financial performance but also aligns with IFCO’s commitment to environmental sustainability.**

# Maximizing the utilization of each crate reduces the need for additional packaging, contributing to both economic and environmental efficiency.

Beyond the benefits of crate tracking, Iñigo sees further opportunities of RAIN RFID in associating the fresh food produce within the crate to the crate itself. This approach extends supply chain visibility not only to IFCO but also to their customers. While IFCO is interested in the location of the crates, customers are concerned with the whereabouts and condition of the produce. By tagging the produce with RAIN RFID, IFCO provides their customers with valuable data, enabling them to manage their own supply chains more effectively.

A significant ripple effect of this enhanced visibility is the potential reduction of food waste. In the complex web of the food supply chain, the challenge often lies in not knowing the precise location of produce, leading to inefficiencies and wastage. Iñigo states, **"anything that we can do, any technologies that we can put in place to make our customers life easier will first of all improve our customer satisfaction, but most importantly is going to support how our customers embrace reusable packaging"**. RAIN RFID has proven to empower growers and retailers with tools to understand the real-time location of their produce. This knowledge, Iñigo states, can aid in better inventory management, ensuring produce is in the right place at the right time, in the right condition – ultimately reducing food waste and reducing the impact on our changing climate.[26]

[26] Project Drawdown, Reduced Food Waste



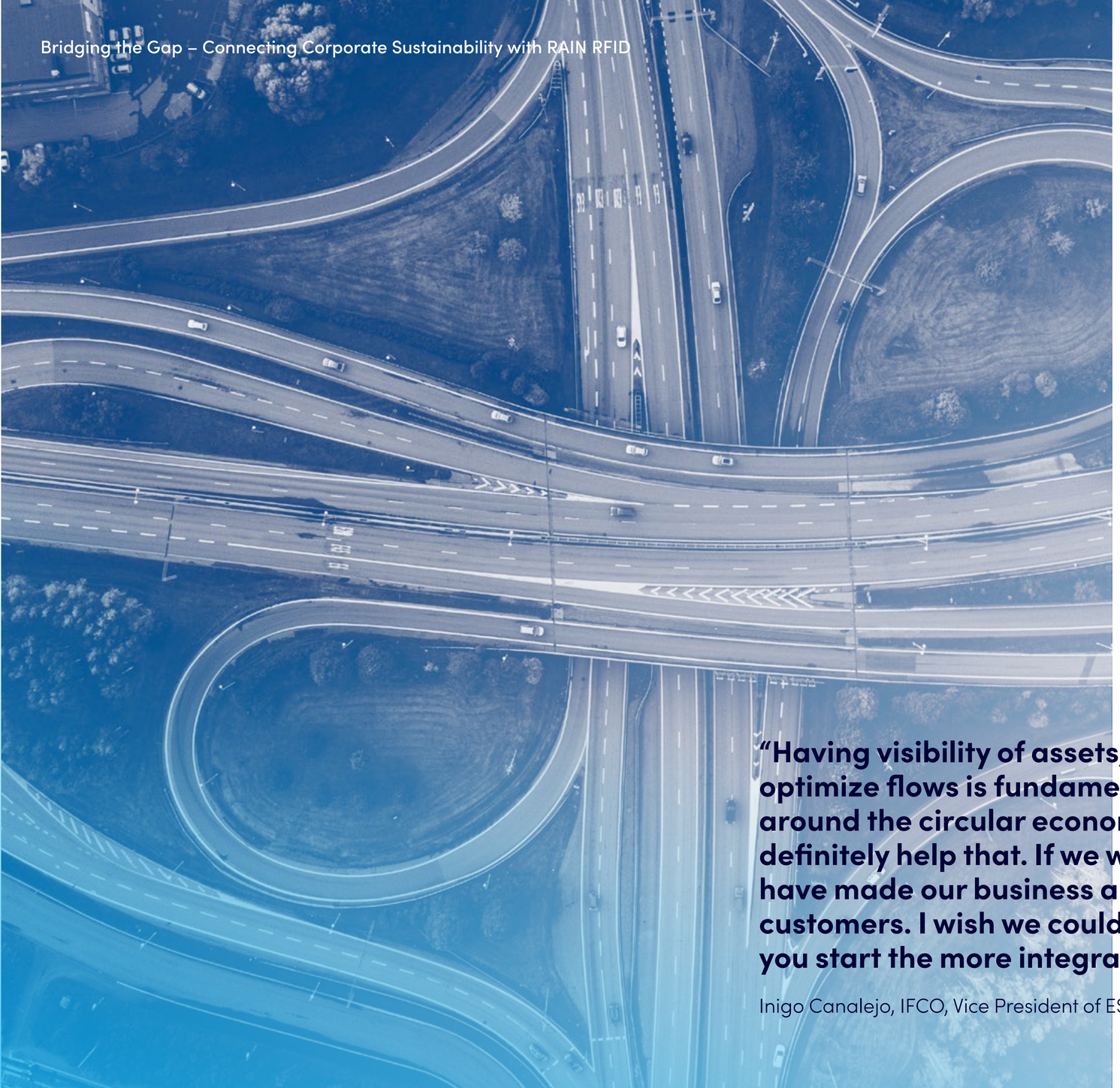
**"The more we are able to use a crate the better it is for our financial results but also the better for the environment. If we are able to use one crate 100 times instead of 50 times then instead of needing 2 crates we would only need one. So any sort of data accuracy that we can get – and obviously RAIN RFID provides us with that data accuracy in order to manage how we improve our pool – will actually be an advantage to the business."**

Iñigo Canalejo

07

# Best Practices:

## Recommendations to Accelerate Adoption



**The experiences and expertise of leading companies connecting RAIN RFID to their sustainability objectives offers a roadmap for other companies, organizations and institutions aspiring to implement similar strategies.**

In this section, we dive into the valuable insights gathered from the survey and in-depth interviews with industry leaders to uncover best practices and offer recommendations to accelerate adoption of RAIN RFID for sustainability use cases. The collective learnings shared by early adopters and industry leaders can serve as a compass, guiding organizations embarking on this journey towards the most effective integration of RAIN RFID for maximum impact on sustainability objectives.



**“Having visibility of assets, knowing where they are and how to optimize flows is fundamental to operating a model that works around the circular economy. I think technology like RAIN RFID can definitely help that. If we would have had that 30 years ago, it would have made our business a lot easier for us, but also for our customers. I wish we could have started earlier. Because the earlier you start the more integrated you can get it into the business.”**

Inigo Canalejo, IFCO, Vice President of ESG

## Recommendation 1:

# Foster Collaboration

It is common in complex organizations for different business units or departments to have their eyes focused on their own priorities and KPIs which can lead to siloed thinking. **When using RAIN RFID to achieve sustainability goals, it is essential to bridge expertise and knowledge across teams and functions.** Fostering strong connections between RAIN RFID implementation teams and those working in sustainability is key to ensure that proper indicators are identified and measured that will allow companies to collect and use necessary data related to climate goals and other impact objectives.

**Cross-industry partnerships and fostering collaborative industry initiatives are also identified as critical in the journey towards sustainability.** RAIN RFID offers companies a powerful means to address pressing sustainability challenges through industry collaboration. The case study featuring Michelin serves as a prime example, underscoring the significance of collaborative efforts across industries in a pre-competitive landscape to achieve sustainability goals through the application of RAIN RFID.

**“Everyone sees the ‘why’ now for using RFID. They are convinced. The issue is that they still don’t know how to do it. It’s not a question of convincing, but HOW to do it the best way.”**

Hervé D’Halluin, Decathlon, Leader RFID United

## Recommendation 2:

# Explore New Business Models for Sustainability

Integrating product level identification through RAIN RFID opens opportunities for new business models as identified in the case studies. For example, opening new revenue opportunities through improving reusability of products while simultaneously achieving sustainability targets. Similarly, efficient use of energy and water along with proper waste management reduces costs while improving company environmental impact.

## Recommendation 3:

# Identify Key Performance Indicators

In all cases, the project plans must identify the desired outcomes and ensure that KPIs are in place to monitor and measure results. Once collected, resources need to be in place to analyze and make sense of the data. KPIs facilitate a culture of continuous improvement, allowing for adjustments and optimizations based on data-driven decisions. Transparent communication throughout the company of KPIs linked to ownership fosters accountability. As sustainability is a rapidly evolving area, flexibility in KPI selection and adaptation ensures alignment with evolving project needs, ultimately contributing to project success and the achievement of strategic objectives.

## Recommendation 4:

# Provide Robust Training Resources

Survey results also showed that many people are looking for support in terms of training, case studies, and consultants for RAIN RFID integration. Often, learning from case studies and market leaders or using outside expertise can help accelerate this process, reducing reliance on internal teams and resources. Discover resources such as webinars, industry reports, whitepapers and more at **https://rainrfid.org/resources/**

In addition, by incorporating internal cross-departmental team training on the integration of RAIN RFID for sustainability, organizations can strengthen their internal capabilities and promote a more cohesive approach to RAIN RFID adoption within the company.

**Examples:**

# Sustainability Use Cases to enhance Existing RAIN RFID applications

## Inventory management data

- Track energy use and measure, calculate and reduce energy use at item level.
- Track and improved inventory forecasting for overproduction mitigation as well as waste management and reduction.
- Asset tracking to optimize maintenance schedules to keep products in use for longer.
- Enable new business models eg; rental, resale, repair.

## Supply chain traceability data

- Inform and comply with CSRD, DPP, and other incoming mandatory sustainability reporting legislation requirements.
- Inform LCA methodology to provide a more accurate understanding of a product's footprint.
- Verify social and labor compliance in the supply chain, and with modern anti-slavery policy.

## Product component and production data

- Facilitate end-of-life sorting and large scale recycling efforts, and benefit from utilizing recycled materials.
- Customer transparency, informing customers of sustainability attributes.
- Raw material traceability and resource optimization.
- Ensure product compliance with incoming Ecodesign for Sustainable Products Regulation (ESPR) and verify environmental claims via Digital Product Passport.

As identified in this report, integrating RAIN RFID into a company's sustainability strategy has the potential to enhance supply chain traceability, support new circular economy business models, reduce waste, facilitate end of life sorting, and contribute to overall sustainability goals. Although these examples highlight positive applications of RAIN RFID, the link between the technology and sustainability use cases is still a developing area with untapped potential.

Refer to the following step-by-step guide to begin leveraging RAIN RFID to achieve your organization's sustainability goals.

# Roadmap:

## How companies can leverage RAIN RFID to achieve sustainability objectives.

01

### Secure top-down commitment

- → Gain commitment from top-level decision makers to explore RAIN RFID applications that can direct existing data infrastructure toward sustainability initiatives.
- → Emphasize the potential benefits and align RAIN RFID sustainability use cases with broader operational objectives.

02

### Clearly define your strategy

- → Develop a well-defined short to long term RAIN RFID strategy that integrates with existing data-driven business objectives.
- → Clearly outline desired sustainability outcomes and identify KPIs for monitoring and measuring success.
- → Consider the long term scalability and integration within existing systems.

03

## Reframe existing data for sustainability

- Analyze the data already collected for business objectives and identify elements relevant to sustainability – including supply chain traceability and inventory management.
- Develop strategies to reframe and repurpose this data to align with sustainability goals as well as to identify new data points required and how they support business objectives.

04

## Enhance integration between departments

- Strengthen collaboration between sustainability and technology/RFID related departments, focusing on utilizing existing data synergies.
- Foster cross-functional teams to utilize internal expertise, enhance communication and support ease of data sharing between departments.

05

## Seek education and expert support

- Explore training opportunities such as webinars to educate teams on aligning existing data with RAIN RFID technology. Discover the RAIN Alliance training course schedule at https://rainrfid.org/rain-rfid-training-course-schedule/
- Engage RAIN RFID experts and consultants to guide the application of RAIN RFID for sustainability.

06

## Learn from successful models

- Build upon the foundations laid by successful companies in integrating RAIN RFID for sustainability.
- Discover resources such as case studies, industry reports and more at https://rainrfid.org/resources/
- Utilize case studies as benchmarks, drawing insights to optimize data utilization for sustainability objectives.

07

## Pilot implementation

- Conduct a small-scale pilot implementation, utilizing existing data infrastructure for RAIN RFID sustainability use cases.
- Gather feedback to refine the integration process and ensure alignment with sustainability and business-driven objectives.

08

## Full-scale application and continuous improvement

- Roll out the RAIN RFID implementation across operations, emphasizing continuous improvement by leveraging existing data.
- Monitor performance using key indicators and refine strategies to optimize sustainability benefits, with a long term perspective.

09

## Establish Collaborative Partnerships

- Forge collaborative partnerships with other industry players to collectively pursue overarching sustainability goals, such as the United Nations Sustainable Development Goals (UN SDGs).
- Share best practices, insights, and resources to amplify the positive impact of RAIN RFID on sustainability.

08

# Conclusion:

## A Sustainable Future Enabled by RAIN RFID

# The opportunity for companies to achieve their sustainability goals leveraging RAIN RFID is enormous.

As shown in this report, there are multiple potential sustainability use cases for RAIN RFID application: new service models, enabling sorting and recycling through product composition information, improving supply chain traceability, collection of environmental information to track and report on CO2 reduction, etc. In addition, the business case for incorporating RAIN RFID is strong, contributing to company efficiencies along the supply chain, reducing shrinkage at retail, and powering new consumer interactions. Indeed, this is one of those rare opportunities where financial returns and sustainability objectives can run in parallel.

The most significant challenge to adopting RAIN RFID to solve sustainability issues lies in the reality that individual teams within companies are often siloed, contributing to a lack of unified vision, uncertainty, and uneven commitment. Fortunately, there is at least one solution that is powerful and straightforward: recognizing that data already being collected for business reasons such as operational efficiency can be reframed to play a crucial role in informing and achieving sustainability objectives.


Utilizing RAIN RFID as the data carrier to collect and store business and sustainability data while addressing circularity challenges marks a new frontier of possibilities  When it comes to RAIN RFID implementation, there is no one-size-fits-all approach but organizations that take the following important steps can begin to identify how this powerful technology can support all their business needs.

As the report has identified, the relationship between RAIN RFID and sustainability use cases is in its infancy.  In addition to the examples highlighted above, more use cases will emerge, pushing the boundaries of how data is collected and applied to sustainable business practices. But one thing is clear: with today's existing market drivers such as regulation, sustainability urgency, and consumer and investor demands, the time to implement RAIN RFID beyond inventory management is now.

**Forward-looking companies will harness the needed expertise and knowledge to implement robust RAIN RFID strategies for business and sustainability objectives through collaboration within their companies and across their industries. Others will be left behind.**

# About RAIN Alliance and the Sustainability Work Group

The RAIN RFID brand name represents passive ultra-high frequency (UHF) RFID technology.

The RAIN Alliance is a consortium of companies that together want to create a smarter and more sustainable world by using RAIN RFID technology to connect trillions of everyday items across their entire lifecycle, simply and inexpensively.

The RAIN Alliance drives awareness and foster's market adoption of RAIN technology and supports the development of the RAIN brand.

The RAIN Alliance offers a variety of membership benefits, including industry research, educational sessions, promotion, and networking opportunities that connect industry members and end-users.

For more information, please visit www.RAINRFID.org

**Sustainability Work Group Members:**
The RAIN Alliance is committed to sustainability. The Sustainability Work Group identifies, develops, and publishes materials that relate to the issues surrounding sustainability and the use of RAIN RFID.

Beontag (co-leader)
Talkin' Things (co-leader)
All4Labels
AMD
Anantics
Arizon
Avery Dennison
Caen
Decathlon
EM
Fineline
GS1
Hana
Impinj
Johnson Controls
Kyobi
Logopak
Michelin
Nedap
NXP
Primo1D
PULR
PyCube
S&S
Sato
SPF Inc
Sustinerid
Tadbik
Tageos
Trace-ID
Voyantic
Zebra



**The RAIN Alliance is the industry organization supporting the universal adoption of RAIN RFID.**

# Glossary

**Circular economy (CE)**
CE is a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible. CE aims to tackle global challenges such as climate change, biodiversity loss, waste, and pollution by emphasizing the design-based implementation of the three principles of the model. The three principles required for the transformation to a CE according to the Ellen MacArthur Foundation are: eliminating waste and pollution, circulating products and materials, and the regeneration of nature.

**Carbon Disclosure Project (CDP)**
CDP is a not-for-profit charity that runs the global disclosure system for investors, companies, cities, states and regions to manage their environmental impacts. The world's economy looks to CDP as the gold standard of environmental reporting with the richest and most comprehensive dataset on corporate and city action.

**Corporate Social Responsibility (CSR)**
The continuing commitment by businesses to behave ethically and contribute to economic development while improving the quality of life of the workplace as well as the local community and society at large.

**Extended Producer Responsibility (EPR)**
EPR is an environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle.

**Internet of things (IoT)**
IoT describes physical objects (or groups of such objects) with sensors, processing ability, software and other technologies that connect and exchange data with other devices and systems over the Internet or other communications networks. RAIN RFID is the most common connection between the "thing" and the "internet".

**Life Cycle Assessment (LCA)**
LCA is a technique used to assess the environmental impacts associated with every stage of a product's life, from raw material extraction through to materials processing, manufacturing, distribution, use, repair and maintenance, and disposal or recycling. LCAs measure everything from water, energy and raw materials inputs to outputs into the air, land and water. Taking a lifecycle view is essential to avoid making improvements in one area that are unknowingly detrimental to another.

**Science-based targets (SBTs)**
SBTs provide a clearly-defined pathway for companies and financial institutions to reduce (GHG) emissions, helping prevent the worst impacts of climate change and future-proof business growth. Targets are considered 'science-based' if they are in line with what the latest climate science says is necessary to meet the goals of the Paris Agreement – limiting global warming to 1.5°C above pre-industrial levels.

**Sustainability**
A concept based on the principle that humans depend on the natural environment for survival and well-being, and that humans and nature can exist in productive harmony. Sustainability is the conditions that ensure that human impact on the environment is sufficiently mitigated in pursuit of the protection of natural resources and of future generations' access to water, material, resources, and social and economic requirements.

Read the full RAIN RFID Sustainability Glossary

# Abbreviations

**CEAP**
Circular Economy Action Plan

**CSRD**
Corporate Sustainability Reporting Directive

**CSDDD**
Corporate Sustainability Due Diligence Directive

**DPP**
Digital Product Passports

**EPR**
Extended Producer Responsibility

**ESPR**
Ecodesign for Sustainable Products Regulation

**ESG**
Environment, Social, Governance

**PEF**
Product Environmental Footprint

**PPWR**
Packaging and Packaging Waste Regulation

**SBTI**
Science Based Targets Initiative

**UN SDGs**
United Nations Sustainable Development Goals

# References (list based on footnotes)


1. RAIN RFID Alliance
2. Global Markets & Applications for RAIN RFID Solutions: A Market Research Report, Rain Alliance, October 2022.
3. The 17 Goals, Sustainable Development United Nations
4. SDG Stocktage: Through the eyes of the private sector, UNGC
5. Companies Taking Action, Science Based Targets
6. The Missing Billions: The Real Cost of Supply Chain Waste, Avery Dennison, 2023
7. Ecodesign for Sustainable Products Regulation, European Commission
8. Proposal for a revision of EU legislation on Packaging and Packaging Waste, European Commission
9. On making sustainable products the norm, European Commission
10. Cross-sector and Sector-specific DPP Roadmaps, CIRPASS
11. The Future of Corporate Climate Action, CDP
12. ESG and the Cost of Capital, MSCI
13. The young consumer and the path to sustainability, Credit Suisse, 2022
14. Investors want to hear from companies about the value of sustainability, McKinsey
15. The role of RFID to improve supply chain sustainability: A systematic literature review and key informant survey, 2023
16. The impact of RFID and EPC network on the bullwhip effect in the Italian FMCG supply chain, 2010
17. Inventory replenishment policies for a grocery supply chain using RFID to improve the performance frontier, 2021
18. Reducing out of stock, shrinkage and overstock through RFID in the fresh food supply chain: Evidence from an Italian retail pilot, 2013
19. Life cycle assessment of RFID implementation in the fresh food supply chain, 2014
20. RAIN Alliance VDC Market Report, 2022
21. The Circularity Gap Report, Circle Economy, 2023
22. Fashion on Climate, McKinsey and GFA, 2020
23. Fashion on Climate, McKinsey and GFA, 2020
24. Decathlon Transition Plan 2020–2026
25. Decathlon 2022 Performance
26. Reduced Food Waste, Project Drawdown


# Appendix

## Methodology

In an effort to understand the current state of play between RAIN RFID and sustainability, as well as to gain insights on leading best practices, we leveraged the following research methods in writing this report:

**Secondary Research**
Desk research involving recent market reports was conducted on topics such as RFID history, adoption, and private sector sustainability efforts are incorporated throughout the report.

**Survey**
To gather findings on the current connection between RAIN RFID and sustainability, a survey was conducted which focused on understanding the present use of RAIN RFID tags in relation to business and sustainability objectives. The survey was open to RFID experts and end users from the following industries: apparel, food, logistics, manufacturing, automotive, beauty and healthcare. Data insights collected from the survey results are shared throughout the report.

To gain clear, specific insights the scope of the survey was limited to companies currently using RAIN RFID today and respondents that are involved in the use of RAIN RFID. A total of 145 individuals responded to our survey request, with 34% completing the survey in its entirety. From the completed responses, 25% of respondents were RAIN members involved with the manufacturing and/or sale of RAIN RFID technology to a wide range of end user clients. 75% of completed responses were end-users of RAIN RFID.

**Interviews**
To gain a deep understanding of the current use of RAIN RFID enabled sustainability, one-on-one in-depth interviews with experts from leading early-adopter companies were undertaken from the automotive, apparel and logistics industries. Insights from these interviews are shared throughout the report as well as in the form of case studies to highlight industry best practices.

**Research Scope**
This report is focused on the use cases to apply RAIN RFID technology to sustainability objectives. It should be noted that the sustainability of the manufacturing and composition of RAIN RFID tags themselves is not in scope. The environmental impact related to RAIN RFID labels is addressed in the 2021 RAIN RFID Alliance Whitepaper 'Defining Sustainability for RAIN RFID: Importance, Challenges and Potential'.

**Background and contributors**
This report was created by the RAIN Alliance Sustainability Workgroup and Sustainabelle Advisory Services.

SUSTAINABELLE

**Authors**
Christine Goulay and Kirraly Antcliff (Sustainabelle Advisory Services)

**Designers**
A Couple Of Birds Design

**Project contributors**
Barbara Dunin (Beontag)
Peter Richards (Talkin' Things)

**Industry contributors**
Decathlon
Michelin
IFCO
Bosch
Pernambucanas
Moose Knuckles
Norsk Lastbærer Pool As
Toennjes
Volkswagen Group of America
Coöperatie Hoogstraten
Cardinal Health
Cencora
Blockstore Group

Visit the RAIN RFID website at **RAINRFID.org**

If you are interested in learning more about the RAIN RFID Alliance, contact us at **info@rainrfid.org**

RAIN RFID