How to Get Started With Technology-Enabled Reusable Packaging Applications

A best practice guide from the Technology Working Group of the Reusable Packaging Association (RPA)

Reusable Packaging
ASSOCIATION

Table of Contents

Introduction

As the widespread adoption and deployment of Reusable Transport Packaging (RTP) assets such as pallets, bins, and containers continue to expand, the industry ecosystem is increasingly applying technologies to enable visibility across the supply chain network of their goods. A technology-enabled reusable asset can benefit a company and its supply chain partners through asset identification, transportation and logistics performance, product damage reductions, sustainability performance metrics, and other customer-specific use cases.

The following best practice and key question guide summarizes the experiences of members of the Technology Working Group (TWG) of the Reusable Packaging Association. After following these best practices, a company or user should be able to ask/understand the right questions through each of the key decision-making topics below.

Business Problem to Solve

When starting any technology-enabled reusable project, the company's leadership and project team must have a holistic understanding of what the project is trying to address. Defining the primary use case with internal and external customers and other strategic stakeholders across the supply chain system is a critical first step to any technology-enabled reusable project. Once the primary use case is defined, project teams should work with each stakeholder to identify additional secondary use cases as the project scope is finalized.

- **What primary use case needs to be solved, and how will a potential solution address the identified problem(s)?**
  - Quantifying the problem and the expected magnitude of business impact is essential in implementing any technology-enabled solution. Understand why the company is interested in getting started and what issues impact the business and customers. Many examples of technologies successfully applied to reusable assets exist globally, where specifically targeted customer and industry use cases result in financial and operational benefits and quantifiable sustainability impact.
- **What are the expected benefits of the project? Has the problem or use case been quantified, and do the benefits include internal stakeholders and the broader external ecosystem partners?**
  - Work closely with your business team, customers, and partners to identify and quantify improvement areas. This process defines the primary use case to focus on and other potential secondary use cases for any technology-enabled project. Based on TWG member experiences, a business or project team must define and carefully understand the primary use case before building a business case or selecting a specific technology-based solution.
- **What similar examples of problems to be solved/resulting benefits exist in the 'reuse' industry?**
  - Technology-enabled reusable assets have moved beyond pilot-scale implementations and are well-established globally across supply chains. Project teams can find examples of technology-enabled reuse on RPA's website, TWG whitepaper, and from RPA technology-enabled solutions member companies.
- **If a customer has mandated a specific solution, how do you approach this while allowing flexibility with other customers? What potential synergies exist, and what 'watchouts' should be considered?**
  - It is not uncommon for various supply chain partners to specify required solutions across their supply chains. Understanding their requirements and any technology industry standards they will follow is essential. Most customer or industry standards focus on common solutions such as serialized barcodes or passive RFID-based solutions. More advanced solutions often have multi-modality capabilities, allowing for different solutions based upon requirements, as required. Ensure a focus on the primary use case and benefits your customer expects and understand existing industry examples. Additionally, taking a systems-level approach to identify an extensible standards-based solution that addresses the mandated specific solution requirements enables flexibility and scaling over time as the selected standards provide additional features and functionality.

Business Case / Strategy Development

Developing a strategy or business case for implementing any labeling, monitoring, tracking, or analytics technology project aims to determine the potential return on investment through cost reduction, process improvements, operational efficiency gains, and sustainability impacts. As shared earlier, focus on the primary use case and the expected financial and operational performance improvements by quantifying the potential investment required and the estimated return regarding cost savings and/or efficiencies gained. Add secondary use case(s) to meet additional performance targets and financial objectives. Lastly, when building the business case, focus on the value delivered as a function of the cost of the technology solution to ensure success. The RPA Technology Whitepaper has a good summary of how to build a business case.

- **Does your company have the expertise internally, or should you find external expertise to develop, build, and implement your strategy?**
  - A company should consider several potential scope responsibility levels, from consulting to full-suite options.While working with a technology supplier/integrator may be an option, working with an external consultancy or technology-enabled data & insights management companies can be options to consider. RPA TWG member companies provide these levels of solutions for a company to get started.
- **Have both the CAPEX requirements and the ongoing OPEX operating costs been included in the business case?**
  - When building your business case, it is essential to consider the CAPEX required for the technology solution and infrastructure investment and any ongoing OPEX expenses ranging from servicing or replacement of labels/tags to data transmission rates based on the technology applied and the storage and analytical computation costs associated to the gather operational data.
- **What are the considerations of a pilot vs. large-scale implementation?**
  - Based upon industry experiences, it is best to build your business case and define and execute a plan to move from 'pilot validation' to 'production deployment' to 'permanent operation.' Use your pilot to validate the primary use case, focusing on confirming the business's financial, operational, and sustainable benefits. After validating the primary use case pilot, execute production deployment and scale to a permanent solution across the ecosystem, as defined in the business case.
- **What risks or uncertainties should be considered in the business case, and how can they be mitigated?**
  - By focusing on the primary use case, a project team can minimize any potential uncertainties in the business case. Use best practices and technology choices shared in the Technology Whitepaper to understand and mitigate potential risks in a business case.

Technology Choices

A wide range of technologies is available to track, identify, monitor, or count goods or assets, as described in the white paper, A Smarter Technology-driven Supply Chain with Reusable Packaging Systems. Technology choices include Barcode, RFID, Cellular or LPWAN, Bluetooth Low-Energy (BLE) or Wi-Fi, and recently introduced technologies such as Self-Organizing Sensor Area Networks, Low Power Mesh, or Ultra-Wide Band (UWB) for RTLS (Real-Time Location System). Each technology has specific characteristics that make it suitable for targeted use cases in reusable packaging-type systems. However, a combination of these technologies, multi-modality, may often be required to meet the performance and operational requirements. Below are some common questions companies should ask when considering adding technology-enabled reusable assets.

- **What device technology(s) should be evaluated to solve the problem, or should the primary use case be identified in the business case?**
    - While there are many variables to consider, the most common include focusing on the value delivered as a function of the cost of the technology to ensure success. An in-depth table and discussion entitled "4.1 What Solutions Exist and Why You Would Use Them" in the TWG whitepaper referenced in this best practice guide is a good industry reference.
- **How will the chosen technology integrate with existing systems and processes within the company and its supply chain partners?**
    - Consider any technology choice and how it will integrate into the business's operational system and your supply chain partner systems. Important considerations include the management of the amount of data generated, integration into the operational systems for decision-making by stakeholders, data security, and others.
- **When should a multi-modality type solution (i.e., multiple technology solutions) be considered?**
    - Companies are applying multi-modality technologies-based identification strategies across their pool or fleet of reusable assets in their network when a single technology-enabled solution is not ideal for the entire fleet. This allows a cost-effective solution and still gains data-based insights by combining technologies and data analytics to generate insights from various data sources. Examples include implementing < 5% of the assets using GPS/GNSS with WAN connectivity, < 20% using BLE or LPM sensors, and 100% using bar codes/RFID data labels.

Companies have found optimal solutions for their specific supply chain characteristics by building a model or 'digital twin' of their networks to simulate what is required. This can be a critical consideration for companies looking for the best combinations of technology-based solutions for reusable assets.

Based on the targeted use case, it is also essential to consider these variables:

Material Choices
- **What type of material (plastic, wood, etc.) is the reusable asset made of?**
  - When applying a technology such as a label or RFID tag, the most vital attribute, whether permanent or removable, is how it interacts with the substrate to which it is attached. The composition and surface energy of the substrate are just as vital as the label method and construction. When working with a label provider, validate the solution and the material/substrate used in the reusable asset.
- **What environmental conditions will the asset be exposed to during movements through the supply chain, including transportation and the environment?**
  - What type of exposure will the reusable asset, including cleaning, serialization, or chemical-based processes, experience during its lifetime? Since a reusable asset can be in service for more than ten years, selecting a permanent label that can last the expected lifetime is critical. When planning any labeling of your reusable asset, it is essential to conduct testing that validates the labeling method selected to endure the real-world environment.

Design / Assembly
- **Where should the ideal placement of a technology-based solution be applied to a reusable asset?**
  - Evaluate where the tag or technology will be applied to the reusable asset. Device placement on reusable packaging must be planned so that it is not damaged or destroyed by forklifts, manufacturing, or cleaning processes. Ideally, the tag should be placed in a protected area of the asset that does not experience high levels of potential damage throughout its life. Additionally, consider if the tag/device is damaged and how it will be replaced, repaired, or synced with other devices on the reusable asset.

Serviceability
- **How will the technology sensor be serviced or replaced? How should the sensor itself or the battery power source be returned when using battery-powered sensors?**
  - Evaluate the expected replacement frequency, as some examples require replacement multiple times a year based on the targeted use case. For example, if a sensing device needs a battery replacement after four trips based on the frequency of data gathered and transmitted, it may take more than 400 hours of operational impact to replace the batteries of 100,000 reusable assets.

Industry Requirements
- **What are the industry requirements of a sensing and monitoring technology device?**
  - For example, using technology-enabled reusable assets in industrial automation vs. oil and gas or pharma industry may have requirements that differ significantly from environmental or regulatory requirements perspectives. Ensure any industry-specific unique regulatory requirements have been met.

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Hardware / Software / Infrastructure Requirements

When building or implementing technology-enabled reusable assets in your business, it is essential to consider the infrastructure required to support your tech-enabled reusable assets and whether this exists in your business operations and your broader supply chain networks. If the infrastructure does not exist, it is essential to consider the investments required to achieve the primary use case identified in the business case and the capability of the technologies to be implemented. The following questions are important to consider across the supply chain.

- **Does the infrastructure exist through your customer and the supply chain ecosystem? If not, how will that be addressed through device technology choices or ecosystem partnerships?**
  - Work closely with your supply chain to determine the technology systems across your customers and partners. If your customer uses an RFID solution, and your logistic providers use GPS-based devices, understand each ecosystem partner's role(s) and how a technology investment will work to achieve the expected benefits identified in the primary use case.
- **How does the frequency of reporting impact the technology choice?**
  - Understanding the amount and frequency of reporting required to develop actionable insights across your business and broader supply chain ecosystem is very important. An increased reporting frequency can significantly reduce the battery life, requiring replacement or charging multiple times over the life of the reusable asset.
- **If a business wants to start technology-enabling its reusable assets but has not invested in the required infrastructure, how can it get started? A simple example would include whether the project team should begin with applying labels and RFID tags to a collection of reusable assets.**
  - Suppose the infrastructure across the ecosystem is not entirely in place. In that case, companies often start with core technologies such as serialized labels/RFID tags, following industry guidelines such as GS1 for data identification and management. This allows the ability to gather data points across some portion of the reusable assets, allowing some insights to be collected that can be used to take actions to increase efficiencies and/or reduce waste. During this time, the application of various technologies can be investigated, piloted, and implemented.
- **What contingency plans are in place to address potential disruptions or failures in hardware, software, or infrastructure components?**
  - When building your strategy and business case, it is essential to consider what options must be accounted for during hardware, software, or infrastructure failures. This may include using a distributed cloud infrastructure or defined processes to repair or replace technology solutions as the reusable asset is moved through the supply chain.

Data Collection and Management

When looking at potential data collection and management solutions for their technology-enabled reusable asset fleet, companies should consider the impact of types and amounts of data being gathered.Key decisions for a project team include the types of data gathered, whether event-based or time-based. As shared earlier, time-based events can significantly impact battery life, depending on the selected technology. Additionally, it is essential to ensure you are measuring the typical asset operations or are focused on the data during an anomaly or exception-based event. This decision can also significantly impact the volume of data gathered across technology-enabled reusable assets and the specific technology selected.

- **Have you considered how to manage the 'volume' of data in your business operating processes?**
  - Define what an event is and when a connected, intelligent asset will trigger it. The project team must consider not flooding your business systems with much-unneeded data.
- **How will the volume and data security considerations be implemented?**
  - When a company and its technology provider build an enabled system using numerous technology-enabled solutions, selecting IoT products and adjacent/connected products that provide the necessary security features is critical when operating as a total system.
- **How will data quality and integrity be ensured throughout the data collection and management? What mechanisms will be implemented to continuously monitor and evaluate the solution's performance?**
  - Data integrity is an important consideration, and consideration for the integrity of the data starts with proper serialization and uniquely identifies the operational assets, secure reading and transmission of the operational data, and a means for validating the collected data to operational norms with exceptions within the collected data flagged for investigation or additional analysis. Data analysis against the operational model is one method, yet this is an area of continued investment and improvement, and data integrity should be part of any initial system design and used in selecting the solution provider.
- **How will data ownership and governance be addressed, particularly in multi-stakeholder environments or collaborative supply chains?**
  - As outlined above, data governance includes data integrity and must be clearly defined when implementing a technology-enabled reusable network. In some businesses, this may be part of the supply chain function; in others, it may be part of the Information Technology, Operational Technology, or Digital Transformation function. Regardless of where the functional ownership resides, working with the functional owners to develop a clear governance policy or plan is critical. Also, a governance plan should be required across the broader supply chain ecosystem when data is shared.

Insights and Action

Companies face complex challenges across their supply chains and are saturated with a large amount of data from their operations. The focus on creating meaningful insights often needs to catch up to the investments and resources in functional teams gathering and managing large amounts of data. When using technology-enabled assets, the benefits of understanding the insights from the data include actively managing logistics and supply chain partner networks, inventory levels, network efficiencies, optimizing working capital, and deploying labor more efficiently across the handling of a movement of goods.

- **How will actionable "insights" be generated so the business or customer (external or internal) can quantify the benefits, and how will they inform decision-making processes?**
    - When looking into data analytics and insights-based learning models, a company or project team should understand and evaluate different models when acting on large amounts of data. The Sense-Infer-Act-Learn and the Observe-Orient-Decide-Act models are two primary models commonly used in AI/machine learning-based applications. Additional insights and learnings are included in the TWG whitepaper, "5. How to Use Data to Develop and Deliver Insights and Value."

- **Who will be responsible for creating actionable insights? Do they have the right competencies and responsibilities in your business, partners, or supply chain?**
    - When the primary use case is defined, it is also essential to determine the resources required for data management and the company's functional areas to identify and act based on those insights.Often, these roles sit within the supply chain and logistics planning functions, and insights are used to create and modify supply chain strategies. When a project works across a broader ecosystem, it is essential to clearly understand the roles/responsibilities of each supply partner company.

- **How will the chosen technology provide essential insights into meeting a company's sustainability objectives?**
    - It is essential to include in a project business case how data insights can be used to measure and report the sustainability metrics of an operating chain enabled by technology-enabled reusable assets. Based on TWG member experiences, many companies search for 'static' sustainability data during the annual reporting process. Still, many more 'operating' sustainability metrics and operational decisions can be made throughout the year when using technology-enabled reusable assets.

Learn More

A more in-depth reference guide and many case study examples for Technology-enabling Reusable Transportation Packaging, "A Smarter Technology-Driven Supply Chain with Reusable Packaging Systems," is available on the RPA website.

This best practice guide, "How to Get Started with Technology-enabled Reusable Applications," is created from the cumulation of experiences of the Reusable Packaging Association's (RPA) Technology Working Group (TWG) members and invited industry experts. The committee's objective is to raise awareness of asset management and develop standards for common processes promoting the efficient movement, handling, visibility, and return of reusable packaging products.

Technology-enabled Reusable solutions, including identification and tracking solutions, can be found at the Reusables Marketplace, where sustainable packaging and reusable packaging products and services from RPA member companies can be found.

About RPA

Founded in 1999, the Reusable Packaging Association (RPA) is a non-profit trade organization representing and promoting the common and pro-competitive business interests of member suppliers and users of reusable packaging products and services. RPA connects the industry to expand, innovate and validate reusable packaging systems.

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Access the RPA Library