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Packaging Data Hub

Solution Overview

V2.6

Introduction

The Packaging Data Hub is a secure, cloud-based platform designed to streamline the management, collection, and analysis of packaging information across complex supply chains. Built on Microsoft Azure, it enables producers, suppliers, and site managers to collaborate efficiently while ensuring data integrity, regulatory compliance, and operational transparency.

Developed with enterprise-grade security and scalability in mind, the application combines automated workflows, role-based access, and real-time validation to simplify the end-to-end process of packaging data submission and verification. It supports configurable data-collection cycles, integrates seamlessly with existing systems, and provides actionable insights through advanced reporting and analytics tools.

By standardising data capture, enforcing validation at source, and maintaining a full audit trail of all user and system actions, the solution helps organisations meet both operational and sustainability objectives – from compliance with environmental regulations to monitoring packaging performance and reduction initiatives.

The following sections outline the system's core features and capabilities, including authentication and security, organisational management, cycle control, data collection and storage, communications, reporting, and advanced integrations.

Technical Overview

The Packaging Data Hub is delivered as a cloud-based Software-as-a-Service (SaaS) solution hosted within the Microsoft Azure ecosystem. It leverages Azure's secure, scalable, and globally available infrastructure to provide high availability, resilience, and compliance with industry standards. The platform is composed of modular application services, APIs, and background workflows deployed within a managed Azure environment – including App Services, Azure SQL Database, Azure Storage, and Azure Active Directory for authentication and access control. All data is encrypted at rest and in transit, and the system follows Azure best practices for networking, monitoring, and disaster recovery. The SaaS deployment model ensures continuous delivery of updates, simplified maintenance, and seamless scalability to meet the evolving needs of enterprise users and suppliers.

Azure Active Directory B2B and OAuth2 Authentication

The application uses Azure Active Directory Business-to-Business (B2B) and OAuth2 authentication to provide secure, seamless access for both internal and external users. Partners and suppliers can log in using their own corporate credentials, reducing administrative overhead while maintaining strict identity control. OAuth2 ensures that authentication is handled through secure, token-based access mechanisms, supporting modern standards for identity federation and single sign-on (SSO). This setup allows organisations to centrally manage user access while providing a smooth, secure login experience.

Role-Based Access Control (RBAC)

Access to system features and data is governed by Role-Based Access Control (RBAC), ensuring users only have permissions appropriate to their responsibilities. Roles define what actions can be performed and what data can be viewed or edited, providing fine-grained control across all organisational levels. Administrators can assign predefined role templates or create custom roles to meet specific business needs. This approach enhances security, simplifies user onboarding, and ensures compliance with internal governance policies.

Multi-Factor Authentication (MFA)

To further strengthen security, the system supports Multi-Factor Authentication (MFA) through Azure Active Directory. MFA requires users to verify their identity using at least two factors – such as a password and a mobile authentication prompt – before gaining access. This prevents unauthorised access even if credentials are compromised, providing a critical layer of protection for sensitive packaging and supplier data. MFA policies can be configured organisation-wide or applied selectively based on user role, location, or risk profile.

Encrypted Data at Rest and in Transit

All data managed by the platform is encrypted both at rest and in transit to ensure confidentiality and integrity. At rest, Azure-managed encryption services protect data stored in databases, file systems, and backups. During transmission, all communication between users, APIs, and services is secured using industry-standard TLS (Transport Layer Security) protocols. This dual-layer encryption approach guarantees that sensitive information remains protected throughout its lifecycle, from submission to storage and retrieval.

Full Audit Logging of All User Actions

The system maintains a comprehensive audit log that records every significant user and system action. This includes authentication events, data submissions, edits, approvals, and configuration changes. Audit data is stored securely and can be filtered and reviewed by authorised administrators to support

compliance reviews, incident investigations, and operational transparency. The immutable nature of these logs ensures accountability and provides a defensible trail for regulatory or internal audit purposes.

GDPR-Compliant User Management and Data Retention

User and data management processes are fully aligned with the General Data Protection Regulation (GDPR) and other privacy standards. The system supports data minimisation, consent management, and configurable retention policies to ensure personal data is only stored as long as necessary. Users have full visibility into the information held about them, and data can be securely anonymised or deleted upon request. This ensures that all aspects of data handling meet modern compliance and ethical standards.

Secure Microsoft Azure Cloud Architecture

The platform is built on a secure Microsoft Azure cloud architecture, leveraging Azure's enterprise-grade compliance, monitoring, and resilience capabilities. Services are deployed in segregated environments with controlled network access and continuous monitoring through Azure Security Center and Application Insights. Built-in redundancy, automated backups, and disaster recovery procedures ensure high availability and business continuity. The use of Azure's managed services allows the platform to maintain strong security posture while scaling effortlessly with organisational demand.

Application Security

The application is protected by a multi-layered security model designed to safeguard data and infrastructure from unauthorised access and cyber threats. At the network perimeter, an Azure Firewall enforces strict traffic filtering and outbound access rules, ensuring only approved communication between application components and external systems. The platform is hosted within a secure virtual network, with private endpoints for databases and storage, preventing direct exposure to the public internet. Authentication and identity management are handled through Microsoft Entra ID (Azure AD), providing enterprise-grade access control, conditional access policies, and multi-factor authentication (MFA). All data is encrypted in transit using TLS 1.2+ and at rest using Azure-managed encryption keys, with continuous monitoring and logging via Azure Security Center and Application Insights. Together, these measures deliver a robust, compliant, and continuously monitored security posture across the entire application ecosystem.

Organisation & User Management

Hierarchical Structure for Sites, Business Units, and Suppliers

The system models the organisational structure of the business using a hierarchical data model that reflects real-world relationships between corporate entities, business units, sites, and suppliers. This allows data, permissions, and reporting to be managed at the appropriate level of granularity. For example, head offices can oversee activity across all suppliers and sites, while individual site managers focus on their own submissions. This structure supports both centralised governance and decentralised accountability, ensuring that data ownership and visibility are aligned with operational responsibilities.

Delegated Administration for Supplier and Site Managers

To reduce administrative overhead, the platform enables delegated administration. Designated supplier and site managers can invite, manage, and remove users within their own organisations, define access levels, and oversee data submissions. This decentralised control empowers suppliers to maintain their own user base while preserving security and traceability under the central organisation's governance framework. Delegated admin actions are fully audited and subject to the same compliance and validation rules as global administrators.

Domain-Based User Access Management

Access to the platform is governed by domain-based rules that streamline user onboarding and reduce the risk of unauthorised access. When a user signs in using their corporate email domain, the system automatically associates them with the correct supplier, site, or business unit, applying the relevant permissions and visibility rules. This mechanism supports automated verification of trusted domains, simplifies user provisioning, and enforces consistent access control policies across large, distributed organisations.

Role Templates for Rapid Setup

The application includes a library of predefined role templates that correspond to common functions within the supply chain – such as supplier admin, site manager, data submitter, or reviewer. These templates define access rights, visibility, and workflow permissions, enabling rapid onboarding of new users and teams. Administrators can use these templates as-is or customise them to align with their organisation's internal policies. This approach ensures consistency, reduces setup time, and mitigates configuration errors.

Bulk User Import and Management Tools

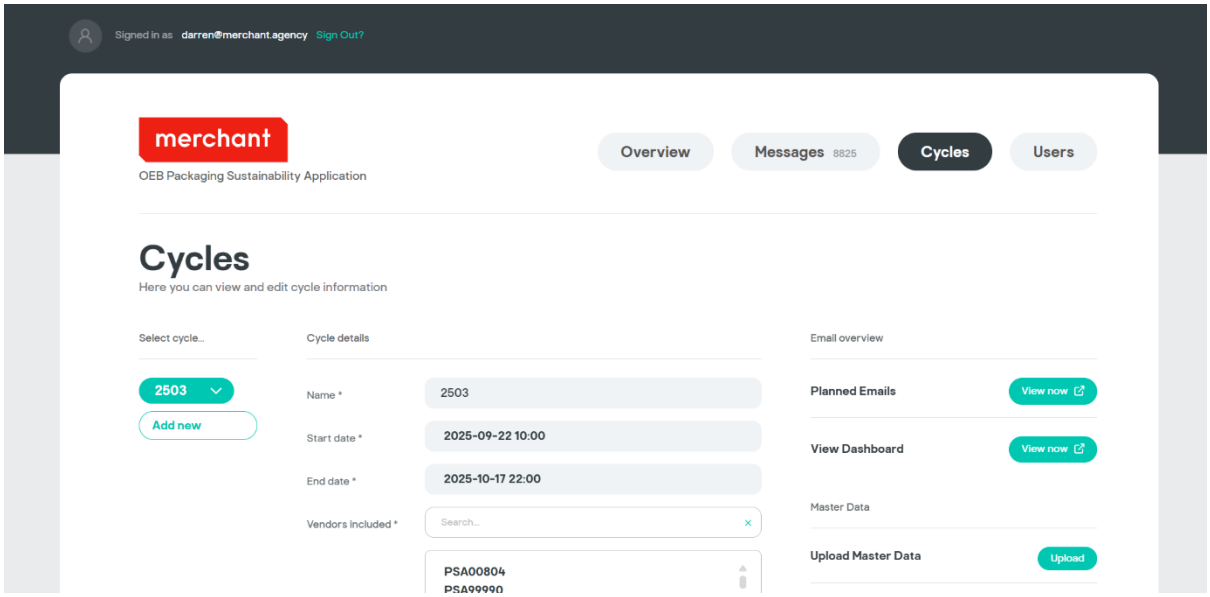
To support large-scale deployments, the system provides bulk user import and management capabilities. Administrators can upload user details via Excel or CSV templates, automatically creating or updating accounts in line with organisational hierarchy and role definitions. Batch updates can also be performed for changes in roles, domain ownership, or site assignments. Integration with Azure AD further enables automated synchronisation of users and groups, simplifying lifecycle management for enterprises with dynamic user populations.

Complete Audit Trail of User and Organisation Changes

Every change to user accounts, roles, and organisational structure is recorded in a comprehensive audit trail. This includes user invitations, access level changes, deactivations, and updates to supplier or site information. Audit records are timestamped, immutable, and linked to the initiating user, ensuring full accountability and compliance with governance and regulatory standards. Administrators can filter and export audit logs for review, reporting, or investigation purposes, supporting both operational transparency and audit readiness.

Cycle Management

Configurable Data-Collection Cycles (Frequency, Scope, Deadlines)



The system supports configurable data-collection cycles that define when, how often, and from whom packaging data is collected. Administrators can configure cycles to match business or regulatory timelines – for example, quarterly, biannual, or annual submissions. Each cycle can specify its own scope, determining which products, suppliers, or sites are included, along with deadlines for submission and

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approval. This flexibility ensures the data collection process aligns precisely with compliance reporting and operational planning needs, while enabling consistent and repeatable workflows.

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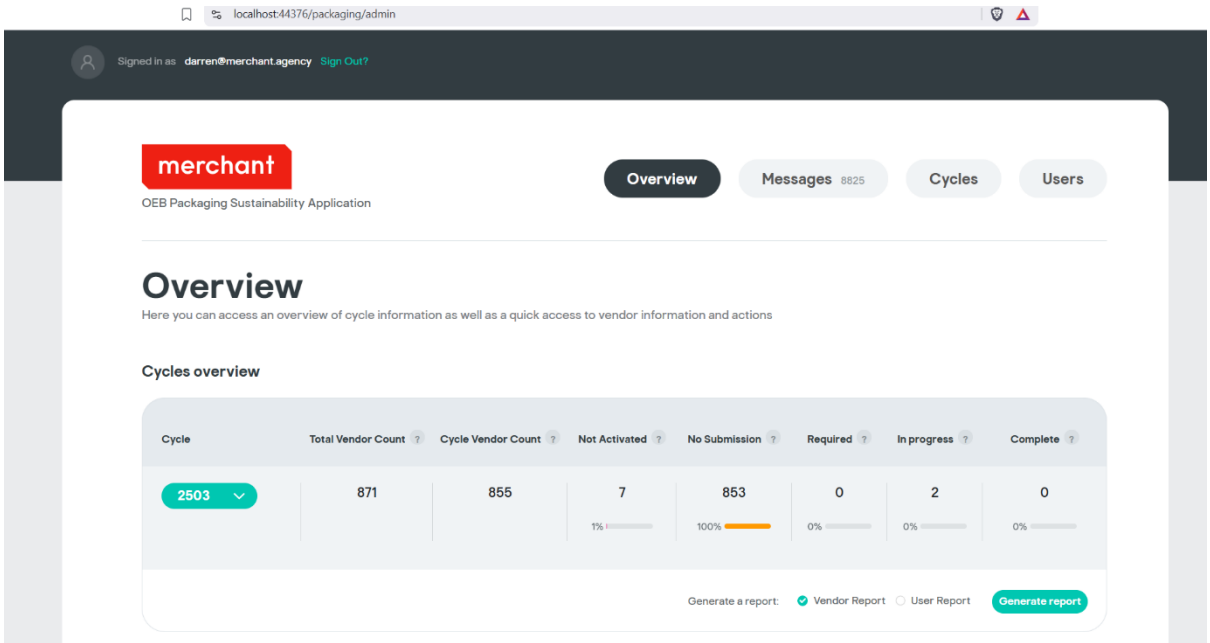
Automated Opening, Closing, and Reminder Workflows

To reduce manual intervention, the application automates the opening, monitoring, and closing of data-collection cycles. When a cycle starts, all relevant suppliers are automatically notified and given access to submit their data. Reminder workflows are triggered as deadlines approach, prompting incomplete or inactive users to take action. At the end of a cycle, the system can automatically close submissions, lock data for review, and initiate escalation or approval processes. This automation ensures timeliness, consistency, and minimal administrative overhead.

Supplier and Product Assignment per Cycle

Each cycle can target a specific subset of suppliers, sites, or products, allowing for precise control over who needs to submit what information. Assignments are defined during cycle setup and can be based on supplier category, product group, or compliance risk level. This selective targeting ensures that only relevant parties are engaged in each round of data collection, reducing noise and improving data quality. The system can also dynamically adjust assignments in response to supplier changes or organisational updates.

Real-Time Dashboards Showing Submission Status



The platform provides real-time dashboards that offer a complete overview of submission progress and status across all active cycles. Administrators can see which suppliers have completed their submissions, which are still pending, and which have failed validation. These dashboards can be filtered by region, supplier, or cycle phase, allowing users to quickly identify bottlenecks or compliance gaps. Visual indicators and charts provide at-a-glance insights, supporting proactive management and faster decision-making.

Exception Management for Overdue or Missing Data

When data is missing, incomplete, or overdue, the system automatically triggers exception management workflows. These workflows flag the affected suppliers or products, notify responsible users, and can escalate unresolved cases to higher-level administrators. Exception reports highlight areas where additional support or intervention may be required, helping teams maintain compliance with regulatory and internal reporting timelines. This ensures that late or missing data is promptly addressed, improving overall data integrity.

Automatic Notifications and Escalation Triggers

The application includes a notification framework that automatically alerts users at key points in the cycle – such as when a new cycle opens, when reminders are due, or when deadlines are missed. Notifications can be sent via email or displayed in-app, depending on user preference. Escalation triggers can be configured to alert higher-level managers or compliance officers when critical milestones are breached or key suppliers fail to respond. This ensures accountability, improves engagement, and maintains momentum throughout the entire data-collection process.

Data Collection & Storage

Standardised Data Schema for Packaging Materials, Components, Products, and Suppliers

The system is built around a standardised data schema that ensures all packaging information – from raw materials to finished products – is captured in a consistent, structured way. Data fields and relationships are designed to align with regulatory and industry best practices, enabling accurate reporting and analysis across suppliers and markets. This uniform data model supports interoperability between systems and simplifies validation, aggregation, and export of packaging data for downstream applications such as compliance reporting and sustainability analysis.

Structured Data Aligned with Recognised Packaging Data Standards (e.g. Open3P)

To ensure compatibility and compliance with broader sustainability and reporting frameworks, the application's data structures are aligned with recognised packaging data standards such as Open3P. This alignment supports seamless integration with external systems and regulatory bodies, reduces the need for manual data reformatting, and ensures that collected information adheres to global expectations. As

standards evolve, the schema can be easily extended to include new data points or updated definitions without disrupting existing datasets.

Dynamic Validation Rules and Real-Time Error Feedback

The platform enforces dynamic validation rules to guarantee the accuracy and completeness of submitted data. These rules validate inputs as users enter information, providing real-time error feedback and clear guidance on how to resolve issues. Validation logic can be tailored per data cycle or supplier type, supporting both generic and custom business rules. This proactive validation approach ensures that errors are corrected at the point of entry, reducing administrative rework and improving overall data quality.

Evidence Upload (Supplier Declarations, Certifications, Specifications)

Suppliers can attach supporting evidence files – such as declarations, certifications (e.g. FSC, PEFC), material specifications, or compliance documents – directly to their data submissions. The system supports a range of file formats and enforces metadata tagging for easy retrieval and auditing. Evidence uploads are securely stored in Azure Blob Storage and linked directly to related records, providing a complete, traceable chain of compliance evidence for every packaging component or product.

Automatic Bill of Materials (BoM) Creation per Product and Site

The application can automatically generate a Bill of Materials (BoM) for each product or site, aggregating all component-level data entered during the collection process. This provides a comprehensive view of the packaging structure, materials used, and weights or recycled content percentages. Automated BoM creation simplifies downstream processes such as environmental impact reporting, material optimisation, and cost tracking, while maintaining full traceability back to the original data submissions.

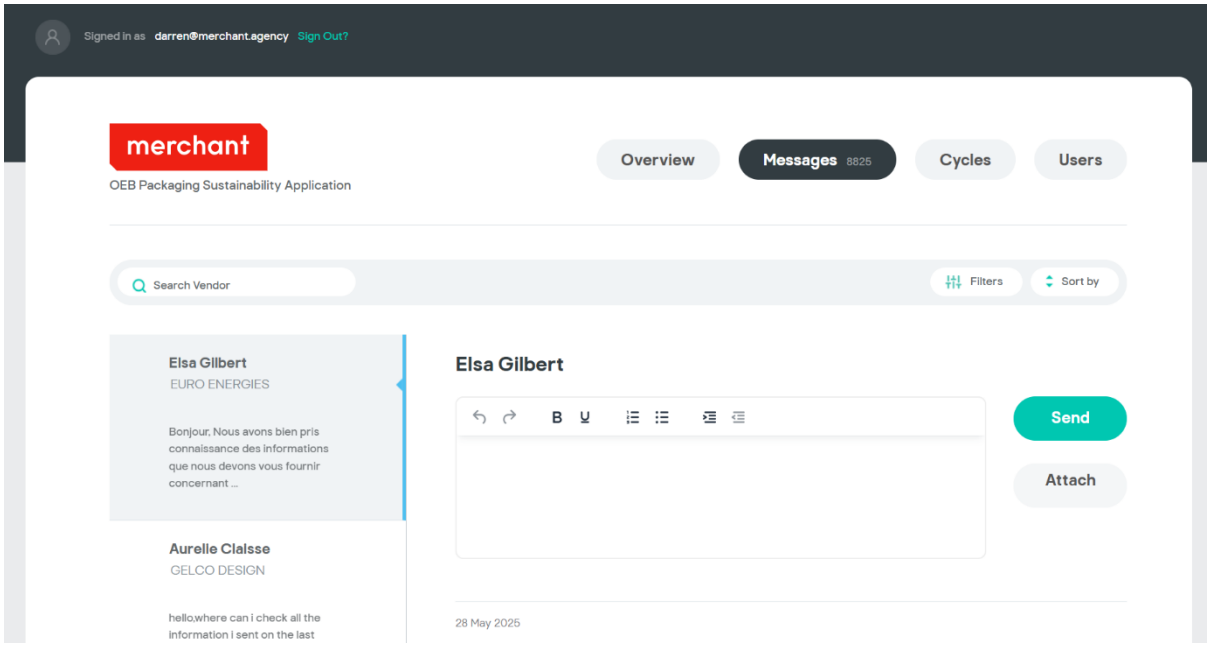
Secure Azure SQL Database with Version Control

All structured data is stored in a secure Azure SQL Database, benefiting from Microsoft's managed service capabilities for performance, resilience, and encryption. The platform implements version control at the data level, allowing administrators to track historical changes and view previous submission versions. This provides a transparent audit history and ensures that every modification is recorded, enabling precise rollback, review, and comparison of past cycles or supplier submissions.

Export and API Access for Integration with Other Systems

To support interoperability, the system provides both export functionality and API access for integration with external platforms. Users can export datasets to Excel or CSV for offline analysis, while RESTful APIs allow automated data exchange with ERP, sustainability, and compliance systems. Secure API authentication is managed through OAuth2, ensuring that only authorised systems can access the data. This flexibility allows organisations to embed the packaging data platform seamlessly within their wider digital ecosystem.

Messaging & Communications



Automated Email and In-App Notifications Triggered by Workflow Events

The system includes an intelligent messaging engine that automatically generates email and in-app notifications based on workflow events. Users are notified when new data-collection cycles open, when submissions are due, or when approvals are required. These automated triggers ensure that all stakeholders remain informed without manual follow-up. Notifications can be customised to match branding and tone guidelines, providing a consistent, professional communication experience across the platform.

Editable Message Templates Managed by Administrators

Administrators have full control over message templates, enabling them to tailor content for different communication types and audiences. Templates support dynamic placeholders, allowing messages to include contextual information such as cycle names, deadlines, and supplier details. This flexibility ensures consistent messaging while reducing repetitive manual communication. Templates can also be versioned and localised, ensuring that updates or translations are centrally managed and deployed instantly across all users.

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Real-Time Alerts for Deadlines, Validation Issues, and Approvals

The platform proactively delivers real-time alerts for key events that affect workflow progress, such as approaching deadlines, data validation errors, or pending approvals. Alerts are visible both within the user dashboard and through configurable email notifications. This real-time feedback loop helps suppliers and administrators stay on top of their tasks, improves response times, and prevents bottlenecks in the data-collection and review process. Alerts are prioritised by severity to ensure critical issues are addressed first

Direct Messaging Between ABP and Suppliers

To improve collaboration and reduce reliance on external communication channels, the application supports direct messaging between administrators (ABP users) and suppliers. Messages are linked contextually to specific products, submissions, or evidence items, providing a clear record of discussion in the appropriate workflow context. This feature enables faster resolution of queries, reduces email clutter, and ensures that important decisions and clarifications are fully auditable within the platform itself.

Full Audit History of All Communications

Every message and notification is recorded in a comprehensive audit history, creating a transparent log of all communications between users. This includes automated notifications, direct messages, and system alerts, along with timestamps and sender information. The audit trail enables administrators to trace the history of any communication for compliance or dispute resolution purposes. Combined with the system's security and logging framework, it provides a complete record of engagement throughout each data-collection cycle.

Reporting & Analytics

Pre-Configured Compliance and Operational Reports (DEFRA, Site, Supplier, Product)

The system provides a suite of pre-configured reports designed to meet both regulatory and operational requirements. These include standard outputs for environmental compliance (such as DEFRA and packaging waste reports), as well as detailed summaries by site, supplier, and product. Each report is designed to provide clear insights into packaging composition, material usage, and compliance status. Administrators can generate and export these reports instantly, ensuring that stakeholders have rapid access to accurate and fully validated information.

Custom Report Builder for Ad-Hoc Analysis

In addition to standard reports, users have access to a custom report builder that allows them to create tailored analyses without technical expertise. Using an intuitive interface, authorised users can select data fields, apply filters, and group results across multiple dimensions such as supplier, material type, or reporting cycle. These custom queries can be saved, shared, and exported, empowering business users to explore their data independently while maintaining governance over data visibility and access control.

Power BI Integration for Interactive Dashboards

The platform integrates natively with Microsoft Power BI, providing interactive and visually rich dashboards that display real-time metrics and trends. These dashboards can track packaging submissions, compliance performance, recycled content, and other key indicators across all suppliers and sites. Users can drill down from corporate-level summaries to individual data points, making it easy to identify areas for improvement or further investigation. This integration supports both embedded dashboards within the app and external Power BI workspaces for enterprise-level analytics.

Real-Time Tracking of Material Use, Costs, and Packaging Performance

All submitted data feeds into real-time performance tracking, allowing organisations to monitor packaging material usage, associated costs, and efficiency metrics as data is collected. Dashboards and reports provide up-to-date visibility into recycled content percentages, plastic reduction progress, and other sustainability KPIs. This real-time insight enables better decision-making, supports continuous improvement initiatives, and ensures that sustainability goals are measurable and transparent.

Export of Data and Reports to Excel or CSV

For flexibility and offline analysis, all reports and datasets can be exported to Excel or CSV. This enables users to perform additional data manipulation or share results with stakeholders who prefer traditional formats. Exports retain column headers, data types, and applied filters, ensuring consistency between

what's viewed on-screen and what's shared externally. Exports are logged within the audit trail to maintain traceability and compliance with data-handling requirements.

Advanced & Future Capabilities

ERP and Finance-System Integration (SAP, Oracle, etc.)

The platform is designed with extensibility in mind, supporting integration with enterprise resource planning (ERP) and finance systems such as SAP, Oracle, and Microsoft Dynamics 365. Through secure APIs and scheduled data synchronisation, packaging and supplier data can flow seamlessly between systems, reducing duplication and ensuring financial, operational, and compliance data remain consistent. This integration enables automated reconciliation of cost, material usage, and supplier performance data, aligning sustainability reporting with core business operations.

Supplier Analytics Dashboards and Benchmarking

Future enhancements include the introduction of supplier analytics dashboards, allowing organisations to benchmark supplier performance across key indicators such as submission timeliness, data quality, recycled content levels, and compliance scores. These dashboards provide powerful insights into supplier behaviour and engagement, helping organisations identify high-performing partners and those needing additional support or corrective action. Benchmarking across business units and markets supports strategic procurement and continuous improvement in sustainability outcomes.

Sustainability Metrics (Recycled Content, Carbon Footprint, Plastic Reduction)

The platform will expand its analytical capabilities to include comprehensive sustainability metrics such as recycled content percentages, carbon footprint calculations, and plastic reduction performance. These metrics will align with corporate ESG (Environmental, Social, and Governance) reporting standards and provide data-driven insights into environmental impact. Organisations will be able to monitor progress against sustainability targets in real time, supporting transparent reporting to regulators, investors, and stakeholders.

AI-Driven Anomaly Detection and Predictive Insights

Leveraging Microsoft Azure's AI and Machine Learning services, the system will introduce AI-driven anomaly detection and predictive analytics to proactively identify irregularities in data submissions or supplier behaviour. These models can flag unusual trends, such as unexpected material usage patterns or missed submissions, and predict potential compliance risks before they occur. Over time, the AI engine will learn from historical data to improve accuracy, enabling smarter, faster decision-making and more resilient packaging operations.

Mobile-Optimised Data Capture for On-Site Validation

The application roadmap includes mobile-optimised data capture tools that allow users to submit or verify packaging data directly from tablets or smartphones. This will enable on-site audits, inspections, and real-time validation of packaging materials, products, or supplier evidence. Offline functionality will allow data to be collected in low-connectivity environments and synchronised automatically once a connection is restored, ensuring flexibility and reliability in the field.

REST API Framework for Interoperability with External Systems

At the core of the platform's integration strategy is a REST API framework that enables secure, standards-based interoperability with external systems. APIs provide structured access to core data entities – such as suppliers, packaging components, products, and evidence – supporting both read and write operations where permitted. Authentication is handled via OAuth2, ensuring secure and auditable connections. This approach allows the platform to serve as a central hub in the broader sustainability and compliance ecosystem.