PACKINPRO SCIENTIFIC CHARTER
ESG Certification System for Sustainable Packaging

1. INTRODUCTION: TOWARD MEASURABLE SUSTAINABILITY IN PACKAGING

1.1 Measurement as an epistemological approach to substantive sustainability

The packaging sector is undergoing a fundamental shift — driven by a convergence of regulatory pressure, market forces, and growing environmental awareness. The proposed **EU Packaging and Packaging Waste Regulation** (PPWR, COM/2022/677), passed by the European Parliament in 2024, marks a turning point: for the first time, it mandates a systemic, whole-lifecycle approach to packaging — from eco-design through to end-of-life — backed by binding quantitative targets for reduction, reuse, and recycling.

That transition, however, runs headlong into a problem that has long compromised corporate sustainability as a whole: the **unreliability and inconsistency of ESG ratings**. As Berg, Kölbel, and Rigobon demonstrated in their landmark study published in the *Review of Finance* (2022), ESG assessments of the same company can differ dramatically across rating agencies, with cross-agency correlations ranging from 0.38 to 0.71. The authors traced 56% of that divergence to differences in how the underlying phenomena are **measured**, 38% to **scope** — which aspects are assessed at all — and just 6% to the **weighting** of different dimensions.

This "aggregate confusion" — the authors' term — is not merely a technical problem. It has real consequences: for companies, for investors, and for the broader economy. Companies receive conflicting signals about where to invest to improve their sustainability performance. Investors struggle to integrate ESG criteria into portfolio decisions. Consumers are exposed to greenwashing. Recent research confirms that ESG rating divergence can raise the cost of capital (Wang et al., 2024), compress equity returns (Tan & Pan, 2023), and increase the risk of stock price crashes (2024, 2025).

PackInPro was built as a concrete, scientifically grounded response to this landscape of uncertainty and fragmentation. It is not another ESG rating. **It is a validated, verifiable certification scheme** designed specifically for the sustainable packaging sector. The PackInPro model addresses the divergence problem through three principles that set it apart from conventional rating systems.

First: full methodological transparency. Every evaluation criterion, scoring threshold, validation checklist, and calculation method is publicly documented. There are no algorithmic black boxes. Every score can be traced back to objective, verifiable evidence.

Second: independent validation under ISO/IEC 17029:2020. Unlike self-assessments or ratings compiled by commercial agencies, PackInPro requires that every ESG data point be verified by an accredited third-party body (MY CERT), through rigorous audit procedures that include risk-based sampling, on-site inspection, and documentary cross-checks.

Third: vertical integration across organisation and product. PackInPro moves beyond the conventional divide between corporate ESG reporting and product certification. It operates on two levels: measuring the sustainability of organisational processes (42 environmental, social, and governance KPIs) and the sustainability of physical packaging products (12 technical-

environmental KPIs). This architecture makes it possible to verify whether what a company states as policy actually holds when measured against what it produces.

This scientific charter has two purposes: to provide **a rigorous, transparent methodological foundation** for ESG certification in the packaging sector; and to make that foundation **legible and actionable** for every stakeholder involved — from manufacturers and materials suppliers to certification bodies, policymakers, and end consumers.

To that end, the charter draws on **four complementary knowledge domains**.

1. **Materials engineering and environmental science** — for measuring the technical and physicochemical properties of packaging products: material density, monomateriality, recyclability, environmental compatibility, and mechanical performance. This draws on established methodology in sustainable packaging science (Siracusa et al., *Sustainable Materials and Technologies*, 2020; Verghese et al., *Packaging Technology and Science*, 2021).
2. **Economics and social science** — for assessing the social and organisational dimensions of sustainability: inclusion, training, employee welfare, ethical governance, and community relations. Reference frameworks include Corporate Social Responsibility principles and social reporting standards such as GRI and ISO 26000.
3. **ESG measurement theory and management systems** — PackInPro aligns with the most rigorous international standards (ISO 14001 for environmental management, ISO 26000 for social responsibility, ISO 37001 for anti-corruption, ISO 45001 for occupational health and safety) and with the emerging European reporting frameworks (ESRS, CSRD, EU Taxonomy).
4. **Systematic life cycle analysis (Life Cycle Thinking)** — consistent with LCA methodology (ISO 14040 and ISO 14044) and the European Environment Agency's orientations within the Circular Economy Monitoring Framework (EEA, 2023).

As Andrew Jordan observes in the *Journal of Environmental Policy & Planning* (2022), measuring sustainability is never a neutral or purely technical act. It involves translating complex phenomena — the interactions between economic activity, natural ecosystems, and social dynamics — into **metrics that can be verified and compared**. This process of quantifying the social carries methodological choices with real consequences: what gets measured and what gets left out; which indicators are privileged; how heterogeneous data are aggregated into a single index.

PackInPro meets this epistemological challenge by building its certification **methodology on objective evidence, subjected to rigorous independent verification**. In doing so, PackInPro does not simply measure sustainability from the outside — it actively helps **to construct and enact it**, in the sense Donald MacKenzie describes in *An Engine, Not a Camera* (2006): certification does not merely describe a pre-existing reality; it shapes organisational behaviour, creates incentives for continuous improvement, and produces what Michael Power calls, in *The Audit Society* (1997), an "infrastructure of trust."

The model introduces into the packaging sector an advanced concept of **"validated ESG rating,"** structured across two complementary levels.

- **Organisational ESG certification** assesses the overall sustainability of the organisation through 42 indicators across three dimensions — Environmental (6 KPIs), Social (23 KPIs), and Governance (13 KPIs) — measuring alignment with the principles of the Corporate Sustainability Reporting Directive (CSRD 2022/2464).

- **Product and product-family certification** apply a grid of 12 environmental and social KPIs to verify the actual performance of packaging products in terms of material efficiency, recyclability, safety, and lifecycle impact.

This two-level approach connects **process sustainability** — organisational — **to outcome sustainability** — material — addressing what Gray, Adams & Owen (*Social and Environmental Accounting*, 2014) call "multi-level accountability": sustainable performance must be measurable both in the productive structure and in its tangible outputs.

PackInPro is not another certification scheme. It is the **infrastructure** for a culture of measurable, verifiable sustainability — one whose purpose is not only to certify, but **to build trust** between manufacturers, suppliers, customers, and consumers, and to establish a shared language for packaging sustainability.

As Eccles, Ioannou, and Serafeim showed in *Management Science* (2014), companies that adopt structured, measurable sustainability policies outperform financially over the long term — but only when those policies are **genuine and verifiable**. PackInPro certification is built precisely for that condition: not as a destination, but as **a process of continuous improvement**, in which each company is guided toward a dynamic balance between economic competitiveness, reduced environmental impact, and shared social value.

From this perspective, certification becomes **a cognitive tool for collective learning** (Voß, Smith & Grin, *Ecological Economics*, 2009): through the measurement and validation of ESG data, companies develop a clearer understanding of their own performance, identify areas for improvement, benchmark their practices against competitors, and communicate their commitments to stakeholders with credibility.

1.2 Alignment with European and international frameworks

The PackInPro model sits at the intersection of **ISO technical standards and international ESG reporting frameworks** — deliberately. The combination is not incidental: it reflects the need to pair the methodological rigour of technical standards with the informational relevance of financial and non-financial disclosure frameworks.

Specifically, PackInPro integrates:

- **GRI Standards 2021 (Global Reporting Initiative)** — for quantitative reporting of environmental and social data against materiality criteria and stakeholder engagement principles.
- **SASB (Sustainability Accounting Standards Board)** — for identifying the ESG topics material to the packaging and supply chain sector specifically.
- **EU Taxonomy for Sustainable Activities (EU Regulation 2020/852)** — for classifying environmentally sustainable economic activities and verifying Do No Significant Harm criteria.
- **ESRS (European Sustainability Reporting Standards, EFRAG 2024)** — for comparability and alignment with double materiality criteria, both financial and impact-based.
- **CSRD (Corporate Sustainability Reporting Directive, EU Directive 2022/2464)** — for the verifiable, auditable ESG disclosure obligations that will progressively apply to all large European companies.

This integration positions PackInPro as **a hybrid scheme**: scientifically grounded but operationally compatible with corporate reporting requirements, translating regulatory metrics into **verifiable indicators of organisational and product performance.**

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2. THE REGULATORY ARCHITECTURE OF THE PACKINPRO SYSTEM

The PackInPro certification system rests on a solid normative foundation, deriving its legitimacy and methodological coherence from **EN ISO/IEC 17029:2020 — *Conformity assessment: General principles and requirements for validation and verification bodies*** — developed jointly by ISO (International Organization for Standardization) and IEC (International Electrotechnical Commission).

Published in 2019 and updated in 2020, this standard now underpins **ESG assurance systems** worldwide. Its significance lies in what it established for the first time: a coherent, cross-sector framework defining what validation and verification bodies (V/VBs) must do to guarantee the reliability of information declared by companies, projects, or products.

As ANAB (ANSI National Accreditation Board), one of the world's leading accreditation bodies, has noted, ISO/IEC 17029 was developed in direct response to the explosion of **sustainability declarations** flooding the marketplace. In an era when brands like Tony's Chocolonely claim to produce "100% slave-free chocolate," DHL commits to net-zero emissions by 2050, and Anheuser-Busch InBev bills itself as "the world's most water-efficient brewer," the ability to separate credible commitments from hollow marketing promises has never mattered more.

Before ISO/IEC 17029, sector-specific standards existed — ISO 14064-3 for greenhouse gas emissions, for instance, dating back to 2006 — but there was no general framework applicable to any verifiable declaration: environmental, social, ethical, safety-related, or quality-related. ISO/IEC 17029 fills that gap, establishing **principles and requirements** that hold across all of them.

The standard establishes six core principles that form the ethical and methodological backbone of every validation process:

- **Impartiality.** The validation process must be conducted free of conflicts of interest, using objective methodologies and criteria. The verification body must be structurally and operationally independent from the entity it is assessing.
- **Competence.** Everyone involved — from the auditor to the body's technical lead — must have the technical and professional expertise to understand and evaluate the information under review. In an ESG context, this means genuinely multidisciplinary knowledge spanning environmental, social, and governance domains.
- **Consistency.** The methodological approach must remain coherent over time and across different assessments. Any variations must be justified, documented, and formally approved.
- **Transparency.** Evaluation criteria, audit procedures, compliance thresholds, and calculation methods must be clear, properly communicated, and applied uniformly.
- **Confidentiality.** All data collected must be handled in strict confidence, in keeping with privacy requirements, trade secret protection, and the GDPR (EU Regulation 2016/679).
- **Objective evidence.** Conclusions must be grounded in verifiable data, records, and documented information from reliable sources. Assessments based on subjective perception or anecdotal information are not admissible.

Rigorous application of these principles within the PackInPro framework ensures that **every ESG rating — whether at company or product level** — is built on data that has been documented, sampled, and verified against internationally recognised criteria, not on self-reported claims or opaque methodologies.

The PackInPro framework is **a multi-level normative system**, each level serving a distinct function — assurance, measurement, or operational guidance. The architecture is deliberately pyramidal: it ensures vertical coherence between general principles and their practical application, and horizontal transparency between company, auditor, and certification body.

Level 1 — Accreditation standard. ISO/IEC 17029:2020 sets the general requirements for independent validation and verification, applicable to any type of verifiable declaration.

Level 2 — Supporting management standards. ISO 14001:2015 (Environmental Management Systems), ISO 26000:2010 (Social Responsibility Guidelines), ISO 45001:2018 (Occupational Health and Safety), ISO 37001:2016 (Anti-Bribery Management Systems). These standards provide organisational frameworks that companies may adopt voluntarily — and which serve as robust evidence during the PackInPro certification process.

Level 3 — PackInPro certification regulations. These define ESG criteria at both company and product level, indicator calculation methods, rating thresholds, and the documentary and on-site validation process. They are set out in two separate documents: the PackInPro Company Certification Regulation and the PackInPro Product Certification Regulation.

Level 4 — Operating instructions (OI). These describe practical management procedures, service level timelines, and the allocation of roles and responsibilities between the Vendor (the applying company) and the Validation Body (MY CERT). Instructions IO_PACKINPRO_01 and IO_PACKINPRO_02 ensure operational consistency and efficiency.

Level 5 — Technical annexes and KPI sheets. Calculation tools, assessment matrices, audit grids, and the quantitative indicators used during verification. This includes ESG spreadsheets, product KPI calculation documents, and validation checklists.

The entire multi-level structure has been designed to be **open and interoperable** with other ESG assessment systems and environmental labelling schemes, including: EU Ecolabel, FSC/PEFC (forestry certifications), OK Compost (compostability), Plastica Seconda Vita, and B Corp Assessment. This interoperability makes adoption easier for companies that already hold other certifications — reducing documentary redundancy and supporting the integration of management systems.

2.1 Independent validation and process governance

One of the defining features of the PackInPro model is **a clean separation of roles** throughout the certification process — in full conformity with ISO/IEC 17029's requirements for impartiality and independence.

Validation Body (MY CERT). An accredited third party responsible for planning, executing, and formally approving the validation process. MY CERT issues the ESG Validation Certificate and

guarantees the impartiality of its findings. It does not provide consultancy services to the companies it certifies — a structural safeguard against conflicts of interest.

ESG Audit Team. A multidisciplinary group responsible for documentary review, sampling, interviews, and on-site inspections. Team members must hold certified ESG competencies and demonstrated experience in industrial auditing. Composition varies according to the complexity of the organisation under assessment and the sector it operates in.

Vendor (applying company). The entity requesting certification. The Vendor completes the ESG self-assessment, provides supporting documentation, and accepts the terms of verification. It designates a Company ESG Officer who acts as the primary interface with the audit team.

Quality System Manager (QSM). Oversees compliance with MY CERT's internal procedures and approves any methodological changes to the certification system. The QSM is responsible for the consistency of the process over time.

The entire process is governed by tight Service Level Agreements: each stage — offer processing, credential submission, provisional rating assignment, documentary review, certificate issuance — is bound by maximum turnaround times of one to three working days, ensuring efficiency, traceability, and speed of service.

Beyond ISO/IEC 17029, the PackInPro framework draws on a coordinated set of technical standards and international instruments that reinforce and deepen the certification structure:

Environmental management — ISO 14001:2015. Verification of company environmental policies, and traceability of data on waste, energy, emissions, and water consumption. ISO 14001 certification serves as robust evidence of an environmental management system during a PackInPro audit.

Social responsibility — ISO 26000:2010. Guidelines for assessing practices around inclusion, safety, workers' rights, community relations, and stakeholder engagement. Although ISO 26000 is not itself certifiable, it provides the methodological reference for evaluating the Social dimension.

Health and safety — ISO 45001:2018. Assessment of workplace safety parameters in production processes, risk management, personnel training, and accident prevention.

Anti-corruption and ethical governance — ISO 37001:2016. Indicators covering transparency, governance, codes of conduct, conflict-of-interest management, and whistleblowing procedures.

Gender equality — UNI/PdR 125:2022. Measurement of KPIs on the gender pay gap, inclusion policies, welfare schemes, and work-life balance. This Italian reference standard is recognised as a benchmark at European level.

Life cycle analysis — ISO 14040 and ISO 14044. Applied in the technical assessment of product KPIs: environmental compatibility, recyclability, and impact across the supply chain.

ESG reporting — GRI Standards 2021 / EFRAG ESRS 2024. PackInPro metrics are aligned with European disclosure standards, ensuring that certified data can also feed directly into mandatory sustainability reporting.

Taken together, this interconnected structure places PackInPro within **an integrated compliance** ecosystem — where certification is not a standalone obligation but **a structural component of the company's sustainable governance.**

2.2 Digital reporting, built in from the start

PackInPro is designed around **digital, data-driven processes** — in line with the EU *Digital Product Passport* regulation (EU Reg. 2023/988) and current European requirements on sustainability data traceability.

Certified digital platforms (MyCert Portal) handle all ESG data and supporting documentation in a tracked, secure environment. In practice, that means:

- Company and product self-assessments are stored in structured digital form, with timestamps and digital signatures.
- Documentary evidence is transmitted to the auditor automatically and encrypted — less administrative friction, more security.
- Provisional and final ratings are generated automatically with qualified digital signatures, compliant with the eIDAS regulation (EU Reg. 910/2014).
- Certificates are published on the PackInPro portal with **a traceability QR code**, letting any stakeholder verify authenticity and access aggregated sustainability data on demand.

This is what **evidence-based transparency** looks like in practice — and it lays the groundwork for future interoperability with European ESG reporting systems and sustainable finance databases, including the ESAP (European Single Access Point) mandated under CSRD to consolidate sustainability disclosures across EU companies.

Digitalisation also takes the friction out of **annual recertification**. Through interactive dashboards, certified companies can track their KPIs in real time, benchmark against sector peers, and spot improvement areas before the surveillance audit — not during it.

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3. HOW THE PACKINPRO SYSTEM WORKS: A TWO-TIER ARCHITECTURE

The PackInPro system operates on **two complementary levels of ESG certification** — a multi-scale structure that reflects the real complexity of sustainability in modern production. The architecture is deliberate. Recent scientific literature has pressed hard on a problem the industry has long sidestepped: the disconnect between organisational ESG reporting and technical product assessment. PackInPro closes that gap, bringing both dimensions into a single coherent framework.

The principle has rigorous backing. In their landmark work on Social and Environmental Accounting (2014), Gray, Adams and Owen argue that sustainable performance must be measurable at two levels simultaneously — in the production system and in its tangible outputs. They call this **"multi-level accountability."** The argument is precise: auditing a company's policies and management systems is not enough. You have to verify that those policies actually produce goods with measurable sustainability characteristics. Organisation-level scrutiny and material-level evidence are not alternatives. Both are required.

PackInPro puts this into practice through two distinct but connected certifications:

1. PackInPro Company ESG Certification assesses the organisation's environmental, social and governance performance across **42 key indicators**: 6 Environmental KPIs, 23 Social KPIs and 13 Governance KPIs. The framework is benchmarked against the Corporate Sustainability Reporting Directive (CSRD 2022/2464) and the European Sustainability Reporting Standards (ESRS).

2. Product or Product-Family Certification measures the material, functional and end-use sustainability of packaging through **12 technical KPIs.** These are derived from physical, compositional and behavioural parameters — verified through laboratory testing, document review and on-site inspection.

Together, the two certifications **connect process sustainability to outcome sustainability**. That connection is what closes what Eccles and Klimenko (2019), writing in the Harvard Business Review, called the "credibility gap" in ESG data: the distance between what a company declares as policy and what it actually delivers in measurable impact. Their argument holds here — ESG data earns credibility through **cross-level traceability**: a verifiable thread running from strategic commitments down to operational results.

3.1 Company ESG Certification: Structure and Scoring Logic

The PackInPro company certification measures overall organisational sustainability through **a numerical rating from 4 (insufficient) to 10 (excellent),** calculated as a weighted average of scores across the three ESG dimensions. The methodology draws on **Multi-Criteria Decision Analysis (MCDA)** — an approach widely used in sustainability assessment precisely because it can bring heterogeneous indicators into a single, comparable index.

Cinelli, Coles and Kirwan, writing in *Ecological Indicators* (2014), identified four properties that make MCDA particularly well-suited to sustainability evaluation: it handles both quantitative and qualitative data; it accommodates the perspectives of multiple stakeholders; it manages uncertainty and trade-offs between competing objectives; and it produces results that are robust and replicable.

The approach has since been validated across demanding sectors. Ferla et al. (2024) demonstrated its effectiveness in food-industry sustainability assessment; Mesa Estrada et al. (2024) applied it to emerging energy technologies; and a meta-analysis published in *Sustainability* (2023) confirmed its validity for circular-economy evaluation in agriculture.

The overall ESG rating is calculated as:

Total ESG Rating = (E + S + G) / 3

where:

E — Environmental covers energy efficiency, natural resource management, greenhouse gas (GHG) emissions, waste management, and held environmental certifications.

S — Social covers labour quality, occupational health and safety, employee welfare, inclusion and gender equality policies, continuous training, and relations with the local community.

G — Governance covers transparency mechanisms, anti-corruption policies, decision traceability, ethical management of conflicts of interest, and the composition of governing bodies.

Each dimension is built from objective, measurable KPIs drawn from documentary evidence and verified through standardised audit procedures.

The PackInPro model is **risk-based and materiality-driven**. Each indicator is weighted according to its materiality — its actual relevance to the ESG impacts of the packaging sector and the expectations of the stakeholders within it. Materiality is determined through **a priority matrix** that weighs three dimensions:

1. **Environmental and social risk** — the potential for significant negative impact
2. **Stakeholder importance** — the relevance attributed by investors, customers, suppliers and the local community
3. **Economic significance** — the direct or indirect financial effect of the indicator

This approach is grounded in the growing literature on *dynamic materiality* in ESG disclosure. Khan, Serafeim and Yoon, in a landmark study published in *The Accounting Review* (2016), showed that companies focusing on ESG issues that are material to their sector consistently outperform their peers financially. Adams (2020) developed the concept further, arguing that materiality is not fixed — it shifts in response to regulatory, technological and social change. More recently, Eccles, Stroehle and Li (2023) identified dynamic materiality as one of the key determinants of credibility in sustainability reporting.

The PackInPro framework takes this seriously. **KPI weightings are reviewed annually** against the evolution of European regulatory requirements, reporting standards (GRI, ESRS) and emerging scientific evidence on the packaging sector. The system is built to stay current — not to fossilise at the moment of its design.

The primary sources of documentary evidence for company certification include:

- **Sustainability reports and ESG disclosures** — assessed for completeness, consistency and comparability
- **Consumption records** — electricity, gas, fuel, water and raw materials
- **Emissions data** — Scope 1, 2 and (where available) Scope 3 GHG calculations, prepared in accordance with the GHG Protocol
- **Employment contracts and company policies** — reviewed for contract types, welfare provision and training
- **Certification credentials** — ISO 14001, EMAS, SA 8000, ISO 45001, ISO 37001, UNI/PdR 125:2022
- **Internal surveys and organisational wellbeing data** — staff turnover rates, absenteeism and employee satisfaction
- **Anti-corruption procedures and codes of ethics** — reviewed for completeness, implementation and ongoing monitoring

All evidence is validated through **systematic or risk-based sampling**, in accordance with ISO/IEC 17029 and the *ESG Assurance Guidance published* by IFAC (International Federation of Accountants, 2022) and by leading audit firms (KPMG, 2023; Deloitte, 2024).

The quality of ESG assurance depends critically on two things: **the multidisciplinary competence of the audit team,** and the rigour of its sampling methodology. Simnett, Vanstraelen and Chua

demonstrated this in a foundational study published in *The Accounting Review* (2009), showing that ESG audits conducted by teams with certified expertise produce significantly more reliable assessments than generic verification exercises.

3.2 Product Certification: Measuring the Material Sustainability of Packaging

The PackInPro product certification is the technical arm of the ESG model — a methodology built around **empirical measurement of packaging's environmental performance** and real-world use. It applies to individual products and to **homogeneous product families alike**.

A "product family" is defined as a group of packaging items that share the same technical, functional and structural characteristics, differing only in physical dimensions — volume, height, width or capacity. All members of the family must be made from the same materials, follow the same production process, use identical assembly technologies, and meet the same performance criteria: mechanical resistance, barrier properties, compatibility with contents, and recyclability or compostability.

This approach makes certification significantly more efficient for manufacturers producing dimensional variants of the same packaging format — reducing cost without compromising the rigour of the assessment.

The product certification system comprises 12 KPIs grouped into four logical categories, drawn from the scientific literature on sustainable packaging and from the orientations of European circular economy policy.

CATEGORY 1: Material Efficiency and Circular Economy

KPI 1 — Raw material quantity (kg) / Volume created (m³) measures the density and volumetric efficiency of the packaging. Lower values indicate optimised material use per unit of protected volume. This indicator operationalises the principle of dematerialisation — one of the cornerstones of the circular economy as defined by the Ellen MacArthur Foundation and the European Circular Economy Action Plan.

KPI 2 — Recycled material content (%) assesses the circular credentials of the packaging by measuring how much material derives from post-consumer or post-industrial recycling streams. Measurement follows the ISO 14021 guidelines on environmental labels and declarations, verified through supplier chain-of-custody certificates.

KPI 3 — Environmental certification of raw materials traces the certified origin of materials: FSC or PEFC for cellulose-based materials; Plastica Seconda Vita or equivalent recycled-content certifications for plastics; compostability certifications where applicable. This KPI addresses the supply-chain transparency now required by European regulation — including the Corporate Sustainability Due Diligence Directive and the Deforestation Regulation.

CATEGORY 2: Safety and Health Impact

KPI 4 — Absence of hazardous substances verifies compliance with REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals), RoHS (Restriction of Hazardous

Substances) and food-contact materials regulation (EU FCM). This KPI is especially critical for food and pharmaceutical packaging.

KPI 5 — Consumer safety assesses end-use safety: absence of sharp edges, mechanical stability, resistance to normal handling stress, and conformity with general product safety standards (EN ISO 12100).

CATEGORY 3: End of Life and Recyclability

KPI 6 — Post-use compactability estimates the volumetric reduction achievable after use — a parameter that directly affects waste logistics and transport costs across recycling supply chains. Measured through compression testing to ASTM D5276.

KPI 7 — Mono-materiality and separability measures how easily the constituent materials can be separated. Single-material packaging, or packaging designed for clean separation, is preferable because it streamlines mechanical recycling. This KPI is benchmarked against the Design for Recycling guidelines published by CONAI and CEFLEX (Circular Economy for Flexible Packaging).

KPI 8 — Recyclability links the material to CONAI environmental contribution bands and to the requirements of the European Packaging and Packaging Waste Directive. It assesses how well the packaging is compatible with existing separate-collection systems and available recycling infrastructure.

KPI 9 — Consumer disposal accessibility examines how clearly and accessibly end-of-life instructions are communicated to the final consumer. This KPI introduces a user-centred dimension into the sustainability assessment — consistent with the findings of Steenis et al. (*Journal of Cleaner Production*, 2019) on the decisive role consumer behaviour plays in determining real-world recycling rates.

KPI 10 — Environmental compatibility assesses biodegradability and degradation timeframes against EN 13432 (compostability) and ISO 14855 (aerobic biodegradability). It also includes qualitative evaluation of potential impact in the event of environmental dispersal — marine litter and microplastic contamination.

CATEGORY 4: Technical Performance *(protective packaging only)*

*KPI 11 – Cushioning***:** measures mechanical shock-absorption performance under ISTA (International Safe Transit Association) and ASTM D5276 test protocols. Essential for protecting products through transit and storage.

KPI 12 – Vibration: measures packaging resistance to vibrational stress in transit, per ASTM D999 and ISTA standards. Critical for fragile or sensitive products.

3.3 The Scoring System, Qualitative Classification Model, Life Cycle Assessment and Circular Design

Each indicator is scored on **a scale of 1 (excellent) to 5 (very poor),** using the performance bands defined in the technical document *Calcolo_KPI_Prodotto*. The scale runs inverse to the company-

level certification — by design: this aligns with established international practice for product assessment, where lower scores signal stronger sustainability performance.

The final rating is the arithmetic mean of all 12 KPI scores:

Product Rating = $\Sigma(KPI_1 \ldots KPI_{12}) / 12$

This yields a qualitative classification as follows:

Score	Classification
1.0 – 1.5	Excellent
1.6 – 2.5	Good
2.6 – 3.5	Adequate
3.6 – 4.5	Poor
4.6 – 5.0	Very poor

The PackInPro certification threshold is set at **a rating of ≤ 3.0 (Adequate).** Only products that meet or beat this floor are eligible for the mark.

The KPI framework reflects the established consensus in **sustainable packaging science** — a field that has generated substantial empirical research at the intersection of Life Cycle Assessment and circular economy over recent years.

A meta-analysis published in the *Journal of Cleaner Production* by Niero et al. (2024), drawing on 147 packaging LCA studies, found that robust sustainability assessment must integrate three dimensions:

- **mechanical and functional performance** (protection, transport, ergonomics)
- **environmental impact across the full life cycle** (cradle-to-grave or cradle-to-cradle)
- **material recovery and reuse potential** (circular design)

A 2024 comparative LCA study by IFCO Systems — conducted by Fraunhofer IBP and reviewed by DEKRA — found that reusable fresh produce packaging can cut CO_2 emissions by up to 62% against single-use cardboard alternatives. The finding underscores the importance of holistic assessment across the entire product life cycle.

PackInPro also brings **a social and behavioural** dimension to packaging evaluation. The framework includes *user-centred sustainability* criteria that measure how clearly and accurately end-of-life disposal information is communicated to consumers — a factor shown to be critical to the real-world performance of circular economy systems (Steenis et al., *Journal of Cleaner Production*, 2019).

3.4 Vertical integration: from company rating to product rating

One of the defining features of the PackInPro model **is the vertical integration of ESG data across the company and product levels.** The system operates on a two-way logic — top-down and bottom-up simultaneously.

Top-down: corporate policies and management systems — ISO 14001, CSR frameworks, ethical governance — shape a company's capacity to design and manufacture sustainable packaging. A strong company-level ESG rating is a reasonable indicator of readiness to innovate toward circular solutions.

Bottom-up: product-level technical evidence — recyclability, safety, environmental impact — feeds back into the company ESG score. If a company reports strong environmental performance but produces packaging with poor recyclability, that gap surfaces clearly in the cross-referenced ratings.

This principle of organisational eco-feedback — described by Nidumolu, Prahalad and Rangaswami in an influential *Harvard Business Review* piece (2009) — means sustainability is not treated as a checklist of isolated obligations, but as **an adaptive system of continuous learning**. Companies certified by PackInPro can use the gap between their company rating and product rating to pinpoint strategic weaknesses and map opportunities for innovation.

Several international frameworks attempt to assess packaging sustainability, but few integrate company-level and product-level evaluation in a single model. PackInPro differs on three counts.

1. Independent validation under ISO/IEC 17029 — a materially higher bar than the self-declaration regime governed by ISO 14021. As DQS and ANAB, two of the world's leading accreditation bodies, make clear, ISO 17029 sets significantly stronger standards for both competence and independence.

2. Proprietary technical and environmental KPIs — scientifically grounded, calibrated specifically to the packaging sector, and designed for like-for-like comparison across different products. Full LCAs remain too costly and time-intensive for routine application; the PackInPro KPIs strike the right balance between scientific rigour and operational practicality.

3. Interoperability with European ESG frameworks — ESRS, CSRD, EU Taxonomy — so that certified data can feed directly into mandatory sustainability reporting and digital disclosure systems, including the Digital Product Passport.

As Haack, Schoeneborn and Wickert argue in *Organization Studies* (2021), the credibility of ESG ratings depends on the standardisation of narratives — the ability to compare data across common, verifiable reference points. PackInPro answers that requirement by translating sustainability performance into **objective, measurable units**: independently verifiable by third parties and fully compatible with the assurance logic demanded by sustainable finance markets (IFAC, 2022).

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4. MEASUREMENT AND VALIDATION METHODOLOGY

Measuring sustainability is never a neutral or purely technical act. As Andrew Jordan observed in a methodological contribution to the *Journal of Environmental Policy & Planning* (2022), it is always a process of **translation** — converting complex phenomena into **verifiable, comparable, communicable metrics**. The phenomena in question are not simple: they span the interactions between economic activity, natural ecosystems, and social dynamics.

Sociologists of science call this process the "quantification of the social" (Espeland & Stevens, 2008). It involves methodological choices with real consequences: what gets measured and what

gets left out; which indicators are prioritised; how heterogeneous data are weighted and aggregated into a single composite index; and what performance thresholds count as acceptable.

The PackInPro model was built to meet the need for **rigorous, objective assessment of sustainable value** — combining the scientific robustness of ISO validation methods with the systemic sensitivity of contemporary ESG metrics. Following the framework proposed by Delmas and Blass in a landmark study published in *Business Strategy and the Environment* (2010), the PackInPro methodology rests on three interdependent, non-negotiable pillars:

1. **Empirical measurement** of ESG performance through quantitative and qualitative key indicators
2. **Independent data validation** in accordance with ISO/IEC 17029:2020
3. **Full digital transparency and traceability** throughout the assurance process

This methodological structure is designed to eliminate the risk of *greenwashing* — a problem still widely documented in non-accredited certifications and self-declared assessments. As Marquis, Toffel, and Zhou demonstrated in a study published in *Organization Science* (2016), companies tend to strategically emphasise positive environmental performance and downplay negative results when disclosure is voluntary and not subject to independent verification.

The PackInPro process follows the operational phases set out in ISO/IEC 17029 and internal certification regulations. It runs across **seven sequential stages**, each with defined responsibilities and timelines governed by Service Level Agreements (SLAs).

PHASE 1 — Planning Define validation objectives, audit scope, data sources, and human and technical resource allocation. Establish the sampling plan. **Output**: Validation Plan (VP) | **Responsibility**: Validation Body (MY CERT) | **Timeline**: 1 business day

PHASE 2 — Evidence Collection Gather ESG data through structured *self-assessment*, company documents, sustainability reports, accounting records, key-personnel interviews, and physical evidence. **Output**: Complete ESG dataset with documentary evidence | **Responsibility**: Audit Team | **Timeline**: 3 business days from self-assessment submission

PHASE 3 — Analysis and Benchmarking Assess internal data consistency, compare against sector benchmarks, and verify alignment with ISO standards and the company's historical data where available. **Output**: Preliminary Compliance Report | **Responsibility**: Audit Team | **Timeline**: 2 business days

PHASE 4 — On-Site Verification Physical audit at production facilities: direct sampling, face-to-face interviews, plant inspections, and review of operational procedures. This phase may be waived only in exceptional circumstances for very small companies with certified internal control systems. **Output**: Documented Audit Minutes | **Responsibility**: Audit Team | **Timeline**: 1–2 business days

PHASE 5 — Technical Review Final validation of findings by the Validation Body, methodological consistency check, and approval of the ESG rating derived from the audit. This stage ensures *independence* and a clear separation between those who conduct the audit and those who take the final decision. **Output**: Validation Report | **Responsibility**: MY CERT (Quality System Manager) | **Timeline**: 2 business days

PHASE 6 — Decision and Issue Issuance of the final assessment and validation document. Where serious non-conformities are identified, a Non-Conformity Report is issued specifying the

corrective actions required. **Output**: Digitally signed ESG Validation Certificate | **Responsibility**: MY CERT | **Timeline**: 1 business day

PHASE 7 — Maintenance Establishment of an annual surveillance plan and periodic review of ESG data to ensure ongoing certification validity. **Output**: Annual Surveillance Report | **Responsibility**: Validation Body

This operational framework meets the **consistency, repeatability, and traceability** requirements of international ESG assurance systems, as documented in the IFAC guidelines (*The State of Play in Sustainability Assurance*, 2023).

The PackInPro process applies **a targeted, risk-based sampling strategy** — a core principle of ISO/IEC 17029 and the standard approach in contemporary ESG audit practice.

As Simnett, Vanstraelen, and Chua demonstrated in a landmark methodological study published in *The Accounting Review* (2009), the quality of ESG assurance is a direct function of sampling depth and auditor technical competence. The authors show that ESG audits conducted using random sampling produce significantly less reliable results than those guided by risk and materiality.

Under risk-based logic, the data sample subject to direct verification must satisfy four criteria:

1. Materiality to stakeholders Priority goes to indicators that most directly influence investment decisions, purchasing choices, and corporate reputation. Examples: Scope 1 and 2 GHG emissions, gender pay equity, occupational safety, hazardous substances in products.

2. Sensitivity relative to reputational and regulatory risk Focus on areas under heightened public scrutiny or tight regulatory oversight. Examples: hazardous waste management, social data on labour rights, integrity of declared environmental data.

3. Data source — manual vs. automated Manually collected data carries a higher error risk and requires more rigorous verification than data extracted from integrated ERP systems.

4. Volume and representativeness of the company dataset Sample size must be proportional to organisational complexity and process variability.

PackInPro requires the sample to cover **at least 70% of material KPIs** across each dimension (E, S, G) and to include **at least one indicator per thematic category** — energy, water, safety, training, and governance. This coverage exceeds minimum ISO standards and ensures the results are statistically robust.

The sampling strategy follows the methodology proposed by Power (*The Audit Society*, Oxford University Press, 1997) and subsequently refined by Martínez-Ferrero and García-Sánchez (*Journal of Business Ethics*, 2018), who argue that the quality of ESG assurance depends not only on sample size but on its strategic *representativeness* relative to the organisation's critical processes.

4.1 Evidence collection and validation

Evidence is gathered through three complementary methods, each calibrated to the type of information being verified and its associated risk level.

A) Document review

Systematic examination of ESG reports, sustainability accounts, financial records, technical data sheets, supply contracts, HR documentation, certifications, and corporate policies. Each KPI is mapped to specific, verifiable evidence through **compliance matrices** — creating a complete audit trail from primary source to published figure.

Tools: standardised checklists aligned with ISO 17029, ESG Data Sheet workbooks, ERP database queries, and internal cross-document consistency checks.

Integrity: every data point is triangulated against at least two independent sources. Energy consumption figures, for example, are cross-checked between supplier invoices and internal monitoring records.

Methodological basis: this approach draws on Feger and Mermet (*Ecological Economics*, 2017), which establishes documentary consistency as a cornerstone of environmental claims verification.

B) Structured interviews

Conversations with ESG leads, technical staff, members of governing bodies, and heads of function — to test understanding of processes, confirm that policies are actually implemented, and assess the organisation's sustainability culture in practice.

Method: a semi-structured protocol combining standardised questions (for comparability) with open-ended ones (for depth). The approach is grounded in Flick (*An Introduction to Qualitative Research*, 2018) and IFAC's ESG audit guidelines.

Sample questions: *"How is energy consumption monitored day to day?" "Who is responsible for vetting critical suppliers?" "What procedures exist for reporting unethical conduct?"*

Interviews surface what document review cannot: whether policies and procedures actually **operate as written** — a gap that purely documentary audits routinely miss.

C) On-site verification

Direct observation of production processes; inspection of environmental and social procedures; physical analysis of packaging products against technical KPIs; site walkthroughs; labelling checks; waste segregation audits.

Techniques:

- Laboratory measurement (mechanical testing, materials analysis)
- Environmental compatibility testing (biodegradability, compostability)
- REACH/RoHS compliance checks for hazardous substances
- Mechanical safety verification to EN standards
- Product sampling for cushioning and vibration testing

Standards referenced: ISO 14040 / 14044 (LCA); ISO 18604 (packaging recyclability); EN 13432 (compostability); ASTM D5276 and D999 (mechanical testing).

All evidence is held in a secure, **auditable digital system** — the *MyCert Portal* — compliant with GDPR (EU Regulation 2016/679) and the Digital Product Passport framework (EU Regulation 2023/988). Every record carries a timestamp, digital signature, and access log, ensuring data integrity and non-repudiation.

4.2 Converting Data into Scores: The MCDA Methodology

PackInPro's rating system is built on the principles of **Multi-Criteria Decision Analysis (MCDA),** a well-established methodology for sustainability assessments in complex systems. As demonstrated by Cinelli, Coles and Kirwan (*Ecological Indicators*, 2014) and confirmed by more recent work from Mesa Estrada et al. (2024) and Ferla et al. (2024), MCDA methods are particularly well-suited to this task because they can:

- Integrate quantitative indicators (emissions, consumption, percentages) and qualitative ones (policy, organisational behaviour and culture)
- Handle the inherent uncertainty in ESG data
- Weight indicators according to materiality
- Produce results that are robust and statistically verifiable

Each KPI is converted into a numerical score against **performance thresholds or sector benchmarks** drawn from:

- Public datasets (GRI Database, CDP Climate Change, EFRAG ESRS Data Points)
- Sector averages published by industry associations (CONAI, Plastics Europe, CEFLEX)
- Peer-reviewed scientific literature
- European regulations and directives (PPWR, EU Taxonomy TSC)

Rating scale — company certification (4–10):

- **10–9**: Excellent/Outstanding — performance significantly above benchmark
- **8–7:** Very good/Good — performance above sector average
- **6–5**: Adequate/Improving — performance at or slightly below sector average
- **<5**: Insufficient/Non-compliant — performance significantly below minimum requirements

Rating scale — product certification (1–5):

- **1**: Excellent — best in class
- **2**: Good — above-average performance
- **3**: Adequate — performance in line with standards
- **4**: Poor — below-standard performance
- **5**: Very poor — critically inadequate performance

For **binary KPIs** (presence or absence of certifications, adoption of policies), the score is **10 (or 1)** if the requirement is fully met, and **4 (or 5)** if it is absent or only partially implemented.

KPI scores within each ESG dimension are aggregated using a weighted arithmetic mean. Each indicator's weight w_i reflects its materiality to the packaging sector, as defined by a priority matrix that is reviewed and updated periodically.

For company certification:

$E = (\Sigma\ w_i \times E_i) / (\Sigma\ w_i)$

$S = (\Sigma\ w_i \times S_i) / (\Sigma\ w_i)$

$G = (\Sigma\ w_i \times G_i) / (\Sigma\ w_i)$

Overall ESG Rating: $Rating = (E + S + G) / 3$

For product certification:

$Product\ Rating = (\Sigma\ KPI_i) / 12$

(For product certification, weights are uniform given the limited number of indicators.)

This methodology is consistent with the multi-criteria approaches used in integrated ESG models, as documented by Mazzi et al. (*Journal of Environmental Management*, 2023).

Statistical validation and system robustness

To ensure **methodological rigour and replicability**, ESG data is subjected to statistical validity checks and sensitivity analysis:

Internal consistency testing (Cronbach's Alpha): verifies that the indicators within each dimension (E, S, G) are genuinely measuring coherent constructs. A value of $\alpha > 0.8$ indicates good internal reliability.

Weight sensitivity analysis: tests the stability of the final rating under marginal changes to KPI weights. Where small weight adjustments produce large rating shifts, the system requires revision.

Year-on-year consistency testing: tracks how ratings evolve over time to identify genuine performance improvements or deterioration. Methodology following Searcy (*Journal of Cleaner Production*, 2016).

Outlier testing: flags anomalous values that may point to measurement errors or exceptional circumstances warranting further investigation.

These analyses are conducted **annually** as part of the periodic maintenance and review cycle, to ensure that ESG scores reflect real changes in company and product performance — and are not an artefact of the methodology itself.

4.3 Validation outputs: report and certificate

The validation process produces two legally binding documents.

1. ESG Validation Report

A full technical record of the assessment, covering:

- **Verification process:** methodology used, sample scope, evaluation criteria applied
- **Evidence and sources:** all documents reviewed, interviews conducted, tests performed
- **Scores:** ratings for each ESG dimension and an overall rating
- **Gap analysis:** comparison against sector benchmarks and areas flagged for improvement
- **Non-conformities (NCs):** each NC identified, its severity, and the corrective action proposed
- **Recommendations:** specific steps for ongoing ESG performance improvement

The report carries the digital signatures of the Lead Auditor and the Quality System Manager at MY CERT.

2. PackInPro Certificate

A public-facing document issued by MY CERT, stating:

- Company or product name and unique identifier
- Final ESG score and rating class (Excellent, Very Good, Good, Adequate)
- Issue date and expiry date — 12 months for company certification, 24 months for product certification
- Certification scope: sites, products, and processes covered
- **A traceable QR code** linking to the PackInPro digital portal, where the underlying data is publicly accessible and verifiable

Both documents are held in **ESG Disclosure System rev.0** — ensuring authenticity, integrity, and full public auditability. As Eccles et al. observed in *Accounting, Organizations and Society* (2022), making **validation visible** is what converts sustainability from a stated value into a structure that can actually be trusted.

4.4 Synthesis: methodology as a performative device

The PackInPro methodology is a **scientifically rigorous, verifiable, and transparent** framework for ESG measurement in the packaging sector. Its defining features:

- A normative architecture aligned with ISO/IEC 17029 and international assurance standards
- A multi-level indicator structure integrating quantitative and qualitative data
- A risk-based validation method with systematic sampling
- An end-to-end digital assurance process with full traceability
- Clear governance, with defined role separation and tight SLAs

At a theoretical level, PackInPro embodies what sociologist Donald MacKenzie calls a **"performative device"** (*An Engine, Not a Camera*, 2006): a system that does not simply describe

sustainability as a pre-existing reality, but actively helps to produce it. Measurement practices shape organisational behaviour. They create incentives for continuous improvement. And they build what Michael Power terms the "audit society" — a world in which verifiability becomes the precondition for trust.

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5. AUDIT AND VALIDATION: HOW IT WORKS IN PRACTICE

PackInPro's audit process starts from a firm premise: sustainability is only credible when it has been **externally validated, independently assessed, and methodologically traceable**. As Power argued in *The Audit Society* (1997) — and as Boiral and Gendron later confirmed in *Organization Studies* (2011) — audit is not simply a technical control mechanism. It is an epistemic practice: one that builds public trust by turning organisational data into verifiable evidence.

PackInPro works within **the assurance-based ESG** tradition — assurance-oriented audit, in the framework set out by Simnett et al. in *Contemporary Accounting Research* (2009) — and applies a methodology aligned with the **International Standard on Assurance Engagements (ISAE 3000 Revised),** integrated with ISO/IEC 17029:2020.

The direction of travel is clear. In a 2024 Deloitte survey of 350 executives worldwide, 87% identified ESG assurance as a critical tool for meeting stakeholder expectations; 76% had already implemented internal ESG audits or were actively doing so. The same research found that companies with ESG assurance in place receive materially stronger ratings from ESG-oriented investors.

The PackInPro audit rests on five non-negotiable principles:
Every ESG judgement must be grounded in objective evidence — **verifiable after the fact**, **traceable** from source to published figure, **free from conflicts of interest** between auditor and auditee, **methodologically consistent over time**, and **fully documented** at every stage.

As O'Dwyer & Owen argue (*Accounting, Auditing & Accountability Journal*, 2005), the legitimacy of ESG certification rests on more than technical accuracy. It requires what they call **epistemic transparency**: the ability to show not just what a score is, but how it was reached and where every input came from — making the entire decision trail open to scrutiny.

The PackInPro validation process follows a closed, time-bound operational sequence with roles and responsibilities defined in internal regulations and operating procedures.

Assessments combine **quantitative and qualitative** methods to evaluate technical, managerial, and cultural performance in an integrated way. As Feger & Mermet argue (*Ecological Economics*, 2017), credible ESG validation requires exactly this: a triangulated approach that draws on multiple, independent sources of evidence.

a) In-depth document review

A systematic review of all company-supplied materials: sustainability reports, ESG disclosures prepared to GRI or ESRS standards, accounting records, product data sheets, supply contracts, HR documentation, and current certifications.

The review is structured around **compliance matrices** that map each KPI to specific, verifiable evidence — establishing a clear **chain of custody** from original source to published figure.

Specific techniques:

- **Document sampling** — risk-based selection of the most material documents
- **Cross-verification** — comparison across independent documents to test consistency
- **Time-series analysis** — tracking data over time to surface anomalies
- **Benchmarking** — comparison against aggregated sector data

b) On-site audit: field verification

Field visits are designed to confirm that declared data reflects reality. They cover:

- **Direct observation** of facilities and production processes — layout, material flows, monitoring systems
- **Physical testing** of product samples: mechanical tests, compositional analysis, labelling checks
- **Interviews with workers** and functional managers to assess ESG culture on the ground
- **Inspection of environmental and safety records**: logbooks, maintenance registers, digital archives

Site visits follow **the risk-based sampling methodology** set out in ISO/IEC 17029, with a minimum of 70% of material KPIs subject to direct verification through observation or measurement.

As an AuditBoard study on ESG best practice (2024) found, companies that voluntarily submit their sites to early on-site audits achieve significantly more reliable ratings — and identify areas for improvement before formal certification, not after.

c) Independent review: guaranteeing impartiality

Once field verification is complete, findings go to MY CERT — the Validation Body — for **technical review**. MY CERT is structurally separate from the audit team that conducted the work.

This **separation of roles** is a cornerstone of ISO/IEC 17029 and is explicitly recommended in the EFRAG guidelines (2024) for ESRS standards. The review checks:

- Methodological consistency across the entire process
- Whether the evidence collected actually supports the conclusions reached
- Correct application of scoring criteria
- Absence of bias or conflicts of interest
- Completeness of documentation

The rating is not finalised, and no certificate issued, until the technical review has been approved.

5.1 ESG Audit Techniques: A Multidisciplinary Skill Set

PackInPro's disciplinary framework recognizes what Milne & Gray (*Accounting Forum*, 2013) established: meaningful ESG audit draws on **multiple disciplines** — technical, economic, environmental, and sociological.

PackInPro audits are structured around three complementary levels of analysis.

Quantitative analysis. KPI review, correlation testing across ESG variables (energy vs. headcount, waste vs. output), GHG emissions verification against the GHG Protocol, and trend analysis over time. **Tools**: verified Excel data sheets, structured ESG databases, LCA software (SimaPro, GaBi, OpenLCA), and certified carbon footprint calculators.

Qualitative assessment. Evaluation of policies, organisational behaviour, and company practices — training programs, inclusion, ethical governance — alongside analysis of sustainability culture and verification that codes of conduct and internal procedures are actually being followed, not just filed. **Tools**: structured and semi-structured interviews, qualitative document analysis, participant observation, and employee focus groups where warranted.

Cross-verification. Systematic triangulation of declared data, physical evidence, and independent secondary sources. Reported electricity consumption, for example, is checked against supplier invoices, meter readings, building management system data, and historical usage. The methodology follows Yin (*Case Study Research: Design and Methods*, 2018), adapted to the ESG context in line with IFAC guidelines (2023).

Together, these three levels address what Gürtürk & Hahn (*Journal of Business Ethics*, 2016) identify as the core requirement of rigorous ESG audit: **epistemological robustness** — the logical coherence between how data is collected, which sources are used, and what conclusions are drawn.

5.2 Certification Decision: Three Possible Outcomes

The certification decision is made only after independent review of the complete technical file and audit report. That **review** produces one of three formal outcomes.

Certified. Full compliance with requirements, or minor non-conformities resolved during the process. The certificate is issued with its definitive rating and is valid for 12 months (company) or 24 months (product).

Conditional certification. Issued where there are methodological gaps, incomplete data, or non-conformities of moderate severity. The applicant has 30 days to implement corrective actions and submit supporting evidence. Once the documentation is verified, the certificate is issued — with a note, where appropriate, on the actions taken.

Rejected. Applied where serious non-conformities are found: document falsification, refusal to grant auditor access, or ESG data that is demonstrably unreliable or manipulated. A reasoned Non-Conformity Report is issued, and the applicant may not reapply for six months — and only then by demonstrating that the identified failings have been remedied.

The PackInPro Certificate states the final ESG score, the rating class, and the validity period. It is digitally signed with a qualified certificate and published on the **PackInPro portal** with a traceability QR code — in line with the principles of public accountability set out by Boiral (*Business Strategy and the Environment*, 2012).

Maintaining certification requires a structured programme of ongoing monitoring and review.

Annual surveillance audit. A check on the continuity of ESG performance: progress on previously proposed improvement actions, variance analysis against the prior rating, and review of any material changes to processes or products. Conducted on-site where possible, or remotely via document review and video conference. Typical duration: one to two days, depending on company size.

Full triennial review (recertification audit). A comprehensive reassessment of all KPIs, with materiality updated against current international standards, regulatory developments, and evolving stakeholder expectations. The process mirrors initial certification in full scope, and includes an assessment of how effectively the ESG management system has been embedded and what measurable improvement has been achieved over the three years.

This approach is grounded in the **continuous improvement** principle codified in ISO 9001 and developed in the sustainable management literature by Hart & Milstein (*Academy of Management Executive*, 2003).

At a deeper level, periodic ESG rating renewal follows the logic of **iterative assurance** — a concept developed by Adams & Frost (*Sustainability Accounting, Management and Policy Journal*, 2008). Rather than treating certification as a box to tick, iterative assurance frames it as a dynamic cycle of organisational learning: one that progressively embeds ESG principles into governance systems and turns sustainability from a compliance event into an ordinary management practice.

5.3 The Relational Dimension of Audit: Knowledge Built Together

PackInPro's framework recognizes that ESG validation is not purely a technical act. It is **a relational process** — one in which auditor and organisation **jointly construct knowledge**.

Latour (*Reassembling the Social*, 2005) and Callon (*The Laws of the Markets*, 1998) argue that every verification system produces a network of human and non-human actors — documents, instruments, standards, data, people — whose interaction generates the certified fact. Audit, on this reading, is never simply inspection. It is co-production.

Within PackInPro's methodology, this takes the form of what Knorr-Cetina (*Epistemic Cultures*, 1999) calls **"dialogical objectivity":** objectivity that does not rest on the auditor's claimed neutrality, but emerges from methodical, transparent exchange — explicit criteria, the freedom to question, the space to clarify. The auditor's authority comes not from distance, but from the quality of the dialogue.

This collaborative model transforms certification from a control mechanism into **a tool for collective learning** — consistent with the *reflexive sustainability governance* framework proposed by Voß, Smith & Grin (*Ecological Economics*, 2009).

In practice, this means:

- PackInPro auditors are trained in relational and communication skills, not just verification technique.
- Audits are conducted as structured conversations, not inspections — allowing organisational context to surface and be understood.
- Improvement recommendations are developed with the company, not handed down to it.
- Annual follow-up becomes a genuine review of how performance has evolved, not a compliance check.

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6. CONCLUSIONS: TOWARD CERTIFIED, PERFORMANCE-BASED SUSTAINABILITY

The PackInPro scientific framework makes a substantive contribution to both the theory and practice of ESG certification in the packaging sector — a model that holds methodological rigor, operational transparency, and industrial applicability in the same frame.

On the theoretical side, PackInPro directly addresses three core challenges identified in the recent academic literature:

ESG rating divergence (Berg et al., 2022): methodological standardization, transparent evaluation criteria, and independent validation under ISO/IEC 17029 together materially reduce the risk of arbitrary discrepancies between competing assessments.

Dynamic materiality (Khan et al., 2016; Adams, 2020): the system is built around an adaptive structure with periodic review of indicator weightings, so that assessments keep pace with shifts in the regulatory, technological, and social landscape.

The gap between corporate reporting and product-level assessment (Gray et al., 2014): PackInPro's two-tier architecture connects process sustainability to outcome sustainability — delivering the multi-level accountability that credible sustainable governance actually requires.

In practice, PackInPro gives packaging companies:

- **Verifiable tools** to measure and communicate ESG performance credibly, reducing greenwashing exposure.
- **Regulatory alignment** with mandatory European frameworks (CSRD, ESRS, EU Taxonomy, PPWR), so that certified data can feed directly into non-financial reporting.
- **Interoperability** with established certification schemes (ISO 14001, FSC/PEFC, Ecolabel), cutting documentary redundancy.
- **Tracked digitization** through the MyCert portal and traceability QR codes, aligned with the European Digital Product Passport
- **An efficient process** with tight SLAs that deliver predictable timelines and costs.

In a crowded market of ESG certifications and environmental labelling schemes, PackInPro stands apart on five counts.

Third-party verified. Unlike self-declarations (ISO 14021) or ratings issued by commercial agencies without audit, PackInPro requires verification by an accredited third-party body, against

standardised, inspectable audit procedures. As ANAB and DQS attest, this level of assurance is materially more rigorous — and carries materially more weight with investors and stakeholders.

Two levels, one coherent picture. The two-tier architecture tests whether a company's strategic commitments actually show up in the products it puts on the market — closing the gap that single-layer certification schemes routinely leave open.

Built for packaging, usable by industry. The indicators are calibrated specifically for the packaging sector, grounded in peer-reviewed literature and international standards (LCA, circular economy, MCDA), and designed to be workable without the cost and complexity of a full LCA.

Nothing hidden**.** Every criterion, threshold, weighting, calculation procedure, and audit checklist is publicly available. There are no proprietary black-box algorithms. Every rating can be traced back to the evidence behind it.

A digital audit trail. The MyCert platform provides full traceability, secure document storage, and certificate issuance with qualified digital signatures. QR codes let any stakeholder verify a certificate's authenticity and access aggregated sustainability data on the spot.

6.1 Current Limitations and the Road Ahead

Notwithstanding these strengths, PackInPro also carries real limitations that warrant honest acknowledgment.

1. International harmonisation
PackInPro is optimised for the European regulatory environment — CSRD, ESRS, PPWR. That focus is a strength domestically, but it creates comparability gaps with non-European schemes such as SASB in the United States or the various ESG standards taking shape across Asia.

Next step*:* develop mapping and crosswalk exercises between PackInPro and major international frameworks; pursue active participation in global standardisation initiatives through ISO and the ISEAL Alliance.

2. Data quality
The model is only as good as the data companies feed into it. As Jagrič et al. (2025) note, ESG data in practice is frequently incomplete, fragmented, or impossible to verify internally — and PackInPro is not immune to that problem.

Next step*:* build pre-assessment tools and training programmes aimed at SMEs; establish partnerships with ESG software providers to streamline data collection; extend on-site audit scope for companies whose internal controls are still maturing.

3. SME adoption barriers
Certification demands time, qualified staff, and investment in monitoring systems. For small and medium-sized enterprises, those demands can be a genuine obstacle rather than a manageable cost.

Next step: develop a simplified pathway for micro-enterprises (under ten employees); introduce collective certification for industrial districts; work toward public funding mechanisms or tax incentives that bring certification within reach.

4. Measuring the S in ESG
Social and Governance indicators are inherently harder to pin down than Environmental ones. Doing them properly requires qualitative audit capacity and specialist knowledge spanning labour law, organisational psychology, and workplace sociology — skills that cannot be assumed.

Next step: deepen auditor training on social dimensions; develop more structured interview protocols; integrate recognised organisational climate surveys such as Great Place to Work or the B Impact Assessment.

5. A regulatory environment that won't hold still
European sustainability regulation is moving fast — CSRD 2024, ESRS in active implementation, PPWR 2024, Digital Product Passport expected by 2027. Keeping the framework current is a standing commitment, not a one-off exercise.

Next step: establish a permanent Scientific Committee with multi-university academic representation, charged with regulatory monitoring and periodic KPI updates; publish interpretive technical notes as new obligations come into force.

6.2 Directions for Future Research

The PackInPro model opens up several lines of empirical and methodological inquiry.

1. Impact studies
Longitudinal research into the effects of PackInPro certification on business performance — financial, reputational, and innovative — as well as on stakeholder perception and circular packaging supply chains. Suggested methods: comparative case studies, panel data econometric analysis.

2. Dynamic materiality in practice
Empirical investigation into how stable KPI weightings are over time, and how sensitive they prove to shifts in the regulatory and market environment. Suggested methods: sensitivity analysis, Delphi studies with sector specialists.

3. Framework interoperability
Mapping studies between PackInPro and other international ESG schemes, aimed at identifying equivalences, gaps, and convergence opportunities. Suggested methods: framework content analysis, multi-stakeholder workshops.

4. The certification experience
Qualitative research into what certified companies actually encounter: the barriers they face, the benefits they perceive, and how they put certification to strategic use in their ESG communications. Suggested methods: semi-structured interviews, focus groups.

5. Does independent assurance reduce rating divergence?
Quantitative studies to test whether ISO 17029 independent validation measurably reduces rating divergence compared with other schemes. Suggested methods: comparative statistical analysis, meta-analysis.

6.3 Certification as trust infrastructure

PackInPro's specification is not another certification scheme. It is **the infrastructure of trust** for the sustainable packaging ecosystem.

Power (*The Audit Society*, 1997) and Strathern (*Audit Cultures*, 2000) both made the same observation: we now live in a world where verifiability is the precondition of trust. Declaring sustainability is no longer enough. You have to prove it — through evidence, examined by independent parties.

PackInPro is built around that requirement. The system:

- **Translates the complexity** of sustainability into measurable, comparable indicators
- Makes evaluation criteria and calculation methods **fully transparent**
- Separates consulting from certification, so **independence is structural**, not promised
- **Drives improvement** by identifying gaps and mapping concrete next steps
- **Creates accountability** by making certification results publicly open to scrutiny

In this sense, PackInPro is what Latour and Woolgar (*Laboratory Life*, 1979) called an **"inscription device":** a system that converts complex, context-dependent phenomena — the sustainability of a company, of a product — into **stable, portable, comparable** facts. Numbers with evidence behind them.

6.4 Beyond certification: building a culture of sustainability

The real measure of PackInPro's success will not be the number of certificates issued. It will be whether the model **shifts how the packaging industry thinks** — from minimum compliance to continuous improvement; from sustainability as a cost to sustainability as a strategic asset; from greenwashing to verified transparency.

Eccles, Ioannou and Serafeim (*Management Science*, 2014) showed that companies with structured, measurable sustainability policies outperform over the long term — but only when those policies are **genuine, verifiable, and communicated honestly.**

PackInPro provides the methodological and operational tools to make that transition real. What happens next depends on companies, stakeholders, and institutions choosing to use them — to build a supply chain where:

- Environmental claims are made, and verified
- Consumers can make informed choices based on reliable data
- Investors can allocate capital toward companies that are genuinely sustainable
- Public policy can reward genuine innovation in the circular economy
- Competition runs on the quality of sustainability, not the quality of the messaging

In this process, certification is not a destination. It is a form of **collective learning** (Voß et al., 2009) — through which the whole sector can raise its standards progressively, share what works, and play its part in the transition to a more sustainable economy.

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TECHNICAL GLOSSARY

ESG Assurance: Independent verification of sustainability disclosures by a qualified third-party body.

Risk-based sampling: A sampling technique that prioritises high-risk areas by assessing where material errors are most likely to occur.

Corporate certification: An assessment of organisational sustainability across 42 ESG KPIs.

Product certification: An assessment of the material sustainability of packaging across 12 technical KPIs.

CSRD: The Corporate Sustainability Reporting Directive (EU 2022/2464), which requires large companies to produce verified ESG reports.

Double materiality: An ESRS principle requiring companies to assess both their impact on the environment and society, and the impact of ESG factors on their own business performance.

ESRS: European Sustainability Reporting Standards — the ESG reporting standards developed by EFRAG.

Product family: A set of packaging items sharing the same technical characteristics and materials, differing only in size.

Greenwashing: Misleading communication that overstates or misrepresents a product's or organisation's environmental credentials.

ISO/IEC 17029: The international standard setting out requirements for validation and verification bodies.

KPI (Key Performance Indicator): A quantitative or qualitative measure of a specific area of performance.

LCA (Life Cycle Assessment): A standardised methodology (ISO 14040/14044) for quantifying the environmental impacts of products or services across their full life cycle.

Materiality: The significance of an ESG issue, determined by its impact on the business and its relevance to stakeholders.

MCDA (Multi-Criteria Decision Analysis): A methodology for evaluating options against multiple criteria that may pull in different directions.

MY CERT: The accredited third-party certification body that conducts PackInPro validations.

PPWR: The Packaging and Packaging Waste Regulation — the EU regulation governing packaging and packaging waste.

ESG rating: A composite score summarising a company's environmental, social and governance performance.

Risk-based: An approach grounded in the systematic assessment and management of risk.

Self-assessment: A structured questionnaire completed by the company before external verification begins.

SLA (Service Level Agreement): An agreement defining guaranteed service levels and turnaround times.

Validation: The process of confirming the plausibility of forward-looking statements or declared intentions.

Vendor: A company applying for PackInPro certification.

Verification: The process of confirming the accuracy of data and results already achieved.

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