
Towards An Assessment Framework of Innovation Enabled by DPP-Related Policies

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Abstract: The Ecodesign for Sustainable Products Regulation (ESPR) and the Digital Product Passport (DPP) mandate information transparency, creating enabling environments for sustainable innovation. However, innovators face practical challenges in designing viable DPP use cases, struggling with conceptual, communication, and collaboration hurdles due to regulatory uncertainty and misaligned stakeholder incentives. Existing tools offer high-level guidance but lack specific support for early-stage ideation. To address this, this Design Science Research (DSR) study proposes the DPP Use Case Assessment Framework, operationalized as an Innovation Canvas comprising 19 integrated diagnostic questions. The framework acts as a structural guide to enforce alignment across policy objectives, functional necessity, and economic viability. By decoupling functional requirements from legal status and assessing ecosystem-wide incentives, the framework mitigates narrative drift and supports the transition from vague concepts to viable, policy-enabled circular business models. This is an example of the abstract style.

Keywords: Digital Product Passport (DPP); Ecodesign for Sustainable Products Regulation (ESPR); Circular Economy; Policy-Enabled Innovation; Design Science Research (DSR); Innovation Canvas.

1 Introduction

The transition to a circular economy requires a shift in product lifecycle management. Within the European Union, the Ecodesign for Sustainable Products Regulation (ESPR) and the Digital Product Passport (DPP) establish digital infrastructures and mandate information transparency, functioning as enabling environments for sustainable innovation. A DPP use case involves circular economy actions actively enabled by the DPP system. Developing such use cases rapidly is critical to unlocking the DPP's transformative potential.

Designing viable DPP use cases remains practically challenging. Empirical observations from ideation workshops reveal a gap in idea quality across three challenges. First, conceptual gaps occur when teams propose utilizing the DPP without functional need or experience narrative drift due to regulatory uncertainty. Second, communication gaps arise as asymmetrical knowledge and evolving policies prevent a stable, shared understanding of requirements. Finally, collaboration gaps emerge when relevant use cases are abandoned due to misaligned incentives, as teams rely on voluntary data sharing instead of recognizing policy mandates as mechanisms to alter business logic.

While existing frameworks provide technical baselines, they lack specific support for ground-level teams during early-stage ideation. Thus, a bottom-up assessment method is needed for early-stage use case design to navigate regulatory uncertainty and misaligned incentives. This research proposes the DPP Use Case Assessment Framework, an Innovation Canvas comprising 19 integrated diagnostic questions. Developed via Design Science Research (DSR), this Research-in-Progress paper reports on the artifact's initial construction and formative evaluation. The framework enforces alignment across policy alignment, functional necessity, and economic viability.

2 Literature Review

Public policy functions not only as a constraint but as an enabler of innovation, shaping technological development and creating new market conditions (Edler and Fagerberg, 2017; Rogge and Reichardt, 2016). However, firms often struggle to translate regulatory frameworks into concrete innovation opportunities due to the need to concurrently consider regulations, technologies, economics, and stakeholders.

Within the European Union, the Ecodesign for Sustainable Products Regulation (ESPR) exemplifies a policy-enabled innovation environment. It prioritizes circular economy principles such as product durability and recyclability (Gulati et al., 2025). A central feature is the Digital Product Passport (DPP), which mandates product-related information transparency across value chains (Henten, Falch and Tadayoni, 2025; Zhang et al., 2026). The ESPR employs complementary policy logics, including compliance-oriented minimum requirements and innovation-oriented procurement (Bundgaard, Dalhammer and Remmen, n.d.). This study focuses on its market transformation instruments, specifically the DPP's digital infrastructure, which creates enabling conditions for circular innovation.

The concept of policy-enabled innovation posits that firms can proactively leverage regulatory frameworks as strategic inputs to alter opportunity spaces, reduce uncertainty,

and create new incentive structures (Ahkami et al., 2026). In the ESPR context, this shifts the focus from reactive compliance to strategically utilizing the DPP's information infrastructures.

Recent research highlights the need for structured approaches to evaluate DPP-enabled use cases. Studies within the CIRPASS project note challenges such as incomplete information requirements and limited empirical evidence of pilot benefits (Wautelet and Ayed, 2024). This is compounded by the evolving ESPR framework and incomplete vocabulary definitions (Boutillier, 2026), necessitating ideation methods that accommodate regulatory uncertainty. Furthermore, initiatives like Battery Pass categorize value creation mechanisms (BatteryPass, 2024), while research highlights structural tensions in DPP adoption, such as transparency versus confidentiality and firm-level versus ecosystem-wide value capture (Krüger et al., 2026).

Currently, the most authoritative methodology for specifying DPP use cases is the European Commission Joint Research Centre's approach (European Commission Joint Research Centre et al., 2026), designed for expert preparatory teams in the regulatory scope. To support ideation, researchers have adapted structured business model tools for sustainability. For instance, Gallina et al. (2024) propose a twin-transition concept for SMEs using adapted canvases and quantitative decision-support methods (Gallina et al., 2024). Additionally, the Business Model Canvas (Osterwalder and Pigneur, 2010) helps teams systematically explore value propositions and resources (Teece, 2010).

Taken together, existing approaches remain fragmented. Technical frameworks focus on implementation, business tools on value creation, and official methodologies on regulatory compliance for expert. There is a clear lack of integrated, bottom-up assessment tools designed specifically for innovators to identify and evaluate DPP opportunities within the policy-enabled environment created by ESPR.

3 Methodology

This study adopts a Design Science Research (DSR) methodology to address the need for structured ideation in policy-enabled innovation (Hevner, 2007; Peffers et al., 2007). The central problem is the gap in idea quality---manifesting as conceptual, communication, and collaboration gaps between high-level policy objectives (e.g., ESPR) and practical innovation use cases. To resolve this, we propose the "DPP Use Case Assessment Framework" to facilitate the strategic alignment of circular business concepts. Our approach follows Peffers et al.'s DSR process model (Peffers et al., 2007), integrating Hevner's three-cycle view (Hevner, 2007):

Relevance Cycle: Bridging the contextual environment with design activities. The input is the complex ESPR design space, the cognitive overload from the range of regulatory states, and the lack of distinction between technical infrastructure and legal mandates. The output is a structural guide for innovators to evaluate implementation, anticipation, or policy gap strategies.

Rigor Cycle: Connecting design activities with the knowledge base. The artifact builds on literature covering innovation policy (Edler and Fagerberg, 2017), co-evolutionary policy interventions (Rogge and Reichardt, 2016), and canvas-based complexity

reduction (Osterwalder and Pigneur, 2010). We also identify gaps in existing tools to ensure our framework adds distinct value.

Design Cycle: Iteratively refining the artifact. The framework is structured around three viability pillars: Policy Alignment, Functional Necessity, and Economic Viability. Iterations prioritized the artifact's ability to decouple functional information needs from regulatory status, surfacing structural tensions early.

As a Research in Progress, this paper reports on the artifact's initial construction and formative evaluation. The evaluation combines an analytical assessment against ten derived requirements with qualitative field observations from pilot ideation workshops. These observations contrast pre-framework narrative drift with post-framework structured outputs. A summative evaluation involving comprehensive field experiments and policymaker feedback is planned for future research.

4 Findings

The following findings represent the formative evaluation of the assessment framework, demonstrating its ability to address the structural gaps identified during the research process. The implementation of the Ecodesign for Sustainable Products Regulation (ESPR) and the Digital Product Passport (DPP) create an environment for innovation by establishing digital infrastructures and mandating information transparency. This framework is defined by the technical availability of systems, such as registers and data standards, as well as the legal mandates requiring actors to share specific datasets.

Innovation occurs through a co-evolutionary process between policy development and organizational strategy. A primary obstacle in this process is the gap in the idea quality, which manifests as three specific challenges. A conceptual gap is observed when proposed innovations do not actually require the DPP system or policy mandates to function. A communication gap occurs when the evolving nature of regulations prevents a stable understanding of requirements across different organizational roles. A collaboration gap is identified when stakeholders lack economic incentives for data sharing, even though regulatory mandates could alter the underlying business logic to ensure viability.

To navigate these challenges, innovators must evaluate required features against their current regulatory status. A viable use case is found where policy alignment, functional necessity, and economic viability for all stakeholders intersect. This is particularly relevant for enabling circular actions by independent operators who require access to manufacturer data through standardized exchange mechanisms.

Comparison of Existing Methodologies

The comparison of existing methodologies was used to identify the specific methodological gap that the proposed framework is designed to address. This analysis highlights significant differences in conceptual maturity and analytical purpose. The JRC methodology is designed for high-level regulatory definition, requiring extensive resources to derive official requirements from technical baselines. In contrast, the Battery Pass approach focuses on the descriptive presentation of value within established

mandates for specific product categories. The proposed framework fills a gap by providing a strategic tool for rapid ideation that is sector-agnostic and accommodates the simultaneous evolution of technology and policy.

Table 1 Methodology Comparison Matrix

Dimension	Our Framework	JRC (MEErP)	Battery Pass
Effort for Assessment	hours - days	days - weeks	hours - days
Primary Output Format	1 page Canvas	Detailed LCA +UC Doc	1 page Canvas
Conceptual Maturity	Strategic / Ideation	Formal / Technical	High-level
User Groups	Innovators, Policymakers	Policymakers	Researchers
Policy Interaction Model	Co-evolutionary	Policy-Defining	Policy-Compliant
Regulatory Scope	Extensible	Constrained	Standardized
Methodological Logic	Deductive / Policy-Enabled	Analytical / LCA-Driven	Descriptive
Purpose	Ideation & Selection	Defining requirements	Quick assessment
Product Category Scope	Sector-agnostic / Generic	ESPR priority products	Batteries
Stakeholder Roles	All actors in exchange	Regulatory actors	Battery pass users
Incentive Logic	Individual check	Top-down compliance	General benefits

These methodologies also diverge in their treatment of stakeholder participation and regulatory scope. While traditional models rely on top-down compliance or general value-chain benefits, this framework explicitly evaluates the individual incentives and legal mandates for every actor involved in a data exchange. This granular assessment allows for the identification of structural tensions that are often overlooked in descriptive or strictly analytical models, facilitating a more robust evaluation of ecosystem viability.

Requirements for the Assessment Framework

To bridge the gap in the idea quality, ten requirements were derived by synthesizing literature on policy-enabled innovation and empirical observations of narrative drift in pilot workshops. These requirements are categorized into four dimensions. First, the framework must manage the interface between policy and innovation by aligning use cases to policy objectives (Req A.1) and decoupling functional needs from the status of information (Req A.2) and technology (Req A.3) requirements, thereby determining the role of enabling features (Req A.4). Second, ecosystem viability is addressed by explicitly mapping stakeholder roles (Req B.1) and evaluating the underlying motivation and participation logic for every actor (Req B.2). Third, to maintain cognitive and process control, the framework must enable fast and effective ideation (Req C.1) while enforcing consistency across the assessed aspects (Req C.2). Finally, the framework must ensure output quality through standardized, comparable results (Req D.1) and transparent indicators of assessment quality and claim robustness (Req D.2).

Designed Artifact

The design artifact developed in this research is the DPP Use Case Assessment Framework, operationalized as a visual Innovation Canvas. This integrated tool structures the ideation process into discrete modules containing 19 diagnostic questions that cover problem identification, technical enablers, stakeholder dynamics, and impact assessment.

DPP Use Case Name		DPP Use Case Category	
1-Sentence Description <i>Q1: Summarize the use case in one sentence!</i>		Environmental & Social Impact <i>Q2: What is the environmental or social problem to be solved? Q3: Does information exchange help solving this problem and how? Q4: How big is the environmental and social impact? [0 1 2 3 4 5] Q5: How good is quality of the information? [0 1 2 3 4 5]</i>	Q11: To which (new) use case category does the use case belong? Product Category <i>Q12: What is the product category, that the use case is addressing?</i>
Enabled by the DPP System? <i>Q6: What technical barriers hinder information exchange in the absence of the DPP system? Q7: Does the DPP System help solving these hindrances? Which of its enabling features? How?</i>		Additional innovation? <i>Q8: What are additionally needed enablers and innovations?</i>	Success Factors <i>Q13: What are success factors or decisive assumptions for the impacts of the use case?</i>
Stakeholders <i>Q9: List the relevant stakeholders!</i>	Data Flows <i>Q10: List the relevant information flows between the stakeholders!</i>	Economic Benefits & Incentives <i>Q14: Does the Use Case create overall economic value and how? Q15: What is the stakeholder incentive to participate?</i>	Enabled by Regulation? <i>Q18: In the context of the ESRP, which regulatory information requirements (including access rights) are needed to enable the use case? Q19: Are other regulations critical?</i>
Stakeholder #1:			
Stakeholder #2:			
Stakeholder #3:			
Open Questions <i>Q20: What are open questions? What should future research focus on?</i>		Q16: How big is the economic impact? [0 1 2 3 4 5]	Q17: How good is the quality of the information? [0 1 2 3 4 5] Source / Contact <i>Q21: Who has provided / assessed this use case?</i>

Figure 1 The DPP Use Case Assessment Framework: Integrated Innovation Canvas.

By consolidating these questions into a single visual interface, the canvas serves as a cognitive aid that forces the simultaneous alignment of functional requirements with economic and regulatory realities. The modular structure ensures that the core assumptions of a use case—such as the necessity of the DPP system or the motivation of independent operators—are explicitly justified within the canvas itself, preventing the narrative drift common in early-stage innovation.

Analytical Evaluation

The evaluation follows a two-pronged strategy: an analytical evaluation comparing design features to the requirements, and a formative evaluation based on qualitative workshop observations. The following represents the analytical evaluation, in which scoring is based on logical argumentation regarding the artifact's design features rather than empirical evidence. This process identifies the specific questions from the canvas that contribute to fulfilling each requirement and identifies where successful aspects from existing methodologies were integrated.

The analysis indicates that while existing methods cover specific dimensions of policy alignment or standardization, they often lack the features necessary for rapid, strategic ideation under regulatory uncertainty. Specifically, by decoupling functional requirements from legal status (Q10, Q18, Q19), the framework allows innovators to anticipate future requirements. Furthermore, the explicit verification of economic incentives for every actor (Q15) ensures that viability is assessed from an ecosystem perspective, rather than assuming compliance.

Table 2 Requirements Fulfilment Matrix

Requirement	JRC (MEErP)	Battery Pass	Our Work
A.1 Alignment to Policy Objectives	+	+	Q2, Q12
A.2 Decoupled Information Requirements	-	~	Q10, Q18, Q19
A.3 Decoupled Technology Requirements	-	~	Q7, Q8
A.4 Role of Enabling Features	+	~	Q6, Q7
B.1 Stakeholder Roles & Info Exchange	+	~	Q9, Q10
B.2 Stakeholder Motivation & Viability	~	-	Q15, Q18
C.1 Fast and Effective Ideation	-	+	Q2, Q4, Q14
C.2 Enforced Consistency & Transparency	+	~	Q1, Q11
D.1 Standardized & Comparable Output	+	+	Q4, Q13, Q16
D.2 Transparent Assessment Quality	+	-	Q5, Q17

5 Discussion

The proposed DPP Use Case Assessment Framework provides a practical contribution to the community of innovators and ideators by bridging the gap between broad circular economy principles and specific data-sharing implementations. While concepts for circular business models (such as R-strategies) are well-established, translating these into effective data-sharing use cases remains challenging. Specifically, identifying the necessary networks of stakeholders and the new roles required to implement circular strategies is often unclear.

The framework's value lies in clarifying how data sharing actively enables these use cases. The DPP functions as an enabler for decentralized networks by establishing data availability independent from the original manufacturer through mandated information requirements. During ideation, many proposed circular strategies rely on existing supply chain relationships and thus do not functionally require a DPP. By explicitly assessing stakeholder participation and network structures, our framework highlights that a genuine DPP use case typically necessitates the inclusion of new, independent operators who rely on standardized data exchange to perform circular actions.

6 Conclusion

This research presents a structured, bottom-up approach for designing policy-enabled innovation within the context of the ESPR and DPP. By enforcing alignment across policy objectives, functional necessity, and economic viability, the Innovation Canvas serves as a diagnostic tool that mitigates narrative drift and helps innovators navigate regulatory uncertainty. Future research will focus on a comprehensive summative evaluation of the artifact, incorporating qualitative interviews with practitioners and the analysis of a populated database of completed DPP use cases to further validate the framework's utility in the field.

Acknowledgements

This research has been partially supported and funded by the Austrian Research Promotion Agency (FFG) for the research projects “PACE-DPP – Promoting Accelerated Circular Economy through Digital Product Passports” under the contract number 917177.

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