Supplier Readiness for Digital Product Passports: A Readiness Framework for Multi-Tier Supply Chains

Master's thesis in Supply Chain Management

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Summary

This thesis examines supplier readiness for Digital Product Passports (DPPs) in multi-tier supply chains in the context of the European Union's emerging Ecodesign for Sustainable Products Regulation. The purpose of the study is to analyze supplier readiness for DPPs by developing a structured assessment framework for multi-tier supply chains.

The study was conducted as a qualitative case study at GARO AB and focuses on a selected product value chain related to a street lighting cabinet. The direct empirical assessment focuses on five Tier-1 suppliers connected to the selected product, while Tier-2 and Tier-3 aspects are addressed indirectly through Tier-1 suppliers' descriptions of upstream traceability, supplier relationships, and information exchange. Empirical data was collected through semi-structured interviews and complemented with secondary data and company documentation. The study draws on Organizational Information Processing Theory and develops the *Supplier Readiness Diamond*, a framework consisting of six capability dimensions related to governance, implementation, product-level data, digital systems, transparency, and collaboration.

The findings show variation in supplier readiness across the five analyzed suppliers. Although some suppliers demonstrate relatively advanced and integrated capabilities, others remain in earlier stages characterized by fragmented structures, limited product-level data, and low upstream visibility. The study also finds that readiness depends not only on individual capability levels, but also on how capabilities are balanced across dimensions.

The main contribution of the thesis is the *Supplier Readiness Diamond*, an original framework developed in this study for assessing supplier readiness for DPP implementation. The framework provides a structured and visual way of comparing supplier readiness across multiple capability dimensions and supports practical evaluation of supplier strengths, weaknesses, and capability gaps. In this way, the study provides both a conceptual contribution to supplier readiness assessment and managerial implications related to supplier evaluation, development, and long-term sourcing decisions under increasing regulatory information requirements.

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Josef Asal, Gothenburg, May 2026
Josefin Hansson, Gothenburg, May 2026

List of Acronyms

Below is the list of acronyms that have been used throughout this thesis listed in alphabetical order:

DPP	Digital Product Passport
EPD	Environmental Product Declaration
ERP	Enterprise Resource Planning
ESG	Environmental, Social and Governance
ESPR	Ecodesign for Sustainable Products Regulation
ISO	International Organization for Standardization
KPI	Key Performance Indicator
LCA	Life Cycle Assessment
MPS	Master Production Scheduling
SME	Small and Medium-sized Enterprises

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1

Introduction

This chapter introduces the background and motivation for the thesis. It presents the regulatory and supply chain context of Digital Product Passports, explains the practical problem addressed in the study, and defines the research purpose, research question, scope, and limitations.

1.1 Background and Context

The European Union's Ecodesign for Sustainable Products Regulation (ESPR), adopted as Regulation (EU) 2024/1781, introduces new rules aimed at making products more sustainable. One part of the regulation is the future use of Digital Product Passports (DPPs). DPPs can be seen as a digital identity for products, components, and materials. The idea is that products will carry information about, for example, material content, environmental impact, and lifecycle data. This information should be accessible digitally, for example through a scannable QR code in order to make it easier for companies, regulators, and consumers to make more informed decisions while also supporting circular economy initiatives (European Commission, 2024).

The DPP reflects a broader shift towards more data-driven and transparent supply chains. In order for it to work in practice, firms need to collect, structure, and share product-level data across organizational boundaries. However, many supply chains are often not designed for this level of data exchange. Research shows that supply networks are typically complex and fragmented, with limited visibility beyond first-tier suppliers (Tachizawa & Wong, 2014). More recent studies also highlight how difficult it is to achieve transparency across multiple tiers (Villena & Gioia, 2020).

Another challenge is that suppliers differ significantly in terms of digital maturity and how they manage data. While some firms have well-developed systems and structured processes, others rely more on manual or less formalized approaches (Mittal et al., 2018). This is particularly relevant for small and medium-sized enterprises (SMEs), which make up a large share of European supply bases. These often lack the resources needed for more advanced digital solutions (Müller et al., 2018).

As a result, the ability to generate and share the data required for the DPP varies between suppliers. This creates challenges when firms need to ensure consistent data quality and traceability throughout a supply network. It also means that DPP implementation is not only a technical issue, but depends on the capabilities of multiple actors across different tiers.

While prior research has addressed transparency challenges and supplier sustainability performance, there is limited work that takes these insights into ways of assessing supplier readiness across a specific supply network (Busse et al., 2017; Sauer & Seuring, 2019). This creates a gap between regulatory requirements and how firms evaluate and manage supplier capabilities in practice.

This study examines supplier readiness within a selected product value chain at GARO AB (GARO). The product analyzed in this study is the *Gatubelysningsskåp 2 GR Astro*, a street lighting cabinet consisting of several component categories sourced from different suppliers. The product was selected in collaboration with GARO due to its expected long-term relevance within the company's product portfolio.

The selected value chain includes five Tier-1 suppliers connected to the product: ETI, Laserstans, Plåtprodukter, Siemens, and a fifth supplier who wishes to remain anonymous and will therefore be referred to as Supplier X. These suppliers contribute different components to the cabinet, making the product value chain suitable for analyzing how supplier readiness for DPP varies across different organizational and technical contexts.

The suppliers were identified together with GARO based on their importance for the product and their role within the supply chain. Access to the suppliers was facilitated through GARO, which provided contact points to relevant Tier-1 suppliers connected to the selected product. A more detailed description of the selected product value chain and its role in the analysis is provided in Section 4.2.

1.2 Problem Description

Although DPP-related requirements are expected to become operational under the ESPR framework, many firms still lack the visibility needed to understand how prepared their supply chains actually are. In multi-tier supply chains, companies often only have direct relationships with their first-tier suppliers, while relevant data is generated further upstream. This makes it difficult to assess whether the required product-level information can be collected in practice (Tachizawa & Wong, 2014).

At the same time, supplier capabilities vary significantly. Differences in digital systems, data structures, and traceability practices mean that some suppliers are well prepared, while others are not (Mittal et al., 2018). This creates uncertainty, especially when firms depend on multiple suppliers across different tiers to provide consistent and reliable data.

Another challenge is that firms often have limited insight into their suppliers' actual capabilities. Information is typically self-reported or incomplete, making it difficult to evaluate how prepared suppliers really are. This increases the risk of making decisions based on inaccurate assumptions about data availability and traceability (Galbraith, 1974).

Without a more structured way of assessing supplier readiness, firms may rely on informal judgments when making sourcing or product development decisions. This can lead to selecting suppliers that are not able to meet future regulatory requirements, which in turn may result in compliance issues, delays, or costly adjustments at later stages (Villena & Gioia, 2020).

These challenges become even more difficult to manage in multi-tier supply chains, where dependencies on lower-tier suppliers are not always visible. Firms may unknowingly rely on suppliers that lack the capabilities needed for DPP implementation, increasing both operational and regulatory risk.

Overall, there is a need for a more systematic way of assessing supplier readiness. Such an approach should make it possible to compare suppliers, identify gaps, and better understand how readiness is distributed across a supply network.

1.3 Research Purpose and Question

The purpose of this thesis is to analyze and conceptualize supplier readiness for Digital Product Passports by developing a structured framework for its assessment in a multi-tier supply chain context. Since DPP implementation depends on information generated across multiple supplier tiers, the study examines how Tier-1 suppliers manage upstream transparency, traceability, and information exchange with their own suppliers. The direct empirical assessment is therefore conducted at the Tier-1 supplier level, while Tier-2 and Tier-3 aspects are analyzed indirectly through Tier-1 suppliers' descriptions of their upstream supplier relationships and information practices. In this way, the study uses Tier-1 supplier assessments as an entry point for understanding broader multi-tier readiness challenges.

The main contribution of the study is the development of the Supplier Readiness Diamond, a DPP-specific and configuration-based assessment framework for evaluating supplier readiness across multiple capability dimensions. Rather than functioning only as a general maturity model, the Diamond provides a diagnostic and comparative tool that visualizes how supplier capabilities are distributed, balanced, and constrained across governance, implementation, product-level data, digital systems, upstream transparency, and collaboration. Although developed and applied within the selected GARO product value chain, the framework is intended to be adaptable to other GARO product chains and, with contextual adjustments, to other focal firms and product-specific supply chains facing similar DPP-related information requirements.

Research question

How can supplier readiness for Digital Product Passports be systematically assessed in a multi-tier supply chain context?

1.4 Scope and Limitations

This study focuses on assessing supplier readiness for DPPs within the context of a single focal firm, GARO AB, and a selected product value chain, namely a street lighting enclosure. The analysis is limited to suppliers connected to this specific product, allowing for a grounded assessment of supplier capabilities and possible dependency-related priority decisions, and multi-tier interactions.

The empirical scope of the study is limited to Tier-1 suppliers connected to the selected GARO product value chain. Tier-2 and Tier-3 suppliers were not directly interviewed, and multi-tier aspects are therefore addressed indirectly through Tier-1 suppliers' descriptions of their upstream supplier relationships, traceability practices, and information requirements. Consequently, the study does not claim to provide a full empirical mapping of the entire multi-tier supply chain, but uses Tier-1 supplier readiness as an entry point for discussing broader multi-tier DPP-readiness challenges.

The study applies a qualitative, interview-based approach combined with structured analytical tools, including the Supplier Readiness Diamond and readiness stage classification. The aim is not to generate statistically generalizable results, but to develop and apply a structured and decision-relevant framework within a real industrial setting.

2

Theoretical Framework

This chapter presents the theoretical foundation used to understand supplier readiness for Digital Product Passports. It first discusses the regulatory information complexity created by DPP requirements and then introduces Organizational Information Processing Theory as the main theoretical lens. The chapter also explains how OIPT informs the development of the supplier readiness framework used in the study.

2.1 Regulatory Information Complexity and DPP

The introduction of DPP changes how information flows in supply chains. Suppliers now need to create, structure, and share detailed product-level data across firms and different supplier tiers. This goes beyond traditional reporting and instead requires ongoing traceability, transparency, and systems that can work together.

This can be understood as a form of regulatory information complexity. Rather than introducing a single reporting obligation, DPP requires organizations to integrate environmental, material, and origin-related information into operational processes. This shift increases both the volume and the interdependence of information flows within and across firms (Karabulut et al., 2025).

Studies have shown that supply chains are characterized by limited visibility beyond first-tier suppliers, making it difficult to verify upstream information in a structured way (Tachizawa & Wong, 2014; Villena & Gioia, 2020). At the same time, suppliers differ significantly in their digital maturity and ability to manage structured data, particularly among SMEs, which often rely on less formalized systems and processes (Mittal et al., 2018; Müller et al., 2018).

This creates a situation where firms must not only obtain information, but also coordinate and integrate it across organizational and multi-tier boundaries. The challenge is therefore not purely technical, but also organizational.

2.2 Organizational Information Processing Theory

To understand how organizations respond to increasing regulatory information complexity, this study draws on Organizational Information Processing Theory (OIPT) (Galbraith, 1974; Daft & Lengel, 1986).

OIPT suggests that organizations need to process information in order to coordinate interdependent tasks. Later, when tasks are well understood, activities can be planned in advance. However, as uncertainty increases, more decisions must be made during execution, increasing the need for information processing. As Galbraith (1974) argued, the greater the uncertainty of a task, the more information must be processed between decision-makers. Organizations therefore face a fundamental design problem. They consist of specialized units that depend on each other, but cannot all communicate directly. The role of organizational design is to introduce mechanisms that allow coordination across these inter-dependencies.

Galbraith (1974) suggested that organizations can respond to increasing information processing demands either by *reducing the need for information processing* or by *increasing their capacity to process information*. In the case of the DPP, reducing the need for information processing is not suitable, as regulatory requirements are external. Organizations are instead required to increase their information-processing capacity.

2.3 Organizational Design Strategies under OIPT

A key contribution of OIPT is that it explains not only why organizations need to process more information under conditions of uncertainty, but also how they can respond to that need. Galbraith (1974) outlines design mechanisms that either reduce the need for information processing or increase the organization's capacity to process information. This has later been further discussed in contingency theory and organizational design literature (Tushman & Nadler, 1978).

In the context of DPP, where regulatory requirements increase both the amount and interdependence of information, these mechanisms provide a useful way of understanding how organizations can adapt.

2.3.1 Slack Resources

One way to handle uncertainty is to reduce the need for coordination by introducing slack resources, such as buffers in time, capacity, or resources (Galbraith, 1974). This allows organizations to handle variability without constantly coordinating activities.

However, in the DPP context, this has limited relevance. Regulatory requirements demand specific and structured product-level data. This means that uncertainty cannot simply be handled through buffers, as firms still need to generate and validate the required information.

2.3.2 Self-Contained Tasks

Another way to reduce information-processing needs is to make tasks more self-contained by grouping interdependent activities within the same unit (Galbraith, 1974). This reduces the need for coordination across units.

In practice, this works when the interdependencies are limited and can be managed separately. In multi-tier supply chains, however, it can be a challenge. Product-level data is divided across suppliers, and firms often lack visibility beyond first-tier actors (Tachizawa & Wong, 2014; Villena & Gioia, 2020). This makes it hard to isolate tasks and reduce dependencies.

2.3.3 Vertical Information Systems

When uncertainty cannot be reduced, organizations need to increase their information-processing capacity. One key mechanism is the use of vertical information systems (Galbraith, 1974).

These systems structure and distribute information, helping organizations process larger volumes of data more efficiently (Daft & Lengel, 1986). In reality, this includes ERP systems, databases, and other digital tools.

In the case of DPP, this becomes very important, as firms need to manage large amounts of structured product-level data. Prior research also shows that digital systems are important for traceability and coordination in supply chains (Gold & Schleper, 2017; Mittal et al., 2018).

2.3.4 Lateral Relations

In addition to vertical information systems, organizations also rely on lateral relations, such as direct communication, coordination across functions, and collaboration between actors (Galbraith, 1974; Tushman & Nadler, 1978).

These mechanisms are important when information is distributed and cannot be fully handled through formal systems. They allow organizations to coordinate more flexibly and resolve uncertainty through interaction (Daft & Lengel, 1986).

In supply chains, this goes beyond the firm. Coordination depends on collaboration with suppliers, especially when information is generated upstream. Research on supply chain transparency highlights the importance of such coordination for achieving traceability (Gold & Schleper, 2017; Villena & Gioia, 2020).

2.4 Link to Framework Development

OIPT provides a structured way of understanding how organizations respond to increasing information-processing requirements. It shows that when uncertainty and interdependence increase, firms need to rely on organizational design mechanisms such as systems, coordination structures, and cross-functional communication in order to manage information more effectively (Galbraith, 1974; Daft & Lengel, 1986).

When it comes to DPP, these insights are highly relevant. Regulatory requirements increase both the volume and complexity of product-level information, while also creating dependencies across organizational and supply chain boundaries. This makes the ability to process and coordinate information a central challenge.

OIPT also implies that organizational adaptation to such conditions is not immediate, but happens gradually. As information-processing requirements increase, organizations must gradually change their structures, systems, and coordination mechanisms in order to align with environmental demands (Galbraith, 1974).

In the early stages, firms may be aware of new regulations and keep track of them, but still lack the structures and systems needed to manage the information. Over time, they introduce clearer responsibilities and systems that help them handle the information in a more structured way.

At the same time, OIPT does not fully capture all aspects of the DPP context. In particular, it does not fully address inter-organizational dependencies in multi-tier supply chains, the availability and structure of product-level data, or the gap between awareness of regulatory requirements and actual implementation. Alternative theoretical perspectives, such as institutional theory and supply chain transparency literature, could therefore also provide relevant insights into supplier adaptation to DPP requirements. Institutional theory, for example, suggests that organizations may acknowledge regulatory pressure without translating it into substantive change (Meyer & Rowan, 1977; DiMaggio & Powell, 1983). However, OIPT was considered the most suitable primary theoretical foundation because the central problem in this study concerns how suppliers process, structure, and exchange increasing amounts of product-level information under uncertainty and interdependence. These complementary perspectives are therefore used to clarify specific limitations of OIPT, while OIPT provides the core logic for translating regulatory information complexity into supplier-level readiness dimensions.

This suggests that supplier readiness should not be seen as something suppliers either have or do not have, but rather as a gradual development where firms become better at handling regulatory information requirements over time. The next chapter builds on this by turning the ideas from OIPT into a structured framework for assessing supplier readiness for DPPs in multi-tier supply chains.

Figure 2.1 illustrates the connection between the information requirements introduced by DPP and the dimensions included in the Supplier Readiness Diamond. Building on OIPT, the figure shows how increasing requirements related to traceability, data exchange, and coordination across supply chain tiers create greater information-processing demands for suppliers.

The figure also shows which dimensions mainly come from OIPT, such as digital systems, transparency, collaboration, and governance, and which are more connected to DPP requirements, such as implementation actions and product-level data. Together, the figure explains how the six dimensions of the Supplier Readiness Diamond were developed.

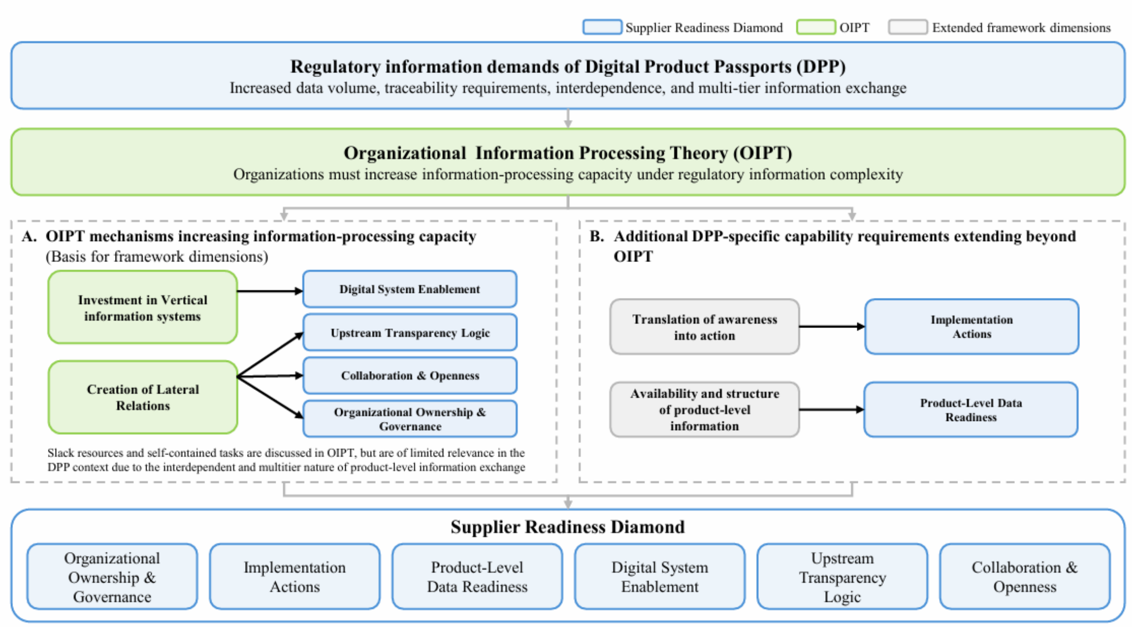


Figure 2.1: Theoretical logic linking OIPT to the Supplier Readiness Diamond

3

Framework Development

This chapter develops the analytical framework used to assess supplier readiness for Digital Product Passports. It explains how the theoretical logic of OIPT is translated into supplier-level readiness dimensions and presents the Supplier Readiness Diamond as the main assessment tool. The chapter also introduces the scoring approach, the interpretation of capability balance and interdependence, and the readiness stage classification used later in the empirical analysis.

3.1 From OIPT to Supplier Readiness

While Chapter 2 explains OIPT as the theoretical background for understanding how organizations respond to increasing regulatory information complexity, it does not directly make it into a supplier-level assessment of readiness in the context of DPP.

OIPT explains how organizations respond to increasing uncertainty through specific design strategies, including vertical information systems and lateral relations (Galbraith, 1974). In the context of DPP, where regulatory requirements increase both the volume and interdependence of information across supply chains, these mechanisms provide a useful base for understanding how firms build information-processing capacity.

The framework developed in this study builds on this logic by translating these mechanisms into a set of supplier-level capability dimensions. Four of the six dimensions can be directly linked to OIPT, while two capture additional requirements specific to the DPP context.

Together, these six dimensions form the *Supplier Readiness Diamond*, which extends OIPT into a multi-tier supply chain context and provides a structured way of assessing supplier readiness.

3.2 Supplier Readiness Diamond

The Supplier Readiness Diamond visualizes relative supplier capability profiles across six dimensions. The purpose of the Diamond is comparative and diagnostic: it highlights where capability gaps reside, rather than providing an absolute compliance judgment.

Supplier readiness is viewed as several different capabilities. To make the framework both practical and detailed, readiness is assessed using a two-layer framework:

(i) A multidimensional readiness profile (Supplier Readiness Diamond)

(ii) An absolute readiness stage classification

3.3 Diamond Dimensions

The Diamond includes the following dimensions (scored 0–10 using anchored criteria):

1. Organizational Ownership & Governance
2. Implementation Actions
3. Product-Level Data Readiness
4. Digital System Enablement
5. Upstream Transparency Logic
6. Collaboration & Openness

The six dimensions were developed by translating the theoretical logic of OIPT and the specific information requirements of DPP into observable supplier-level readiness capabilities. The purpose was not to reproduce OIPT concepts directly, but to operationalize them into dimensions that could be assessed empirically through supplier interviews. This translation logic is illustrated in Figure 2.1, where DPP is shown to increase regulatory information demands, while OIPT explains how organizations need to increase their information-processing capacity in response.

The OIPT-based part of the framework builds primarily on vertical information systems, lateral relations, and coordination structures. These concepts were translated into supplier-level dimensions by asking what each mechanism would mean in practice for a supplier preparing for DPP. Vertical information systems were therefore translated into *Digital System Enablement*, because the relevant empirical question is whether suppliers have digital systems that enable structured handling of product-level information. Lateral relations were translated into both *Upstream Transparency Logic* and *Collaboration & Openness*, because DPP-related information exchange requires both access to upstream supplier data and willingness to share information with customers and supply chain partners. Coordination structures were translated into *Organizational Ownership & Governance*, because DPP-related information spans several internal functions and therefore requires clear responsibility and governance.

However, OIPT alone does not fully capture all requirements of DPP readiness. OIPT explains how organizations process and coordinate information, but it does not fully address whether suppliers have started to act on emerging regulatory requirements or whether the required product-level information actually exists. For this reason, two DPP-specific dimensions were added. *Implementation Actions* captures whether suppliers have moved from awareness to concrete preparation, while *Product-Level Data Readiness* captures whether the required product-specific data exists and is structured in a usable form.

In this way, the six dimensions were not selected as a generic list of maturity criteria. They were derived from the interaction between OIPT and the information requirements introduced by DPP. The OIPT-derived dimensions capture the organizational capacity to process and coordinate information, while the DPP-specific dimensions capture whether suppliers have acted on the requirements and whether the required product-level data exists. The following subsections explain each dimension in more detail, including why each label was chosen and how each dimension is interpreted within the Supplier Readiness Diamond.

3.3.1 Organizational Ownership & Governance

The dimension is labelled *Organizational Ownership & Governance* because it captures both responsibility and coordination. In the DPP context, readiness depends not only on whether the supplier is aware of regulatory information requirements, but also on whether responsibility for DPP-related information is formally assigned and governed across relevant internal functions. Organizational Ownership & Governance reflects integrative coordination mechanisms in OIPT. As information-processing requirements increase, organizations must introduce coordination structures that reduce fragmentation and clarify responsibility (Galbraith, 1974).

In the context of DPP, product-level data spans multiple functions, including procurement, engineering, sustainability, IT, and external supplier management. Without clearly defined ownership, information risks becoming dispersed across departments, leading to inconsistencies and bottlenecks. This dimension therefore captures whether responsibility for DPP-related information is formally assigned, whether coordination mechanisms exist, and whether regulatory data management is embedded within the organization.

3.3.2 Implementation Actions

The dimension is labelled *Implementation Actions* because it captures the movement from regulatory awareness to concrete preparation. The term emphasizes that supplier readiness requires observable actions, rather than only general knowledge of future DPP requirements. Implementation Actions represents a dimension not directly captured by OIPT. While OIPT explains how organizations respond to increasing information-processing requirements, it does not distinguish between awareness and actual adaptation. In practice, organizations may recognize regulatory requirements without turning them into concrete actions.

This dimension therefore captures whether suppliers have gone beyond passive awareness and initiated actual adaptation efforts. Such actions may include mapping data gaps, initiating implementation projects, allocating responsibility, or upgrading systems. It therefore reflects the extent to which organizations translate regulatory awareness into operational capability.

3.3.3 Product-Level Data Readiness

The dimension is labelled *Product-Level Data Readiness* because DPP implementation depends on the availability and structure of data at the level of the specific product or component. The term was chosen to distinguish product-specific readiness from broader company-level sustainability reporting, general data maturity, or site-level environmental information. Product-Level Data Readiness is also an additional dimension beyond OIPT. OIPT focuses on how information is processed, but largely assumes that relevant information exists. In the context of DPP, this assumption is problematic because the availability and structure of product-level data is itself a central challenge.

DPP requires detailed and structured information regarding material composition, origin, and environmental impact at the product level. This dimension therefore captures whether suppliers can generate, structure, and maintain such data. Without structured product-level data, digital systems and coordination mechanisms cannot function effectively, making this a prerequisite capability for DPP readiness.

3.3.4 Digital System Enablement

The dimension is labelled *Digital System Enablement* because it assesses whether digital systems enable the supplier to manage DPP-relevant information in a structured and scalable way. The term is used instead of the OIPT term "vertical information systems" because the empirical assessment focuses on practical system capability rather than the theoretical design mechanism itself. Digital System Enablement corresponds directly to vertical information systems in OIPT. Vertical information systems increase the organization's capacity to process information by structuring, storing, and distributing information more efficiently (Galbraith, 1974; Daft & Lengel, 1986).

In the DPP context, this dimension captures whether the supplier has the digital infrastructure required to manage large volumes of product-level data. This may include ERP systems, traceability systems, integrated databases, and interoperable interfaces. Suppliers relying on manual processes or fragmented systems are less able to manage recurring and standardized information flows required for DPP.

3.3.5 Upstream Transparency Logic

The dimension is labelled *Upstream Transparency Logic* because it assesses the supplier's underlying approach, routines, and mechanisms for obtaining information from its own upstream suppliers. The word *logic* is used to emphasize that the dimension is not limited to stated transparency, but concerns how upstream information access is organized in practice. Upstream Transparency Logic builds on lateral relations in OIPT, but extends this concept beyond the boundaries of the individual firm. Lateral relations are used to coordinate across organizational units when information is distributed. In the DPP context, information is distributed across multiple supplier tiers, meaning that coordination must also occur across organizational boundaries.

This dimension captures whether suppliers have established mechanisms to access, request, validate, and integrate upstream data. This may include supplier requirements, traceability protocols, data requests, or engagement with upstream actors. Without upstream transparency, internal readiness remains incomplete, since critical information may be unavailable further up the supply chain.

3.3.6 Collaboration & Openness

The dimension is labelled *Collaboration & Openness* because DPP readiness depends on both the ability and the willingness to exchange information across organizational boundaries. The term captures the relational side of readiness, including responsiveness, transparency, dialogue, and willingness to engage with customer or supply chain data requests. The dimension also reflects lateral relations in OIPT. While Upstream Transparency Logic focuses on mechanisms for obtaining information from upstream suppliers, Collaboration & Openness captures the relational dimension of information exchange between the supplier and its customers or partners.

Effective coordination requires not only systems and structures, but also willingness to share information and engage in dialogue. This dimension therefore captures whether suppliers are responsive to information requests, willing to share data, and able to participate in transparent and cooperative information flows. Even when formal systems exist, weak collaboration can limit effective information exchange, making this dimension critical for overall readiness.

3.4 Example Visualization

This section presents an illustrative example of the Supplier Readiness Diamond, which is used to visualize and compare supplier capabilities in relation to DPP readiness.

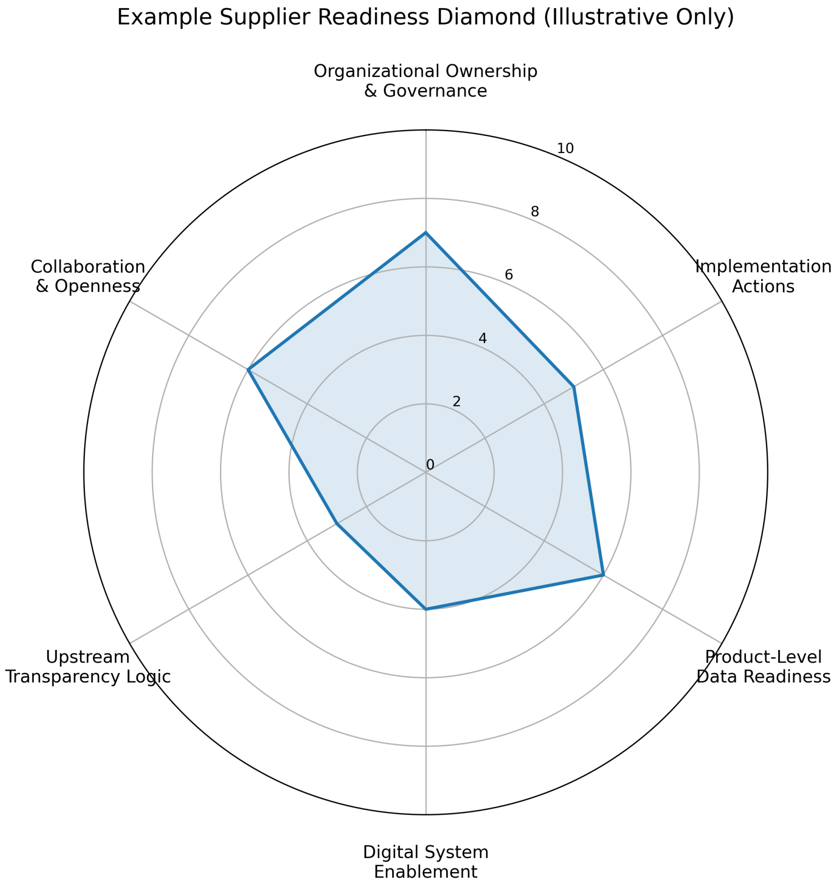


Figure 3.1: Example Supplier Readiness Diamond (illustrative profile)

3.5 Scoring Approach and Anchored Criteria

Each diamond dimension is scored on a 0–10 integer scale using anchored, behavior-based criteria. The scores are not treated as interval-level measurements and are not aggregated into a composite index. Instead, the scale is used as a qualitative coding device that supports (i) consistent cross-supplier comparison and (ii) visual diagnosis of capability gaps. The scale is therefore more ordinal and does not represent equal interval distances, which indicates a difference between 3 and 5 is not necessarily as big as a difference between 5 and 7. The emphasis is instead placed on anchor-defined capability categories rather than the numerical magnitude itself, meaning that movement between scores reflects shifts between qualitative stages of organizational maturity rather than proportional increases in readiness.

Benchmarking principle (ideal-type alignment)

Scores reflect the degree of *structural institutionalization* of DPP-relevant capability, benchmarked against an ideal-type implementation scenario (i.e., functional alignment with anticipated DPP requirements). This means that suppliers are evaluated in terms of implemented structures, routines, and data/system capabilities not ambition, general sustainability maturity, or stated intentions.

Evidence rule

Scores are assigned by matching interview evidence against predefined anchors. When interviews do not provide evidence of a specific structural element, *absence of evidence is treated as absence of structure* for the purpose of scoring.

Inference restraint

Given the interview-based nature of the empirical material, interpretations follow *analytical inference* rather than psychological speculation. In practice, this means that conclusions are drawn from the implications of what is stated (and what is not stated) in relation to DPP requirements, while avoiding claims about motives, intent, or strategic impression management.

The scoring approach reflects this distinction by differentiating between evidence-based thresholds and interpretation-based refinement. The anchor scores (e.g., 3, 5, 7, 10) correspond to clearly identifiable capability levels, where specific organizational practices, systems, or structures can be directly observed in the material. These levels therefore require explicit evidence of implementation and are not assigned based on inference.

In contrast, intermediate scores (e.g., 4, 6, 8) allow for analytical interpretation of the material, reflecting cases where suppliers exhibit indications of progression that do not fully correspond to a defined capability threshold. This interpretive space is necessary, as the assessment framework cannot exhaustively capture all possible forms of preparation for DPP. Suppliers may demonstrate incremental adjustments, emerging practices, or a general level of organizational maturity that, while not constituting a distinct shift, still signals movement toward higher readiness.

Accordingly, these intermediate scores provide a way to incorporate nuances without speculation. Rather than inferring unobservable intentions, the interpretation remains grounded in observable patterns and overall consistency in the material, making sure that the assessment is based on evidence but also sensitive to context.

The full anchored rubric used to assign scores is provided in Appendix D.

3.6 Capability Interdependence, Balance, and Weakest-Link Logic

Building on the multidimensional view of supplier readiness, it is not sufficient to assess the six readiness capabilities in isolation. Rather, supplier readiness must be understood as the outcome of how these capabilities interact and reinforce one another within an integrated system.

OIPT remains the primary theoretical foundation for this argument, as it explains why organizations must develop sufficient information-processing capacity when uncertainty and interdependence increase. However, in order to interpret how the dimensions of the Supplier Readiness Diamond function together in practice, the analysis also draws on complementary analytical logics related to capability interdependence, balance, and weakest-link dynamics. These concepts are not introduced as separate theoretical lenses, but are used to clarify how the readiness dimensions interact and how weaknesses in one area may constrain the effectiveness of the overall readiness profile.

In the context of DPP, information-processing demands span multiple domains simultaneously, including product-level data generation, digital system integration, upstream transparency, and inter-organizational information exchange. Importantly, information processing is therefore not confined to a single activity, but requires alignment across the full chain of information generation, structuring and validation.

This implies that the effectiveness of any individual capability is contingent upon the presence of others, reflecting a logic of capability complementarity (Milgrom & Roberts, 1995). Within the Supplier Readiness Diamond, this means that readiness dimensions should not be interpreted as isolated capabilities, but as mutually supporting elements of the supplier's overall information-processing capacity.

Applied to the present context, product-level data has limited operational value without digital systems to structure and manage it, while upstream transparency cannot be achieved without governance mechanisms enabling supplier coordination and data requirements. Capabilities therefore do not contribute independently to readiness, but jointly determine the organization's ability to process and utilize information.

Supplier readiness should be conceptualized as a system-level property emerging from the balance and coherence of capability configurations across dimensions. This view is consistent with a systems perspective, where overall performance depends on the alignment of interdependent components rather than the strength of individual elements. Suppliers that exhibit strong performance in isolated dimensions may still face limitations if other critical capabilities are underdeveloped, as the absence of supporting elements prevents the effective utilization of otherwise advanced capabilities. Furthermore, the interdependent nature of these capabilities introduces a weakest-link logic, whereby overall system performance is constrained by its most underdeveloped components. This logic is well-established in both operations and systems theory, where bottlenecks limit the throughput and effectiveness of the entire system (Goldratt & Cox, 1984). In the context of supplier readiness, deficiencies in any dimension, such as digital infrastructure, governance, or upstream transparency, may create bottlenecks that restrict the organization's ability to process, integrate, or exchange required information. If such bottlenecks exist, this raises the question of why they are present in the first place.

As a result, readiness is not driven by peak performance in individual dimensions, but by the extent to which all required capabilities are sufficiently developed and aligned. Balanced capability configurations enable organizations to manage the complexity of regulatory information more effectively, whereas imbalances introduce structural constraints that limit overall functionality. Supplier readiness, therefore, evolves through the coordinated development of interdependent capabilities, where the absence of alignment reduces the effectiveness of otherwise advanced elements.

3.6.1 Visual Illustration of Capability Configurations

To further clarify the implications of capability interdependence and balance, two stylized capability configurations are illustrated in Figure 3.2. The blue profile visualized in the figure represents an imbalanced ("spiky") profile, where a supplier demonstrates high performance in a limited number of dimensions but remains underdeveloped in others. The orange profile, meanwhile, represents a balanced configuration, where capabilities are more evenly developed across all dimensions. This visual comparison is to highlight how different capability distributions may influence overall readiness, particularly in light of the interdependencies and weakest-link dynamics discussed above.

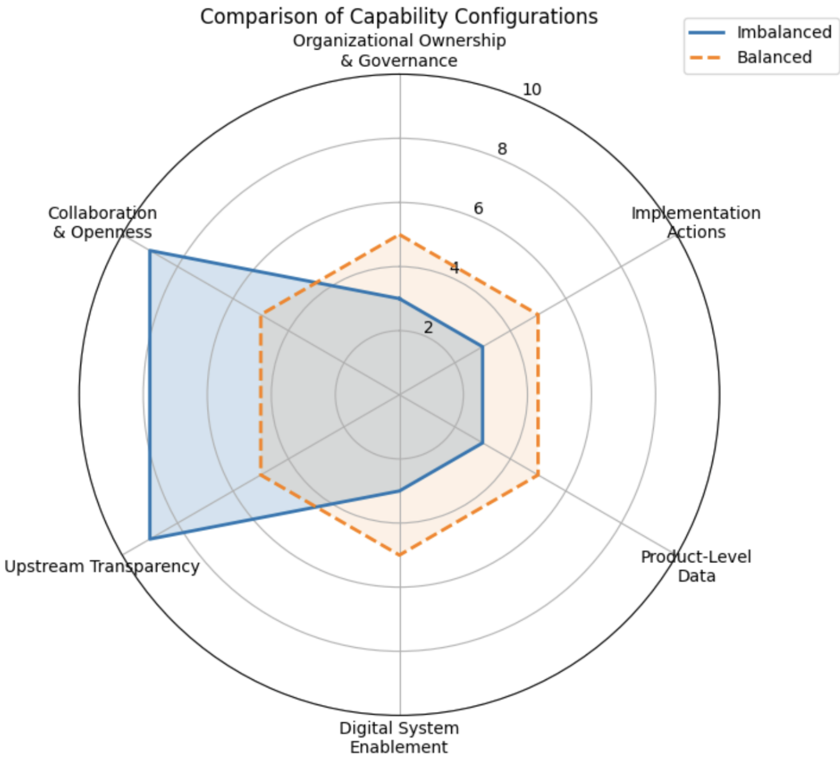


Figure 3.2: Visual representation of an imbalanced and a balanced diamond profile

3.6.2 Aggregated Scores

The comparison further highlights a key limitation of treating supplier readiness as an aggregated score across dimensions. Although the two configurations presented exhibit identical total scores (5+5+5+5+5+5 & 3+3+3+3+9+9), they represent fundamentally different capability structures. The unbalanced configuration concentrates performance in a limited number of dimensions while remaining underdeveloped in others. The balanced configuration, however, distributes capabilities more evenly across all dimensions. This shows that aggregated scoring does not capture the interdependent nature of the capabilities underlying supplier readiness. As discussed in the theoretical framework, capabilities function as a system of complementary and mutually reinforcing elements. Consequently, severe weaknesses in certain dimensions may constrain the broader system, even when other capabilities are relatively well developed. This is because the absence of supporting capabilities limits the extent to which stronger dimensions can be effectively integrated and utilized.

Based on the discussion above, supplier readiness cannot be meaningfully assessed through additive or average-based measures. Instead, it must be evaluated in terms of the configuration and balance of capabilities across dimensions. The visual comparison shows that two suppliers with identical aggregate scores may exhibit significantly different levels of readiness, depending on how their capabilities are distributed and aligned.

3.7 Readiness Stage Classification

While the Supplier Readiness Diamond provides a comparative and multidimensional readiness profile, the readiness stage classification provides a complementary way of categorizing each supplier's overall level of preparedness for DPP. Whereas the Diamond shows the distribution, balance, and weaknesses of supplier capabilities across dimensions, the stage classification translates these multidimensional patterns into a more concise and operational interpretation of the supplier's overall readiness position.

Stages are assigned using a rule-based assessment across dimensions, rather than through numerical aggregation. Although the stage classification captures overall preparedness, it does not in itself determine whether suppliers are ready in practice, as this depends on how capabilities are configured and aligned across dimensions. Table 3.1 summarizes the stage categories and their defining criteria.

Table 3.1: Readiness stage classification criteria

Stage	Stage description
Unaware	Limited or no knowledge of DPP requirements; no internal ownership; no preparatory actions.
Aware but passive	Awareness of DPP exists, but preparation is limited to monitoring; ownership and concrete actions are absent or minimal.
Preparing	Ownership is emerging and concrete preparatory actions have begun, but product-level data and/or system enablement remain limited.
Internally data-ready	Product-level data is largely available and structured internally; the traceability approach is defined; remaining gaps relate mainly to external integration and scaling.
DPP-ready/piloting	DPP-related data flows are structured, validated, and at least partly automated; pilots or customer-facing implementations are underway.

Building on these criteria, the readiness stage classification was designed to support a more operational interpretation of overall readiness. Although the Supplier Readiness Diamond enables detailed analysis of capability configurations and structural differences between suppliers, such complexity may be difficult to interpret and operationalize directly in practice, particularly in managerial and supply chain decision-making contexts.

To address this, the framework was complemented with a readiness stage classification model that translates multidimensional capability patterns into more interpretable and actionable readiness categories. In this sense, the stage model functions as a simplified interpretive layer built upon the broader analytical structure of the Supplier Readiness Diamond.

This logic is also consistent with organizational design perspectives high-lighting the importance of defining meaningful sub-goals and interpretive structures in order to coordinate organizational adaptation under conditions of uncertainty and interdependence (Tushman & Nadler, 1978). In the context of DPP, where organizations gradually need to adapt systems, governance structures, product-level data capabilities, and inter-organizational coordination mechanisms simultaneously, the stage classification provides a more operational way of interpreting overall supplier preparedness.

4 Methodology

This chapter presents the methodological approach used to examine supplier readiness for Digital Product Passports in the selected GARO product value chain. It describes the research design, case context, data collection process, and analytical procedure used to translate qualitative interview material into structured readiness assessments. The chapter also discusses quality criteria and ethical considerations related to the study.

4.1 Research Design

This study adopts a qualitative case study design to investigate supplier readiness for DPPs within a multi-tier supply chain context. A qualitative approach is appropriate because the research aims to explore organizational capabilities, structures, and practices related to regulatory information management rather than to test predefined hypotheses.

The case study focuses on a specific product value chain at GARO, where several suppliers contribute components and materials required for the final product. Case studies are particularly suitable for examining complex organizational phenomena embedded within real-world contexts (Yin, 2018). In the context of DPP implementation, supplier readiness depends on organizational structures, digital systems, and inter-organizational coordination mechanisms that are best understood through in-depth qualitative investigation.

By analyzing multiple suppliers connected to the same product value chain, the study enables comparative assessment of readiness profiles while maintaining a consistent contextual setting. In this study, the primary unit of analysis is the individual supplier organization connected to the selected product value chain.

4.2 Case Description and Unit of Analysis

This study uses GARO as the focal case organization. GARO is a Swedish manufacturer of electrical distribution products and operates within complex supply chains involving multiple upstream suppliers providing components and materials. Like many manufacturing firms operating within the European Union, GARO is increasingly affected by emerging sustainability regulations, including the forthcoming implementation of DPPs.

The empirical investigation focuses on a specific product value chain within GARO's operations, related to the *Gatubelysningsskåp 2 GR Astro*. The product was selected in collaboration with GARO based on input from the company supervisor, who identified it as strategically relevant and expected to remain important within GARO's product portfolio over time. This ensured that the study was not conducted on arbitrary suppliers, but on suppliers connected to a product value chain with high relevance for the focal firm. Since the selected product was not viewed by GARO as a temporary or declining offering, but rather as a product with continued operational and commercial significance, the suppliers contributing to it also became relevant from a DPP-readiness perspective. The selection was therefore intended to make the analysis decision-relevant for GARO by focusing on suppliers whose components, data capabilities, and information-sharing practices may have operational and managerial implications under future DPP-related requirements.

The selected product is illustrated in Figure 4.1.

Figure 4.1: Street lighting cabinet (Gatubelysningsskåp 2 GR Astro)

The product represents a combination of different component types, including both electrical modules and structural elements. This composition makes it suitable for analyzing how product-level data and traceability requirements are distributed across different parts of the supply chain.

The suppliers included in the study were derived from this selected product value chain. In collaboration with GARO, five Tier-1 suppliers connected to the *Gatubelysningsskåp 2 GR Astro* were identified as relevant for the analysis. ETI and Siemens supply electrical components used in the cabinet, Supplier X provides switching and electrical safety-related components, while Laserstans and Plåtprodukter are connected to the metal and sheet-metal parts of the product. Together, these suppliers represent different component categories, information requirements, and potential traceability challenges within the same product.

It is important to clarify that the empirical data collection was conducted with Tier-1 suppliers only. The study did not include direct interviews with Tier-2 or Tier-3 suppliers. However, because DPP-related information requirements often extend beyond the first tier, the interviews with Tier-1 suppliers included questions about their upstream supplier relationships, traceability practices, supplier requirements, and access to product-related information from their own suppliers. In this way, the study captures multi-tier supply chain aspects indirectly, while maintaining Tier-1 suppliers as the direct empirical unit of analysis. Figure 4.2 illustrates this empirical scope by distinguishing between the directly studied Tier-1 supplier level and the upstream tiers that were addressed indirectly through Tier-1 supplier interviews.

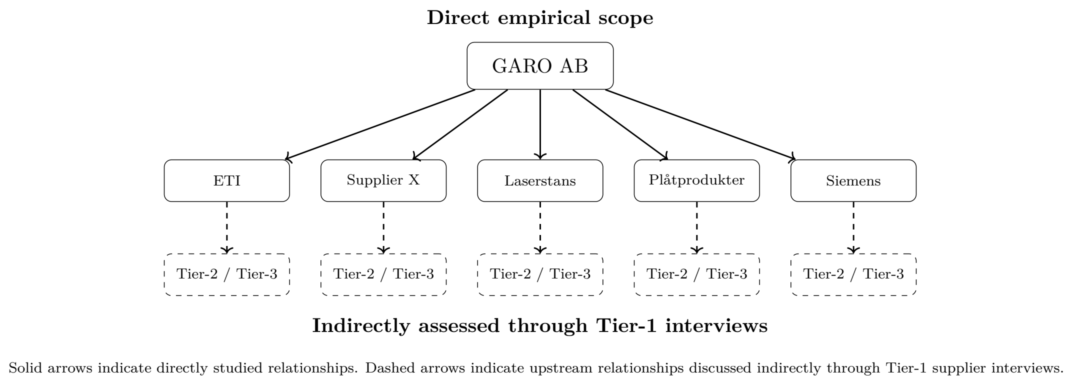


Figure 4.2: Empirical scope of the selected GARO product value chain

4.3 Quality Criteria

By focusing on suppliers connected to a single product value chain, the study maintains a consistent analytical context while allowing for comparison between supplier organizations with different roles in the product. This approach enables the identification of variation in supplier readiness while controlling for product-specific and contextual factors. In this way, the analysis remains grounded in a shared product context, while still capturing differences in how suppliers manage DPP-relevant capabilities such as product-level data, digital systems, upstream transparency, and collaboration.

The purpose of the study is not to evaluate GARO as an organization, but to use GARO's selected product value chain as an empirical context for analyzing how suppliers with different roles in the product architecture respond to emerging regulatory information requirements. In this sense, GARO functions as the contextual setting that enables an organized assessment of supplier readiness across a product-based supplier network.

4.4 Data Collection

This study relies primarily on qualitative empirical data collected through interviews with suppliers connected to the selected product value chain. Interviews constituted the main source of empirical material, as they enabled an in-depth understanding of organizational practices, capabilities, and perceptions related to DPP requirements. In addition to interviews, secondary data and relevant documents were used to complement and contextualize the findings.

4.4.1 Interviews

The primary empirical data for this study were collected through semi-structured interviews with suppliers connected to the selected product value chain. Semi-structured interviews were chosen because they allow the researcher to explore predefined themes while also providing flexibility to follow up on relevant insights that emerge during the conversation. This approach is particularly suitable when investigating organizational structures, decision-making processes, and practices related to regulatory adaptation.

In total, ten semi-structured interviews were conducted with representatives from the Tier-1 suppliers connected to the selected product value chain. The initial ambition of the study was to include Tier-2 and Tier-3 suppliers directly in order to capture upstream readiness and traceability practices more comprehensively. However, after initial attempts, lower-tier suppliers proved difficult to access within the timeframe of the thesis. As a result, a second round of interviews was conducted with the five Tier-1 suppliers, where additional emphasis was placed on upstream supplier relationships, traceability practices, information exchange routines, and visibility beyond the first tier. Through this approach, information regarding Tier-2 and Tier-3 practices was obtained indirectly through the Tier-1 suppliers' descriptions of their upstream supplier relationships and traceability practices. As a result, parts of the upstream transparency assessment rely on how Tier-1 suppliers describe their own upstream management processes rather than on direct observations of lower-tier suppliers.

The interviewees typically held roles related to quality management, sustainability, operations, or supply chain management. These roles enabled them to provide insights into organizational processes related to regulatory compliance, data management practices, and supply chain coordination. An interview guide was developed based on the theoretical framework presented in Chapter 2.

The questions were designed to capture information related to the six capability domains of the Supplier Readiness Diamond, including organizational governance, implementation initiatives, product-level data availability, digital system support, upstream transparency, and inter-organizational collaboration. Structuring the interviews around these themes ensured that the collected data aligned with the analytical framework used in the study. Due to practical access constraints, interviews were primarily conducted with Tier-1 suppliers, while direct access to Tier-2 and Tier-3 suppliers proved difficult to obtain within the timeframe of the study. To still capture upstream supply chain dynamics, interview questions included topics related to supplier transparency, traceability, and the requirements that Tier-1 suppliers place on their own upstream suppliers. Through this approach, information regarding Tier-2 and Tier-3 practices was obtained indirectly through the Tier-1 suppliers' descriptions of their supplier management processes and information exchange practices.

The interviews were conducted remotely and lasted between approximately 30 and 60 minutes. With the consent of the participants, the interviews were recorded to ensure proper documentation of the responses and the option to go back and listen. Notes and interview transcripts were used as the primary empirical material for the analysis. Summaries of the interviews are provided in Appendix E to increase transparency regarding the empirical material underlying the supplier assessments. An overview of the supplier interviews is provided in Table 4.1. The table summarizes the suppliers included in the empirical analysis, the interview rounds conducted and the interviewee roles.

Table 4.1: Overview of supplier interviews

Supplier	Interview round	Interviewee role
ETI	Round 1 and 2	Sustainability Manager
Supplier X	Round 1 and 2	Quality, Environment and Sustainability Manager
Laserstans	Round 1 and 2	Quality and Environmental Manager
Plåtprodukter	Round 1 and 2	Sales representative
Siemens	Round 1 and 2	Product and sustainability data specialist

4.4.2 Documents and Secondary Data

In addition to interviews, documents and secondary data were used to support and contextualize the empirical analysis. These sources included publicly available company information, supplier documentation, and internal materials related to the selected product value chain provided by GARO. Such documents contributed to a better understanding of the product structure, supplier relationships, and supply chain configuration related to the studied street lighting cabinet.

Secondary sources were primarily used to complement the interview data and provide contextual background rather than serving as the main source of empirical evidence. Combining interviews with documentary material enabled triangulation of information and supported a more comprehensive understanding of the supply chain context in which supplier readiness was analyzed.

4.5 Data Analysis

The empirical material collected through interviews was analyzed using a theory-driven qualitative analysis approach. The analysis was guided by the theoretical framework developed in Chapter 2, particularly the six capability domains represented in the Supplier Readiness Diamond. Interview transcripts and notes were reviewed and systematically examined to identify evidence related to the six capability dimensions: organizational governance, implementation capability, product-level data readiness, digital system enablement, upstream transparency, and relational collaboration. Statements from interview participants were interpreted and categorized according to these dimensions in order to assess how each supplier addressed the organizational requirements associated with DPP implementation.

Although some empirical statements could relate to more than one readiness dimension, the scoring was not based on a general impression of the supplier's overall maturity. Instead, each statement was evaluated against the specific anchored criteria of the relevant dimension, as defined in the scoring rubric in Appendix D. This means that higher scores in each dimension required evidence of the specific capability represented by that dimension. For example, higher scores in Product-Level Data Readiness required evidence that product-level data was available, structured, and increasingly suitable for DPP requirements, while higher scores in Digital System Enablement required evidence that digital systems supported structured handling of such data. Similarly, Upstream Transparency Logic focused on mechanisms for obtaining information from upstream suppliers, whereas Collaboration & Openness focused on the willingness and ability to share information with GARO or other supply chain partners. In this way, potential overlap between dimensions was acknowledged, but the scoring remained anchored in distinct implementation requirements for each dimension.

Based on this structured assessment, each supplier was systematically assessed across the six capability dimensions using a rule-based evaluation rubric. The rubric provided anchored descriptions for different score levels, enabling a consistent interpretation of supplier capabilities across the analyzed cases. This structured assessment process allowed qualitative interview data to be translated into a structured capability profile for each supplier.

The resulting scores were then visualized using the Supplier Readiness Diamond, which illustrates how capabilities are distributed across the six analytical dimensions. This visualization supports comparison between suppliers and highlights areas where organizational readiness may be more or less developed.

To strengthen the chain of evidence between the empirical material and the assigned readiness scores, the scoring process followed a structured evidence-to-score procedure. First, interview transcripts and notes were reviewed to identify statements related to each of the six readiness dimensions. Second, these statements were grouped under the relevant dimension and compared with the anchored scoring criteria presented in Appendix D. Third, each score was assigned based on the closest match between the observed evidence and the predefined capability anchors.

Where evidence clearly corresponded to an anchor level, that score was assigned directly. Where the evidence indicated partial progression between two anchor levels, an intermediate score was assigned and justified through interpretation of the overall pattern in the material. To make this process more transparent, Appendix C provides examples of how specific interview evidence was translated into analytical interpretation and final scores, as illustrated in Tables C.1 and C.2.

Finally, the overall readiness of each supplier was evaluated using the rule-based readiness stage classification developed in the study. This classification positions suppliers along a staged adaptation continuum reflecting the degree to which organizational structures, systems, and inter-organizational coordination mechanisms align with the regulatory information requirements associated with DPPs.

To ensure the credibility and analytical rigor of the study, several methodological considerations were applied throughout the research process. First, credibility was supported through the use of semi-structured interviews with knowledgeable representatives from supplier organizations. Interview participants typically held roles related to sustainability, quality management, or supply chain operations, providing informed perspectives on organizational practices related to regulatory compliance and data management. Furthermore, the interview guide was derived directly from the theoretical framework developed in Chapter 2, ensuring alignment between the conceptual constructs of the study and the empirical material collected.

Second, analytical consistency was strengthened through the use of a structured scoring rubric. The anchored criteria used for the Supplier Readiness Diamond provided predefined capability descriptions for different score levels. By matching interview evidence against these anchored criteria, the study aimed to ensure that supplier assessments were based on comparable evaluation principles rather than subjective impressions. The rubric therefore functioned as a structured qualitative coding device supporting systematic comparison across suppliers. To strengthen consistency in the assessment process, an initial subset of suppliers was independently assessed by both authors using the scoring rubric. The assessments were then compared and discussed in order to align the interpretation of the capability criteria before the remaining suppliers were evaluated.

Third, analytical transparency was maintained by clearly documenting the process through which interview material was translated into readiness assessments. The analytical framework, scoring criteria, and readiness stage definitions are explicitly described in Chapter 3 and in the appendices. This documentation enables readers to understand how qualitative observations were interpreted and how conclusions were derived from the empirical material.

The study may also be affected by selection bias. Suppliers were identified through GARO's supplier network and participation in the interviews was voluntary. Suppliers willing to participate in discussions related to DPPs and sustainability may therefore be more engaged in these issues than non-participating suppliers. This means that the study may somewhat overrepresent suppliers with relatively higher awareness or more developed readiness-related practices.

Finally, given the interview-based nature of the empirical data, the analysis required careful interpretation of how respondents described their organizational practices and capabilities. Interview participants may not explicitly articulate organizational limitations or capability gaps, particularly in professional contexts where organizations are likely to present their practices in a positive light. The analysis therefore applied an evidence-based interpretive approach, in which interview responses were assessed in relation to the structural requirements implied by DPP implementation.

This approach involved reading between the lines of interview responses while avoiding speculative interpretation. Rather than relying solely on direct statements, conclusions were drawn from the structural implications of what respondents described and what was not described in relation to the anchored capability criteria used in the scoring rubric. Such interpretive inference from qualitative data is commonly applied in qualitative research when assessing organizational practices and structures (Miles, Huberman & Saldaña, 2014).

4.6 Ethical Considerations

Ethical considerations were taken into account throughout the data collection and research process. All interview participants were informed about the purpose of the study and the academic context in which the research was conducted. Participation in the interviews was voluntary, and respondents were given the opportunity to decline answering specific questions if they wished.

Prior to each interview, participants were informed that the information provided would be used solely for academic purposes within the context of this thesis. With the consent of the participants, interviews were recorded in order to ensure accurate documentation of the responses. The recordings and interview notes were used exclusively for analytical purposes and were not shared outside the research process.

Organizational identification was handled according to the consent obtained from the participating organizations. Named organizations are included only where permission for identification in the published thesis was obtained. Where such permission was not available, unclear, or where anonymity was requested, the supplier was anonymized.

In presenting the empirical findings, care was taken to avoid disclosing sensitive or confidential business information. The analysis focuses on organizational structures and practices relevant to supplier readiness rather than evaluating individual respondents or revealing proprietary operational details. This approach helps ensure that participating organizations are not exposed to unintended reputation or commercial risks as a result of the study.

In addition to these ethical considerations, the use of generative AI tools during the writing process was handled with transparency and author responsibility. Generative AI tools were used as language-support tools, primarily to improve grammar, clarity, structure, and academic phrasing. They were not used to generate empirical data, conduct the analysis, assign scores, create findings, or replace the authors' own interpretation of the material. All content, arguments, assessments, and conclusions remain the responsibility of the authors.

5

Application to the Case

This chapter applies the supplier readiness framework developed to the selected product value chain in GARO AB. In line with the two-layer structure of the framework, each supplier is assessed in two analytical steps. First, a multidimensional readiness profile is presented using the Supplier Readiness Diamond. Second, each supplier is classified into an absolute readiness stage based on the readiness stage classification criteria established in Chapter 3 and the anchored scoring criteria provided in Appendix D. The supplier assessments presented in this chapter are therefore based on the combination of interview evidence, the anchored scoring rubric, and the evidence-to-score logic illustrated in Appendix C.

5.1 ETI

This section presents the readiness assessment of ETI, one of the suppliers connected to the selected product value chain.

5.1.1 Supplier Readiness Diamond

This section presents ETI's readiness profile using the Supplier Readiness Diamond. The assessment follows the analytical structure defined in Chapter 3. Figure 5.1 illustrates the Supplier Readiness Diamond profile for ETI Group.

Organizational Ownership & Governance (Score: 4)

The supplier demonstrates a basic level of organizational awareness regarding sustainability, supported by the presence of a designated Sustainability Manager and the integration of ESG considerations into the company's broader strategic direction. However, the findings provide limited evidence that these responsibilities are operationally embedded in organizational routines or linked to product-level data management. The absence of cross-functional coordination mechanisms, structured governance processes, and clearly defined roles related to DPP-relevant information suggests a relatively weak level of institutionalization. The score therefore reflects formal awareness and assigned responsibility, but limited operational integration and governance maturity.

Concrete Implementation Actions (Score: 4)

The supplier demonstrates limited evidence of concrete implementation actions related to DPP-relevant requirements. Some preparatory initiatives are underway, including the development of a program for calculating product-level CO_2 emissions and the availability of LCA data for a limited number of products. However, these efforts appear fragmented and remain insufficiently integrated into broader operational processes. No evidence is provided of formal implementation projects, structured rollout strategies, or clearly defined roadmaps related to DPP alignment. The score therefore reflects early-stage exploratory actions that indicate emerging engagement, but limited implementation maturity.

Product-Level Data Readiness (Score: 4)

The supplier demonstrates limited availability of product-level sustainability data, including basic information on material composition, hazardous substances, and LCA results for a limited number of products. The interview evidence indicates that ETI can provide "$\mathrm{CO_2}$ emissions data for production sites, as well as information on material composition and hazardous substances," but that "product-level $\mathrm{CO_2}$ calculations are still under development" (Interview, ETI). In addition, while Safety Data Sheets, certificates, and material source declarations are available, the respondent stated that "LCA results are available for some products, but not all" and that ETI "currently does not provide EPDs" (Interview, ETI). This suggests that relevant sustainability data exists, but remains incomplete, unevenly distributed, and insufficiently structured at product level. The score therefore reflects partial and exploratory data capabilities, but limited completeness, consistency, and structural maturity.

Digital System Enablement (Score: 4)

The supplier demonstrates the presence of basic digital infrastructure through the use of an ERP system, indicating that certain operational data is managed within a structured digital environment. However, the continued reliance on Excel for data collection and storage suggests that data management remains partially manual and fragmented. There is limited evidence that sustainability-related or product-level data is systematically integrated, automated, or managed within existing digital systems. Furthermore, no indication is provided regarding interoperability, automated data exchange, or DPP-aligned information flows. The score therefore reflects the existence of basic digital infrastructure, but limited evidence of integrated and scalable digital system capabilities.

Upstream Transparency Logic (Score: 3)

The supplier demonstrates limited visibility into its upstream supply chain, with traceability primarily confined to direct suppliers. This limitation was explicitly stated in the interview, where the respondent noted that ETI has "limited visibility into second- and third-tier suppliers" and identified confidentiality and limited upstream transparency as key barriers to full traceability (Interview, ETI). Although formal supplier governance mechanisms are present, including a Supplier Code of Conduct, contractual requirements, and occasional audits, these are not linked to systematic collection of sustainability- or DPP-related information. The respondent further stated that second-tier suppliers are not currently required to report emissions or material origin, indicating that upstream data collection remains limited and largely passive. The score therefore reflects weakly structured transparency capabilities, with low levels of multi-tier integration and data coordination.

Collaboration & Openness (Score: 3)

The supplier demonstrates a limited and largely passive approach to collaboration and information sharing. While a general willingness to engage is expressed, there is limited evidence of structured data-sharing practices or active collaboration related to sustainability or product-level information. Information sharing appears to be confined to high-level communication, such as the availability of a general sustainability report, rather than interactive or product-specific data exchange. Furthermore, no evidence is provided of proactive coordination, joint initiatives, or DPP-related collaboration with customers or supply chain actors. The score therefore reflects a basic level of openness, but limited collaboration maturity and weakly structured information-sharing capabilities.

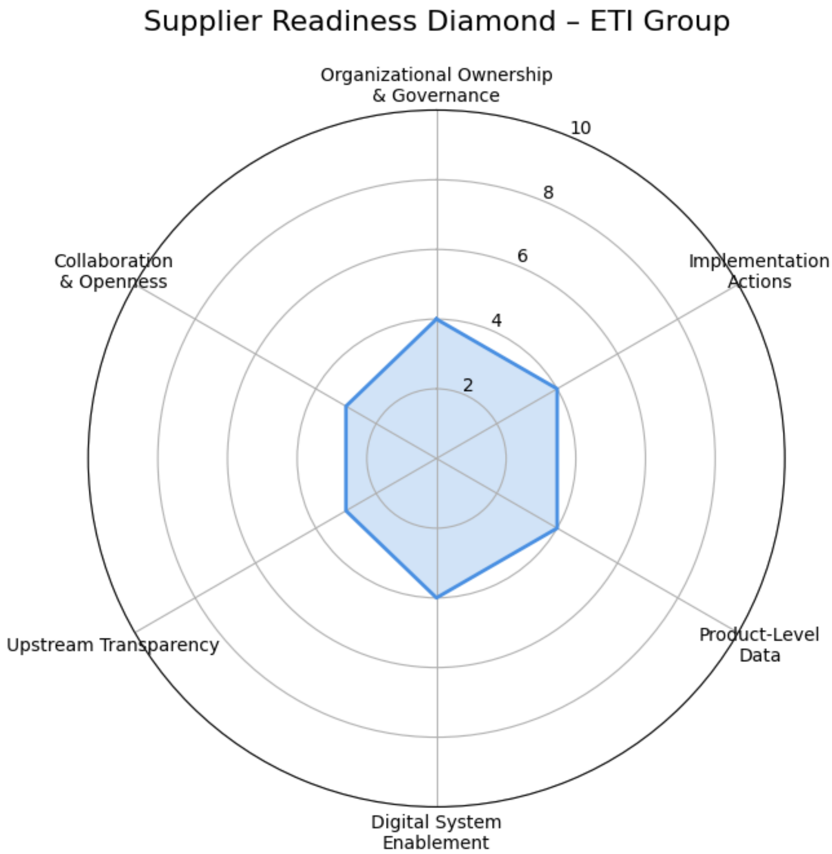


Figure 5.1: Supplier Readiness Diamond – ETI

5.1.2 Readiness Stage Classification

Based on the anchored stage definitions, ETI is classified as **aware but passive**. While the supplier demonstrates a general awareness of sustainability-related issues, the available evidence provides no clear indication of structured or ongoing implementation efforts related to DPP requirements. The responses lack specificity regarding concrete actions, system integration, or product-level data development, and no mechanisms for upstream data collection or supplier coordination are identified. In addition, there is no evidence of formalized governance structures or digital systems supporting the generation, management, or exchange of DPP-relevant information. Capabilities appear fragmented and weakly developed, with no clear indication that existing resources are actively mobilized toward addressing increasing regulatory information demands. The classification therefore reflects a supplier that is aware of sustainability-related pressures but has not yet translated this awareness into structured, operational capabilities aligned with DPP requirements.

5.2 Supplier X

This section presents the readiness assessment of Supplier X, a supplier connected to the selected product value chain at GARO AB. The analysis follows the same two-step structure applied to ETI. First, Supplier X's readiness profile is presented using the Supplier Readiness Diamond, illustrating how capabilities are distributed across the six analytical dimensions. Second, the supplier is classified into a readiness stage based on the anchored, rule-based criteria defined in Chapter 3.

5.2.1 Supplier Readiness Diamond

Organizational Ownership & Governance (Score: 8)

Supplier X demonstrates well-established sustainability governance structures and clear organizational ownership of environmental and quality-related matters. The interviewee holds senior-level responsibility for sustainability issues, indicating that such matters are institutionally embedded rather than handled on an ad hoc basis. Furthermore, the company operates under certified management systems, including ISO 9001 and ISO 14001, suggesting formalized procedures, internal monitoring mechanisms, and structured environmental management processes. Sustainability considerations are described as part of the company's strategic direction, with defined targets and performance indicators followed at the organizational level. This reflects integration of sustainability into managerial decision-making and ongoing operational oversight. However, while governance structures are clearly in place, no explicit evidence indicates the existence of a formally institutionalized DPP-specific governance framework or dedicated DPP implementation roadmap. The score therefore reflects strong and structured sustainability governance, but without confirmed embedding of DPP-specific management systems.

Concrete Implementation Actions (Score: 7)

Supplier X demonstrates concrete sustainability-related implementation actions beyond passive awareness. Sustainability objectives are integrated into the company's strategic direction, and performance indicators are actively monitored. The company reports ongoing efforts to improve material recyclability and reduce environmental impact in production processes, indicating operational engagement rather than symbolic commitment.

However, no explicit DPP-specific implementation project, pilot initiative, or structured roadmap for regulatory adaptation was described in the interview. While the company expressed confidence in its ability to meet future requirements, evidence of targeted DPP-aligned system adjustments or preparatory integration efforts remains limited. The score therefore reflects active sustainability implementation and operational engagement, but without documented DPP-focused execution.

Product-Level Data Readiness (Score: 7)

Supplier X demonstrates a relatively advanced level of product-level data readiness. The respondent stated that the company has conducted LCA calculations for "over 95% of our products" and has also completed greenhouse gas calculations for the whole company (Interview, Supplier X). In addition, the supplier can provide Safety Data Sheets, certificates, material origin declarations, and EPDs for some products, while noting that more EPDs are still being developed. This indicates that relevant sustainability data is not only available at company level, but has also been generated for a large share of the product portfolio. However, some material-related information was still described as "happening right now, but is not ready," and no evidence was provided of automated mechanisms for exporting DPP-relevant data. The score therefore reflects strong product-level data capabilities, but not yet fully systematized, validated, or digitally interoperable DPP-ready data flows.

Digital System Enablement (Score: 6)

Supplier X operates within established digital management systems and certified quality and environmental frameworks, indicating structured internal data handling. The presence of ISO-certified processes suggests formalized documentation routines and digital traceability at an operational level. However, the interview did not provide evidence of DPP-specific digital integration, automated data exchange mechanisms, or system interoperability designed for structured external sustainability data sharing. Although the digital foundation appears solid, its explicit alignment with the upcoming Digital Product Passport requirements remains undeveloped. The score therefore reflects a stable digital infrastructure with potential for adaptation, but without confirmed DPP-oriented system integration.

Upstream Transparency Logic (Score: 5)

Supplier X demonstrates general awareness of its upstream supplier structure and is able to describe the types of suppliers and raw material categories involved in its production processes. The company appears to have visibility at the first supplier tier and an understanding of the broader sourcing landscape. However, the interview did not provide evidence of institutionalized multi-tier traceability mechanisms or formalized data collection routines extending systematically to Tier-2 and Tier-3 suppliers. No structured enforcement mechanisms or digital transparency systems were described that would enable validated, product-level upstream traceability aligned with DPP requirements. The score therefore reflects partial upstream visibility and contextual awareness, but limited structural integration of multi-tier transparency logic.

Collaboration & Openness (Score: 7)

Supplier X demonstrates structured willingness to share sustainability-related information and engage in upstream data collection. The company has conducted LCAs for approximately 95% of its products and can provide documentation such as Safety Data Sheets, certificates, and EPDs for several products, indicating that relevant sustainability data is prepared for external communication rather than handled informally. Supplier X has also actively engaged suppliers in structured data collection processes. As the respondent explained in relation to conflict minerals, "we contacted our suppliers with these forms" and "they contacted their suppliers and so on" (Interview, Supplier X). This reflects proactive engagement in establishing traceability processes beyond direct internal documentation. However, no evidence was presented of formal DPP pilot participation or structured co-development of Digital Product Passport systems with customers, thus limiting the score from reaching 8 or above on the scale.

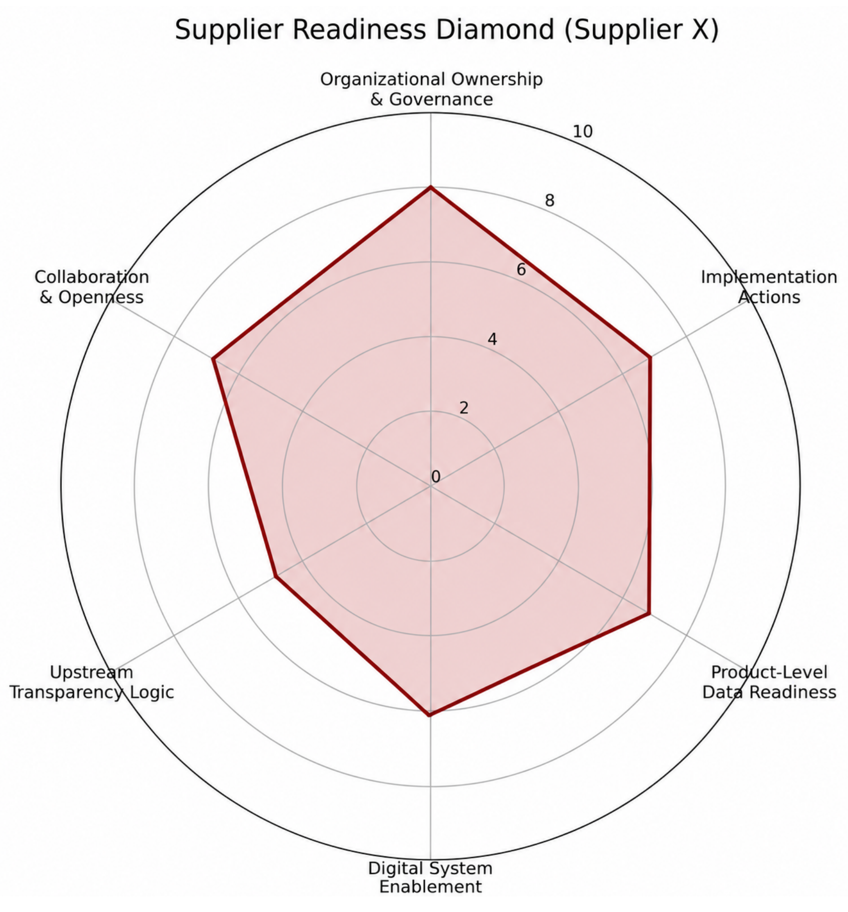


Figure 5.2: Supplier Readiness Diamond – Supplier X

5.2.2 Readiness Stage Classification

Supplier X is considered to be at the **internally data-ready** stage, based on the presence of structured product-level data and operational traceability capabilities, while remaining gaps primarily relate to DPP-specific integration and scaling. The empirical findings support this classification. Supplier X has conducted LCAs for approximately 95% of its products and completed company-level greenhouse gas calculations. The company is also able to provide Safety Data Sheets, certificates, material origin declarations, and Environmental Product Declarations (EPDs) for several products, indicating that product-level environmental data is systematically generated and managed.

In addition, Supplier X has implemented structured upstream traceability practices in selected material categories, particularly regarding conflict minerals through formalized CMRT processes. However, advancement to the *DPP-ready / piloting* stage would require evidence of automated and interoperable data flows explicitly aligned with DPP requirements, as well as participation in structured pilot initiatives. The interview did not provide evidence of DPP-specific system integration, API-based exchange mechanisms, or pilot implementations. Taken together, Supplier X demonstrates strong internal data structuring and traceability capabilities, but limited evidence of advanced DPP-specific digital integration. The supplier therefore aligns most closely with the *internally data-ready* stage according to the rule-based framework.

5.3 Laserstans

This section presents the readiness assessment of Laserstans, a supplier connected to the same selected product value chain at GARO AB as the previously analysed suppliers. The analysis follows the same two-step structure applied to the previous suppliers. First, Laserstans' readiness profile is presented using the Supplier Readiness Diamond, illustrating how capabilities are distributed across the six analytical dimensions. Second, the supplier is classified into a readiness stage based on the anchored, rule-based criteria defined in Chapter 3.

5.3.1 Supplier Readiness Diamond

Organizational Ownership & Governance (Score: 5)

GLS Laserstans demonstrates defined responsibility structures for sustainability and regulatory compliance. The interviewed respondent holds the role of Quality and Environmental Manager and is responsible for ensuring compliance with environmental legislation and maintaining internal structures related to quality and environmental management. The company also monitors relevant regulations and reports hazardous waste to national authorities. These elements indicate the presence of formalized responsibility for environmental and compliance-related matters. However, no evidence suggests the existence of a dedicated governance structure specifically addressing Digital Product Passport requirements. The score therefore reflects defined organizational ownership, but without explicit institutionalization of DPP-related governance.

Concrete Implementation Actions (Score: 5)

Laserstans demonstrates several operational sustainability-related initiatives that extend beyond passive environmental monitoring. The company systematically tracks waste volumes and material scrap, separates waste streams into multiple fractions, and collaborates with external recycling partners for responsible material handling. In addition, hazardous waste is reported to national authorities, and the company is in the process of registering with EcoVadis, indicating engagement with external sustainability assessment frameworks. These actions demonstrate operational commitment to environmental management and data collection. However, no evidence was found of structured implementation initiatives specifically targeting DPP requirements, such as dedicated projects, system adaptations, or pilot activities. The score therefore reflects operational sustainability engagement, but limited DPP-specific implementation maturity.

Product-Level Data Readiness (Score: 4)

Laserstans demonstrates the availability of certain sustainability-related information, particularly regarding material usage, waste volumes, and environmental performance indicators. The company also reports environmental data annually and has begun investigating carbon dioxide equivalents related to steel materials used in production, indicating emerging awareness of product-related environmental data. However, the findings provide limited evidence of systematically structured product-level datasets or formalized documentation such as LCAs, EPDs, or standardized product-level data formats. Environmental information appears to be managed primarily at company or process level rather than consistently at product level. The score therefore reflects emerging product-level data awareness, but limited structural maturity and standardization.

Digital System Enablement (Score: 5)

Laserstans demonstrates the presence of basic digital infrastructure through the use of an ERP system supporting production and business processes. The respondent also identified digital development as a future priority, explaining that the main challenge concerns “system integration” and the ability to retrieve figures automatically from the business system so that customers can access product-specific CO_2 equivalents (Interview, Laserstans). This suggests that a digital foundation exists, but that sustainability-related data is not yet automatically integrated or externally accessible in a DPP-aligned format. The findings provide limited evidence of structured digital traceability workflows, automated sustainability data integration, or system architectures specifically designed to support DPP requirements. The score therefore reflects basic digital capabilities, but limited evidence of integrated and DPP-aligned system functionality.

Upstream Transparency Logic (Score: 5)

Laserstans demonstrates partial upstream transparency through structured interactions with its direct suppliers. The respondent explained that the company maintains supplier dialogue, sends out questionnaires on issues such as conflict minerals, and collects "certificates and documents" to support traceability and compliance requirements (Interview, Laserstans). These practices indicate the presence of basic mechanisms for upstream information collection. However, the findings also reveal limitations regarding deeper multi-tier traceability, as the respondent noted that "when the material has been melted together, full traceability becomes difficult" (Interview, Laserstans). This suggests that upstream visibility is partly dependent on supplier-provided documentation rather than independent verification or integrated transparency systems. The score therefore reflects structured supplier interaction, but limited institutionalization of multi-tier transparency capabilities.

Collaboration & Openness (Score: 5)

Laserstans demonstrates a cooperative and open attitude toward sustainability-related information sharing and external engagement. The respondent openly discussed internal environmental practices, supplier relationships, and traceability challenges, and indicated that the company is able to provide sustainability-related information when requested by customers. In addition, the company expressed willingness to facilitate further contact with upstream suppliers, suggesting openness toward broader supply chain transparency. However, no evidence was found of structured collaboration related to DPP implementation, joint data development initiatives, or participation in pilot programs. The score therefore reflects a collaborative and transparent orientation, but limited formalization of DPP-related collaboration activities.

Figure 5.3: Supplier Readiness Diamond – Laserstans

5.3.2 Readiness Stage Classification

Laserstans is classified as **Preparing** according to the readiness stage definitions presented in Table 3.1. The Preparing stage is characterized by emerging awareness of regulatory requirements and the presence of initial organizational actions aimed at improving sustainability transparency and data availability. The empirical findings indicate that Laserstans has begun implementing several environmental management practices, including systematic monitoring of waste streams, collection of environmental performance data, and supplier engagement through questionnaires and documentation requests. These activities demonstrate movement beyond passive monitoring and indicate early preparatory steps toward increased supply chain transparency.

However, advancement to the Internally data-ready stage would require the presence of systematically structured product-level datasets and digital systems capable of supporting traceability and standardized data exchange. The interview did not provide evidence of such structures. Environmental data appears to be collected primarily at a company or process level rather than systematically linked to individual products or components. In addition, while the company uses digital business systems, there is no evidence of integrated traceability infrastructure or automated DPP-related data flows. Taken together, the company demonstrates emerging readiness but lacks the structured product data and digital integration required for higher readiness stages. The supplier therefore aligns most closely with the Preparing stage according to the rule-based framework.

5.4 Plåtprodukter

This section presents the readiness assessment of Plåtprodukter, a supplier connected to the same selected product value chain at GARO AB as the previously analysed suppliers. The analysis follows the same two-step structure applied throughout the study. First, Plåtprodukter's readiness profile is presented using the Supplier Readiness Diamond, illustrating how capabilities are distributed across the six analytical dimensions. Second, the supplier is classified into a readiness stage based on the anchored, rule-based criteria defined in Chapter 3.

5.4.1 Supplier Readiness Diamond

Organizational Ownership & Governance (Score: 4)

The supplier demonstrates the presence of sustainability-related organizational activity through collaboration with a centralized sustainability team and the execution of company-level emissions calculations (Scope 1–3). However, the findings provide limited evidence that these responsibilities are structurally embedded within the supplier's own operational organization or formal management systems. No dedicated internal role for sustainability or regulatory data management is identified, and limited familiarity with Digital Product Passport requirements suggests that regulatory awareness has not been translated into structured governance mechanisms.

Furthermore, no evidence is provided of DPP-specific ownership or formal accountability structures. The score therefore reflects the presence of sustainability-related activity, but limited operational embedding and governance institutionalization.

Concrete Implementation Actions (Score: 5)

The supplier demonstrates the presence of initial preparatory actions through the execution of company-level emissions calculations (Scope 1–3) and the identification of gaps in product-level data. In addition, the supplier has outlined plans to integrate product-level emissions data into its MPS system, indicating movement toward more structured article-level data generation. These elements reflect early-stage implementation efforts beyond passive awareness. However, no evidence was found of structured implementation projects, dedicated resources, or system development explicitly aligned with DPP requirements. The score therefore reflects initiated but still limited and weakly structured implementation activities.

Product-Level Data Readiness (Score: 3)

The supplier demonstrates the availability of sustainability-related data at company level, including emissions calculations for Scope 1–3 and energy-related performance metrics. However, the main limitation concerns the absence of structured product- or article-level sustainability data. This was explicitly recognized by the respondent, who stated that "what we lack is article- or product-level data," while also noting that this is expected to be developed by 2027 (Interview, Plåtprodukter). Although certain production-related information is available, such as processing time per product, energy consumption and CO_2 emissions per article are not currently implemented. As a result, existing data remains aggregated at company or process level and is not yet sufficiently granular for DPP-related reporting. The score therefore reflects structured company-level data availability, but limited product-level data readiness.

Digital System Enablement (Score: 4)

The supplier demonstrates the presence of a digital operational infrastructure through the use of an MPS system and the availability of production-related data, such as processing time at product level. As the respondent explained, the company knows "how long each product runs in each machine," but energy consumption per article is "not implemented yet" (Interview, Plåtprodukter). The respondent further stated that the plan is to integrate this into the MPS system during 2026, so that product-level CO_2 data can be generated by 2027. This indicates that a digital foundation exists, but that sustainability-related data is not yet captured, integrated, or managed at product level. The score therefore reflects the presence of digital infrastructure, but limited DPP-integrated system capabilities.

Upstream Transparency Logic (Score: 4)

The supplier demonstrates a degree of upstream visibility through established relationships with key material suppliers and access to sustainability-related data, such as CO_2 emissions associated with primary materials. Traceability is possible to the level of the producing steel mill, indicating that supplier-level information is available and utilized within the organization. However, the findings provide limited evidence of formalized mechanisms for upstream data collection, validation, or governance across multiple tiers. Traceability beyond direct suppliers remains constrained by practical and cost-related barriers, and no structured routines for systematic multi-tier integration are described. The score therefore reflects a transitional level of upstream transparency, positioned between basic supplier visibility and formalized data governance.

Collaboration & Openness (Score: 5)

The supplier demonstrates a willingness to engage in information sharing and maintain open communication regarding sustainability-related topics. The respondent provides detailed responses on internal practices, data availability, and traceability limitations, and expresses openness to facilitating further contact with upstream suppliers. This indicates a cooperative attitude toward transparency and external dialogue. However, no evidence suggests structured or proactive collaboration related to Digital Product Passport implementation, such as joint data development, coordinated integration efforts, or participation in pilot initiatives. Information sharing appears to remain primarily reactive and request-based rather than embedded in formal collaboration processes. The score therefore reflects openness and responsiveness, but limited evidence of structured and DPP-oriented collaboration.

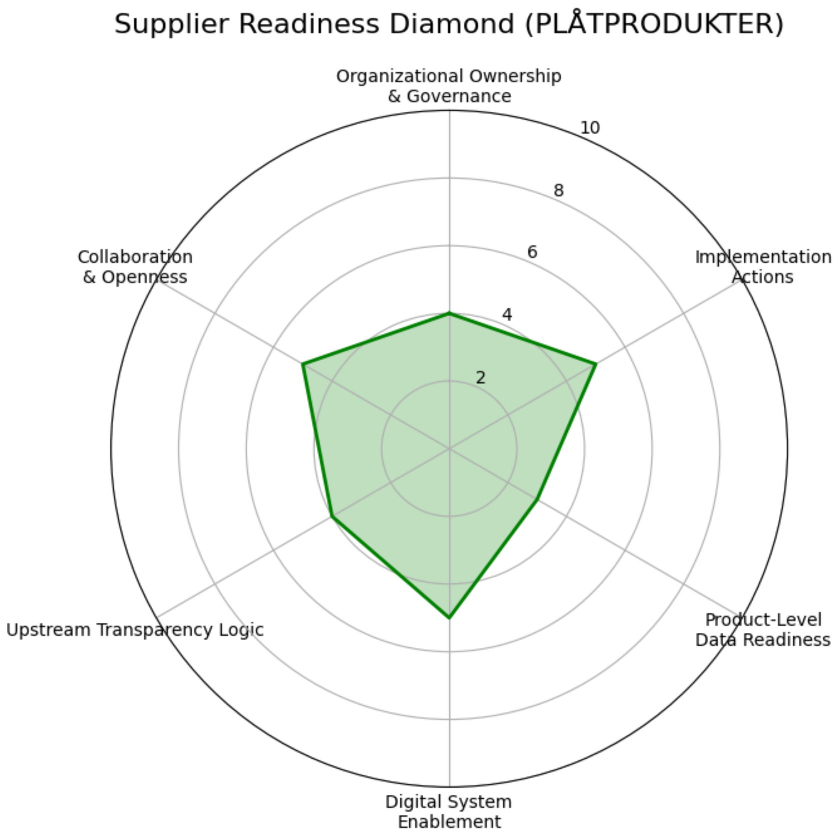


Figure 5.4: Supplier Readiness Diamond – Plåtprodukter

5.4.2 Readiness Stage Classification

Plåtprodukter is classified as **Preparing** according to the readiness stage definitions presented in Table 3.1. The empirical findings indicate that the supplier has initiated several preparatory activities, including company-level emissions calculations (Scope 1–3) and the identification of gaps related to product-level sustainability data. In addition, the supplier has outlined plans to integrate product-level emissions data into its MPS system, indicating early steps toward more structured data generation. However, advancement to the *internally data-ready* stage would require systematically structured product-level datasets and digital systems capable of supporting traceability and standardized data exchange. The interview did not provide evidence of such capabilities. Sustainability data remains aggregated at company level, while product-level data and integrated DPP-related system functionality are not yet implemented. Furthermore, governance structures and upstream transparency mechanisms remain limited and weakly formalized.

Taken together, the supplier demonstrates emerging readiness and initial implementation efforts, but lacks the structured product data, system integration, and governance maturity required for higher readiness stages. The supplier therefore aligns most closely with the *Preparing* stage according to the rule-based framework.

5.5 Siemens

This section presents the readiness assessment of Siemens, a supplier connected to the same selected product value chain at GARO AB as the previously analysed suppliers. The analysis follows the same two-step structure applied throughout the study. First, Siemens' readiness profile is presented using the Supplier Readiness Diamond, illustrating how capabilities are distributed across the six analytical dimensions. Second, the supplier is classified into a readiness stage based on the anchored, rule-based criteria defined in Chapter 3.

5.5.1 Supplier Readiness Diamond

Organizational Ownership & Governance (Score: 8)

The supplier demonstrates a highly developed governance structure for sustainability and product-related data, characterized by clearly defined organizational responsibility and integration across multiple organizational levels. A dedicated role is responsible for coordinating product-level data, including information from upstream suppliers and alignment with central functions at headquarters. This indicates that sustainability and data management responsibilities are actively embedded in organizational processes and cross-functional coordination mechanisms. Furthermore, sustainability is described as a central organizational priority, supported by continuous internal engagement and systematic management of supply chain data dependencies. While no explicit DPP-specific governance structure is described, the existing setup demonstrates a high level of institutionalization and integration. The score therefore reflects a systematically embedded governance capability aligned with complex regulatory information-processing demands.

Concrete Implementation Actions (Score: 9)

The supplier demonstrates a highly advanced level of implementation through several operationalized initiatives for managing and communicating product-related sustainability information. Product-level environmental information is already generated through LCAs and EPDs, indicating that core data required for DPP-type applications is not only recognized but actively produced and used in practice. In addition, Siemens has implemented customer-facing mechanisms for making product information accessible, including QR-code-based access to technical and environmental documentation. Ongoing R&D activities further support implementation by adapting product composition and material use in response to regulatory and sustainability requirements. These efforts indicate that sustainability-related data management is embedded in operational processes rather than remaining at a preparatory or conceptual stage. The score therefore reflects an operational and scalable implementation capability, with only limited gaps remaining relative to full DPP alignment.

Product-Level Data Readiness (Score: 9)

The supplier demonstrates a highly advanced level of product-level data readiness through the availability of structured environmental data across the full product life cycle. Product-specific information is generated through LCAs and environmental product declarations (EPDs), covering stages such as manufacturing, distribution, use, and end-of-life. In addition, product-level data is systematically organized and accessible through digital systems, enabling the retrieval of material composition, certifications, and environmental performance information. This reflects a mature capability for managing and communicating sustainability-related data at a detailed level. However, certain elements, such as environmental declarations, are not consistently third-party verified, limiting the level of formal validation required for full regulatory alignment. The score therefore reflects near-complete product-level data readiness, with only limited gaps remaining regarding standardization and external verification.

Digital System Enablement (Score: 9)

The supplier demonstrates a highly advanced level of digital system enablement through integrated digital platforms that make product-related information structured, accessible, and externally available. This is supported by the respondent's explanation that Siemens products include QR-code-based access, where scanning the code provides "all information about the product," including technical data, manuals, certificates, product information, catalogues, and images (Interview, Siemens). This indicates that product information is not only stored internally, but also made available through scalable digital interfaces that support external information access. However, while Siemens demonstrates highly advanced digital accessibility and product-level information management, no explicit evidence was provided of fully interoperable, API-ready DPP architecture across all supply chain tiers. The score therefore reflects advanced digital system enablement, with only limited gaps remaining regarding full end-to-end interoperability.

Upstream Transparency Logic (Score: 9)

The supplier demonstrates a highly advanced level of upstream transparency, including visibility into material and smelter-level information. This indicates that transparency extends beyond direct suppliers and reflects a strong understanding of upstream dependencies and material flows. The interview also shows that transparency is supported by formal supplier requirements and enforcement mechanisms, as the respondent explained that Siemens cannot work with suppliers that are unable or unwilling to disclose required information (Interview, Siemens). This suggests that upstream transparency is embedded within supplier governance rather than treated as voluntary disclosure. However, while visibility and supplier requirements are highly developed, no explicit evidence is provided of fully integrated and interoperable digital data exchange across all supply chain tiers. The score therefore reflects highly developed upstream transparency and control, with only limited evidence of full end-to-end digital integration.

Collaboration & Openness (Score: 8)

The supplier demonstrates a high level of openness and active engagement in information sharing through a proactive approach to making product-related data accessible to external stakeholders. Rather than treating information sharing as a passive response to individual requests, the respondent emphasized that product information must be easily accessible because “the market almost requires this now” (Interview, Siemens). This indicates that transparency is integrated into how information is communicated to customers and other external actors. In addition, the supplier demonstrates a strong willingness to support external actors in understanding and utilizing available data, through documentation, direct links, and system demonstrations. However, no explicit evidence is provided of formalized co-development processes, joint implementation initiatives, or ongoing customer collaboration related to DPP solutions. The score therefore reflects highly proactive openness and advanced information-sharing practices, but limited evidence of structured inter-organizational collaboration.

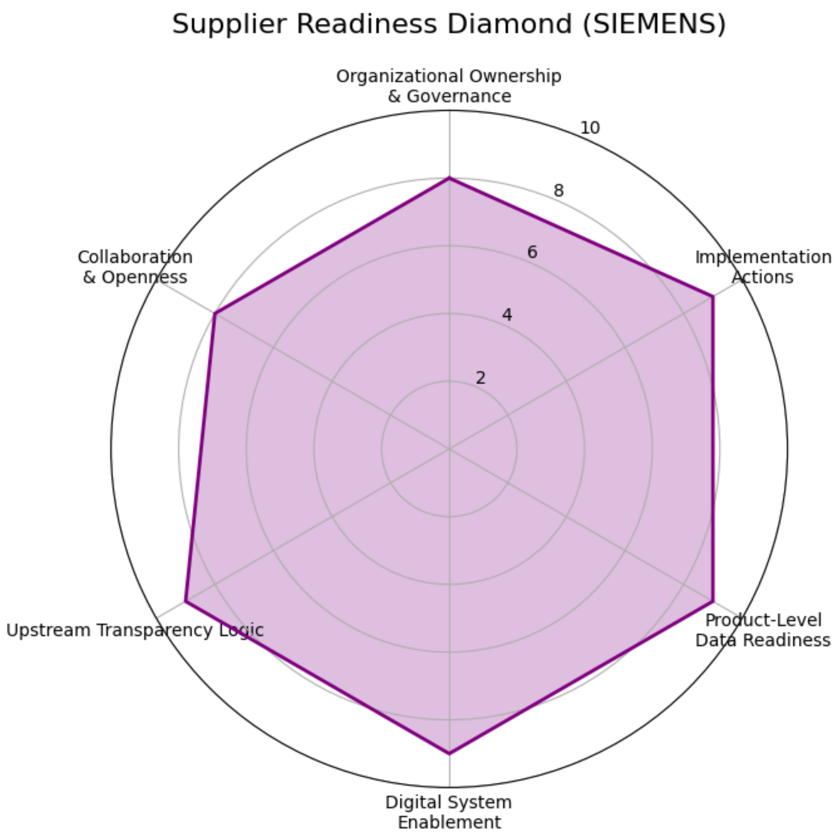


Figure 5.5: Supplier Readiness Diamond – Siemens

5.5.2 Readiness Stage Classification

Based on the anchored stage definitions, Siemens is classified as **DPP-ready/piloting**. The supplier demonstrates a highly advanced and operationalized readiness configuration across all core dimensions. Governance structures are clearly embedded within the organization, with dedicated roles responsible for managing product-related data and coordinating information flows across internal functions and upstream suppliers. Product-level environmental data is actively generated through life cycle assessments and environmental declarations and integrated into digital systems, enabling structured storage, management, and external accessibility of product-related information. The presence of QR-code-based access to product data further demonstrates that information is not only generated but also made accessible in a scalable and user-oriented format. In addition, the supplier demonstrates strong upstream integration through formalized supplier requirements and enforcement mechanisms, ensuring that relevant data is collected and maintained across multiple supply chain tiers. However, certain elements required for full DPP alignment remain partially unfulfilled. In particular, the lack of consistently third-party verified data and the absence of clearly demonstrated interoperable system integration across the entire supply chain indicate that full regulatory alignment has not yet been fully achieved.

Taken together, the supplier demonstrates a highly mature and operationalized

DPP-related capability structure, with only limited gaps remaining relative to full compliance. The supplier, therefore, aligns most closely with the *DPP-ready/piloting* stage according to the rule-based framework.

5.6 Summary of Results

Supplier readiness cannot be understood solely in terms of overall capability level, but also depends on how capabilities are distributed and aligned across dimensions. While the mean score provides a descriptive indication of the supplier's general level of capability development, the minimum score highlights the lowest individual capability dimension and thereby potential weakest-link constraints within the overall readiness configuration. The purpose of including these values as well as the total aggregated score is therefore not to rank suppliers numerically, but to provide additional context for interpreting the shape, balance, and constraints of each readiness profile.

This distinction is important, as suppliers with relatively similar average capability levels may nevertheless exhibit different readiness conditions depending on how balanced their capability profiles are. In line with the weakest-link logic discussed in Section 3.6, underdeveloped dimensions may constrain the effective utilization of otherwise stronger capabilities by creating bottlenecks in the organization's ability to process, structure, or exchange DPP-related information. The weakest-link dimension is therefore important for interpreting each supplier's readiness profile, as it indicates where the overall capability configuration may be most constrained.

At the same time, the findings also indicate that balance alone does not determine readiness. For example, ETI demonstrates a relatively balanced but overall weak capability profile, while Siemens exhibits both high capability levels and strong alignment across dimensions. This suggests that supplier readiness depends both on the overall level of capability development and on the degree of structural balance between interdependent dimensions.

The readiness stage classifications should therefore not be interpreted as numerical outcomes of the mean or minimum scores, but as rule-based assessments of overall preparedness derived from the broader capability configuration and the anchored criteria presented in Section 3.6.

Supplier	Supplier Readiness Diamond	Mean score	Minimum score (Weakest link)	Aggregated score	Interpretation	Readiness Stage Classification
ETI	 Organizational Ownership & Governance 4 Implementation Actions 4 Product-Level Data Readiness 4 Digital System Enablement 4 Upstream Transparency Logic 3 Collaboration & Openness 3	**3.7**	**3**	**22**	Low overall readiness reflected in both low mean and aggregate scores, though the capability profile remains relatively balanced with limited major bottlenecks	Aware but passive
Supplier X	 Organizational Ownership & Governance 8 Implementation Actions 7 Product-Level Data Readiness 7 Digital System Enablement 6 Upstream Transparency Logic 5 Collaboration & Openness 7	**6.7**	**5**	**40**	High aggregate and mean scores indicate substantial capability development, although upstream transparency remains the primary weakest-link constraint	Internally data ready
Laserstans	 Organizational Ownership & Governance 5 Implementation Actions 5 Product-Level Data Readiness 4 Digital System Enablement 5 Upstream Transparency Logic 5 Collaboration & Openness 5	**4.8**	**4**	**29**	Moderate aggregate and mean scores reflect developing readiness, though some uneven capability development remains across dimensions	Preparing
Plåtprodukter	 Organizational Ownership & Governance 4 Implementation Actions 5 Product-Level Data Readiness 3 Digital System Enablement 4 Upstream Transparency Logic 4 Collaboration & Openness 5	**4.2**	**3**	**25**	Relatively balanced but low overall capability development, reflected in modest mean and aggregate scores together with several weaker dimensions	Preparing
Siemens	 Organizational Ownership & Governance 8 Implementation Actions 9 Product-Level Data Readiness 9 Digital System Enablement 9 Upstream Transparency Logic 9 Collaboration & Openness 8	**8.7**	**8**	**52**	High and consistently balanced capability development across dimensions, reflected in high mean, aggregate, and minimum scores with limited visible bottlenecks	DPP-ready / Piloting

Note: Mean score represents the arithmetic average across the six capability dimensions
Minimum score represents the lowest individual capability dimension and reflects the potential weakest-link constraint discussed in section 3.7

Figure 5.6: Summary matrix of supplier readiness profiles

6
Discussion

The empirical findings indicate that supplier readiness for DPP varies substantially across the analyzed suppliers, both in terms of overall readiness levels and how capabilities are distributed across dimensions. While some suppliers demonstrate relatively advanced and structured readiness, others remain at early stages of development, with limited alignment between organizational structures and regulatory information requirements. In addition to these differences in overall maturity, the results reveal considerable variation in how capabilities are distributed across dimensions. Some suppliers exhibit relatively balanced capability profiles, while others display more uneven or "spiky" configurations, characterized by strengths in certain dimensions and weaknesses in others. This suggests that differences in readiness are not only a matter of how developed suppliers are, but also how their capabilities are distributed.

A closer look at the supplier readiness profiles reveals recurring patterns in how capabilities develop across dimensions. In particular, certain dimensions tend to appear more consistently developed, while others remain constrained across multiple suppliers. In addition, recurring themes can be observed in how different capability dimensions develop across suppliers, particularly in terms of which capabilities tend to emerge earlier and which remain systematically constrained.

6.1 Interpretation of Findings

Building on the observed variation in both overall readiness levels and capability configurations, the findings show that differences between suppliers are not only reflected in how developed they are, but also in how their capabilities are distributed across dimensions. In particular, suppliers exhibit distinct patterns in their capability profiles, with some demonstrating relatively balanced configurations, while others display more uneven or "spiky" profiles characterized by pronounced strengths and weaknesses.

These patterns appear to be related to overall readiness levels. Suppliers with more advanced capability development tend to exhibit more balanced configurations, whereas less developed suppliers more frequently display uneven profiles. This raises important questions regarding the underlying drivers of capability development, and why some suppliers are able to achieve more coordinated and aligned capability configurations than others. This observation points toward several possible dimensions of variation that warrant further analysis. For instance, it remains unclear whether such differences are primarily driven by firm-specific factors, such as strategic priorities, resource availability, or internal coordination, or whether they reflect underlying relationships between capability dimensions themselves. In particular, the extent to which certain capabilities may enable or constrain the development of others becomes a critical question for understanding how supplier readiness evolves.

At the same time, the presence of uneven or "spiky" configurations suggests that capability development may occur in a more fragmented way, where certain dimensions are prioritized while others remain undeveloped. This raises further questions regarding how suppliers prioritize capability development, whether such prioritization is intentional or emergent, and how these choices influence overall readiness. If such prioritization is intentional, an important question concerns what drives these decisions. In particular, it remains unclear whether capability development is primarily driven by internal considerations, such as strategic priorities and value creation objectives, or whether it reflects adaptive responses to external regulatory pressures associated with DPP requirements.

These observations suggest that supplier readiness is not only about how developed individual capabilities are, but also about how well different dimensions work together. The recurring uneven capability profiles indicate that some suppliers are held back by weaker areas that limit the effectiveness of stronger ones. This creates different development paths and highlights the importance of understanding capability relationships, sequencing, and constraints across suppliers.

This points toward the importance of understanding supplier readiness as a configuration-dependent phenomenon, where both the level and distribution of capabilities influence how effectively suppliers can respond to DPP requirements.

6.2 Configuration Analysis

As outlined in the theoretical framework, supplier readiness is not only a function of overall capability levels, but also depends on the interrelationships between dimensions and the extent to which capabilities are balanced within the overall configuration. Building on this, a further analytical distinction can be made between different types of capability configurations observed across suppliers, where two broad patterns emerge: relatively balanced configurations and more uneven or "spiky" configurations.

Suppliers with balanced configurations are characterized by a relatively even distribution of capabilities across dimensions, indicating a more coordinated and aligned development of readiness. In these cases, no single dimension appears to significantly constrain the others, suggesting a higher degree of internal consistency in how capabilities are developed.

In contrast, uneven or "spiky" configurations are characterized by large differences between dimensions, where certain capabilities are relatively well developed while others remain significantly constrained. These configurations indicate a more fragmented development pattern, where capability development may be unevenly distributed across dimensions. Importantly, these different configuration types appear to be associated with distinct implications for supplier readiness.

Suppliers showing relatively balanced capability configurations are characterized by a consistent distribution of capability levels across dimensions, where no single dimension deviates significantly from the overall profile. This suggests that capability development is relatively aligned across dimensions, rather than concentrated in isolated areas.

Importantly, balanced configurations are observed at different levels of readiness. While some suppliers display high and consistently developed capabilities, others exhibit similarly balanced profiles at lower levels. In the latter case, the configuration may indicate the presence of an underlying structural foundation, where the relationships between capability dimensions are aligned, providing a basis for more coordinated development over time and suggesting stronger DPP readiness potential. However, such patterns may also reflect a general lack of investment or organizational attention, where uniformly low capability levels arise from limited development across all dimensions rather than deliberate alignment. Distinguishing between these interpretations requires a more context-sensitive assessment of each supplier, taking into account both the empirical evidence and the broader organizational setting.

This distinction should not be understood as a binary classification, but rather as a spectrum along which suppliers exhibit varying degrees of balance. The purpose of distinguishing between balanced and uneven configurations is therefore not to categorize suppliers into fixed groups, but to provide an analytical way for examining how capabilities are distributed and how effectively they are aligned within the overall configuration.

From this perspective, the degree of balance serves as an indicator of how coherently capability development is structured, and whether suppliers are approaching readiness as an integrated system or through more fragmented and uneven development patterns.

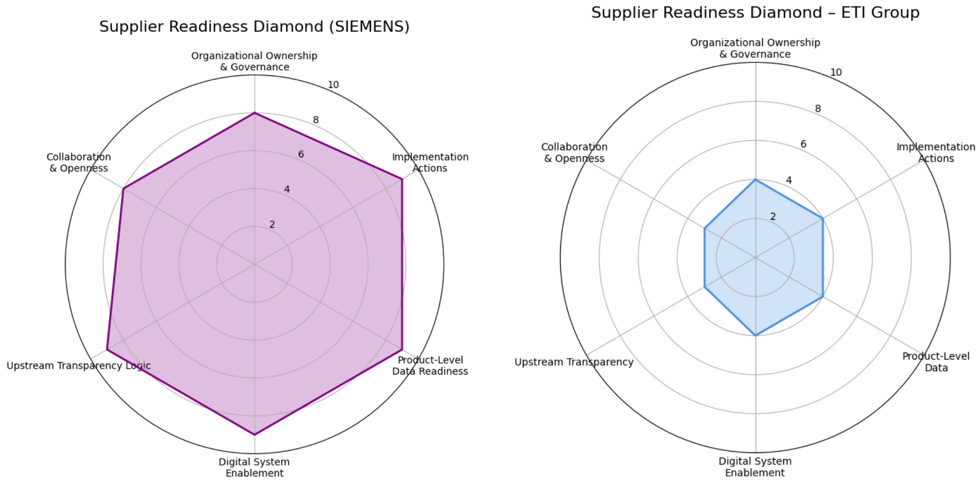
The emergence of these different configuration types also raises important questions regarding the underlying drivers of capability development. In particular, it remains unclear whether balanced configurations result from more coordinated and systematic development processes, while uneven configurations reflect more fragmented or selective prioritization across dimensions.

6.2.1 Balanced vs Spiky

Building on the weakest-link logic introduced in Chapter 3, this section applies the distinction between balanced and uneven or “spiky” capability configurations in order to examine how supplier readiness profiles are composed across dimensions. From this perspective, the shape of the configuration becomes analytically important, as underdeveloped dimensions may constrain broader organizational integration and information-processing capacity, even when other capabilities are relatively advanced. The analysis, therefore, focuses not only on the absolute level of capabilities but also on how capabilities are distributed and aligned across interdependent dimensions. More balanced configurations suggest that capabilities are developed in a way that better supports coordination and interaction across the broader system, whereas more uneven or "spiky" configurations may indicate that certain weaker domains limit the extent to which stronger capabilities can support overall readiness. The distinction between balanced and spiky profiles should therefore not be understood merely as a visual difference, but as an indication of how effectively the overall readiness structure is able to function as an integrated system.

6.2.1.1 Balanced Capability Configurations

The findings include a set of suppliers showing balanced capability configurations, as illustrated in the figures below. In these cases, capability levels are distributed evenly across dimensions, with no single dimension deviating markedly from the overall profile. Within this group, both higher and lower levels of overall capability development can be observed. Some suppliers exhibit consistently high levels across all dimensions, reflecting a well-developed and coordinated capability structure. Others display similarly balanced configurations at lower levels, indicating that while overall readiness remains limited, capability development is not fragmented.



Siemens ETI

Figure 6.1: Balanced Supplier Readiness Diamonds

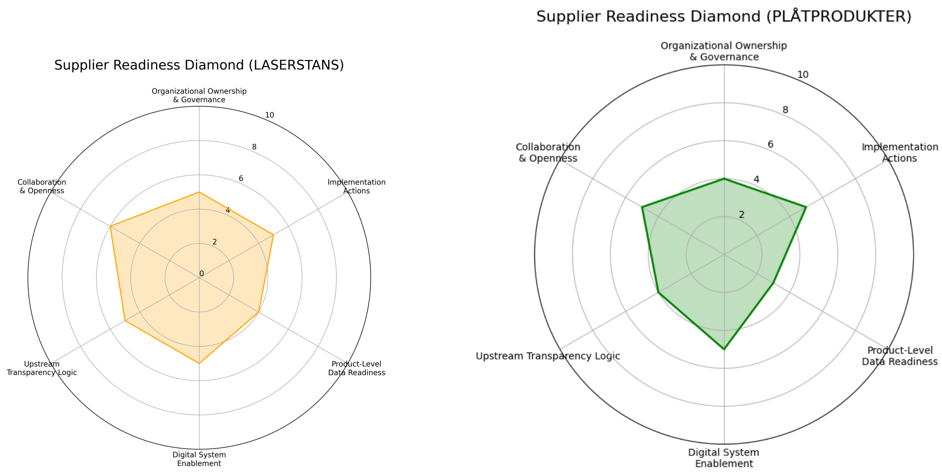
6.2.1.2 Balanced Configurations: Conceptual Distinction and Empirical Variation

Common among balanced configurations is the absence of pronounced deviations in any single dimension, resulting in an even distribution of capabilities. However, the empirical findings suggest that such a balance can emerge from different underlying conditions. On the one hand, balance may reflect a well-developed and coordinated capability structure, where multiple dimensions have evolved in alignment through sustained investment and organizational focus. On the other hand, balance may also arise at lower levels of capability development, where all dimensions remain relatively underdeveloped. In such cases, the absence of variation does not reflect coordination, but rather a lack of substantive investment across the configuration.

This distinction is very important, as it highlights that balance in itself is not indicative of readiness, but must be interpreted in relation to the level of capability development. While high-level balance may signal structural alignment and coordinated evolution across dimensions, low-level balance may instead reflect a pre-developmental state, where the absence of differentiation is driven by limited engagement rather than integration. In such cases, capability development has not yet progressed to a stage where interdependencies become activated. Both forms of balance appear across the observed suppliers, suggesting that similar configuration shapes may reflect different levels of organizational development and information-processing capacity.

6.2.1.3 Unbalanced Capability Configurations

The empirical findings also include suppliers exhibiting more uneven or “spiky” capability configurations, as illustrated in Figure 6.2. In these cases, capability development is not evenly distributed across dimensions, but instead concentrated in certain areas while remaining constrained in others. This results in profiles characterized by pronounced strengths alongside clearly underdeveloped capabilities. Unlike balanced configurations, these profiles indicate that capability development has occurred in a more fragmented manner, where certain domains have progressed independently of others. As a result, the overall configuration reflects not only the presence of capability gaps, but also a lack of structural alignment between interdependent dimensions. Importantly, such configurations do not necessarily reflect uniformly low levels of capability. Rather, they often combine moderate or relatively developed capabilities in selected areas with persistent weaknesses in others. This suggests that uneven configurations may emerge both from selective capability development and from constraints that prevent certain dimensions from evolving in parallel. From this perspective, spiky configurations highlight how imbalances between capability domains may limit the effective integration of information-processing capacity, even when individual capabilities are partially developed.



Laserstans Plåtprodukter

Figure 6.2: Unbalanced Supplier Readiness Diamonds

In contrast to the patterns observed in balanced configurations, the profiles of Laserstans and Plåtprodukter exhibit more uneven distributions of capabilities across dimensions. Rather than displaying a relatively consistent level of development, both suppliers show variation, where certain dimensions demonstrate moderate capability levels while others remain more constrained. Visually, these configurations appear more irregular, lacking the relative consistency observed in balanced profiles. Although both suppliers demonstrate some development in selected areas, such as elements of sustainability-related data collection, supplier interaction, or the initial use of digital tools, these capabilities do not appear to develop evenly across the overall configuration. Instead, capability development remains distributed unevenly across dimensions, with some areas showing greater progression than others. This suggests that capability development may be occurring in a more selective or uneven manner, rather than through a consistently coordinated pattern across the configuration.

6.2.1.4 Transitional Capability Configurations

A third pattern can be observed in the case of Supplier X, which does not fully align with either the balanced or the more uneven configurations identified in the analysis. Visually, the profile displays a degree of unevenness across dimensions that, at first glance, resembles the more irregular capability distributions observed in suppliers such as Laserstans and Plåtprodukter. However, unlike these more uneven profiles, Supplier X demonstrates comparatively stronger development across several dimensions, particularly in areas related to governance, implementation actions, and product-level data. While certain dimensions remain less advanced, the presence of multiple moderately to strongly developed capability domains distinguishes the configuration from the more fragmented patterns observed in the other uneven cases. This raises questions regarding why capability development in Supplier X appears more concentrated and advanced in several structurally important dimensions, despite the continued presence of visible imbalance across the overall configuration.

From this perspective, the observed unevenness may not simply reflect fragmented capability development, but potentially a different form of capability evolution in which certain domains begin to develop ahead of broader system-wide integration.

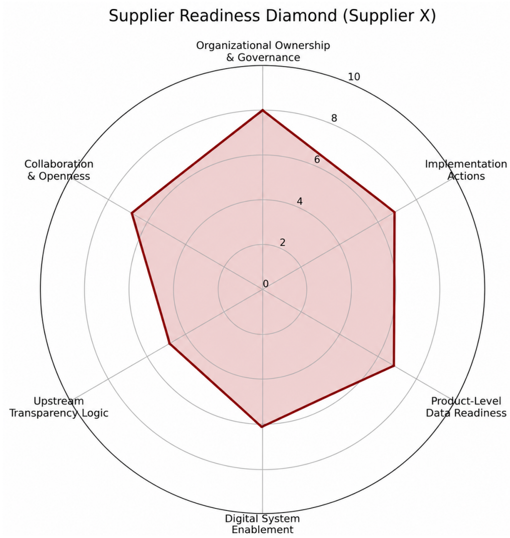


Figure 6.3: Supplier Readiness Diamond – Supplier X

6.2.2 Comparison

6.2.2.1 Balanced configurations at different readiness levels

A first comparison can be made between Siemens and ETI, both of which exhibit relatively balanced capability configurations. In both cases, capabilities are distributed evenly across dimensions, with no single dimension deviating markedly from the overall profile. However, despite this similarity in configuration shape, the two suppliers differ substantially in their level of readiness. Siemens demonstrates consistently high capability levels across all dimensions, reflecting a well-developed and integrated configuration. In contrast, ETI exhibits uniformly low capability levels, indicating that while its configuration is balanced, it remains underdeveloped across all domains.

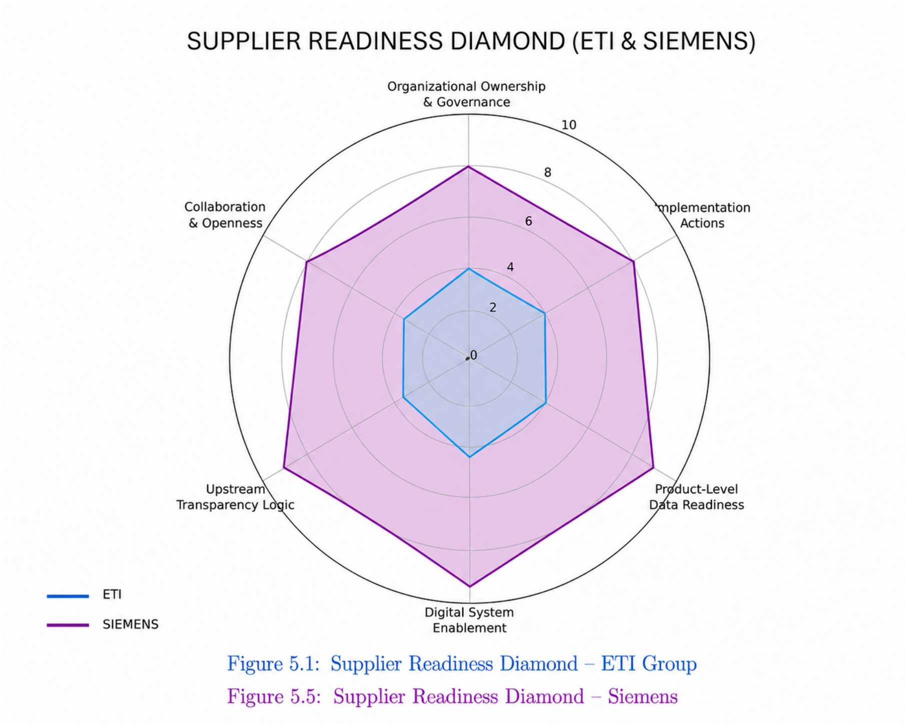


Figure 6.4: Supplier Readiness Diamond Comparison – Siemens vs ETI

This comparison highlights a critical insight: balance in itself is not indicative of readiness. While balanced configurations may signal alignment between dimensions, they do not capture the level of information-processing capacity embedded within those structures. In the case of Siemens, the balance reflects coordinated development across interdependent capabilities, enabling effective processing, integration, and transmission of regulatory information. In contrast, ETI's balanced configuration reflects a lack of differentiation driven by limited capability development rather than alignment.

From an OIPT perspective, this suggests that readiness depends not only on the alignment of capabilities but on whether sufficient information-processing capacity has been developed across all relevant domains. Even if the dimensions are balanced, the supplier is still limited if the overall capability level is low.

6.2.2.2 Transitional vs Spiky Configurations: Supplier X vs Laserstans & Plåtprodukter

A second comparison focuses on the relationship between Supplier X and the more fragmented spiky configurations represented by Laserstans and Plåtprodukter. While all three suppliers exhibit some degree of uneven capability distribution, the underlying structural patterns differ substantially. In particular, Supplier X demonstrates a configuration where several central capabilities appear significantly more developed and integrated, suggesting a more transitional form of readiness compared to the narrower and more fragmented capability structures observed in Laserstans and Plåtprodukter.

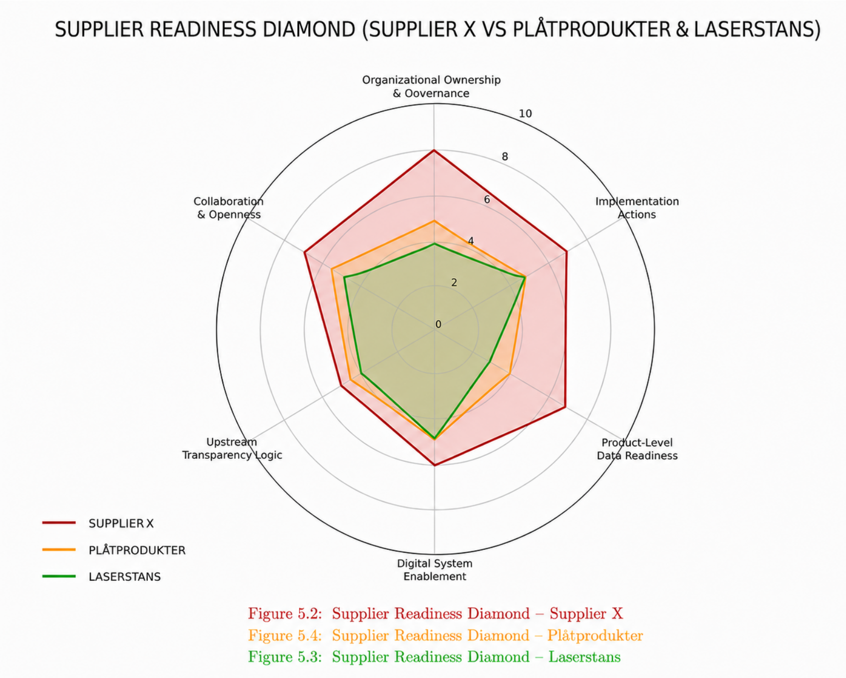


Figure 6.5: Supplier Readiness Diamond Comparison – Supplier X vs Laserstans & Plåtprodukter

Although Supplier X, like Laserstans, and Plåtprodukter display partially uneven capability distributions, the comparison reveals important structural differences in how readiness capabilities are configured across the organizations. In the Laserstans and Plåtprodukter cases, stronger dimensions appear more isolated and weakly connected to broader organizational integration mechanisms. Capability development remains concentrated within narrower areas, while several related dimensions remain comparatively underdeveloped, resulting in more fragmented readiness structures with limited evidence of systemic integration.

In contrast, Supplier X demonstrates comparatively stronger development across dimensions associated with organizational coordination and information integration, particularly governance, implementation activities, product-level data, and traceability. Importantly, these dimensions also correspond closely to the strongest dimensions observed in the Siemens configuration. This suggests that Supplier X's profile differs qualitatively from the more fragmented spiky patterns, as its strongest capabilities appear more structurally aligned with dimensions that support broader organizational integration.

6.2.2.3 Transitional vs advanced configurations: Supplier X vs Siemens

A third comparison focuses on the relationship between Supplier X and Siemens, with particular attention to similarities in their capability configurations. While Siemens represents a highly developed and fully integrated readiness profile, Supplier X exhibits a configuration that, although less developed, shares notable structural similarities.

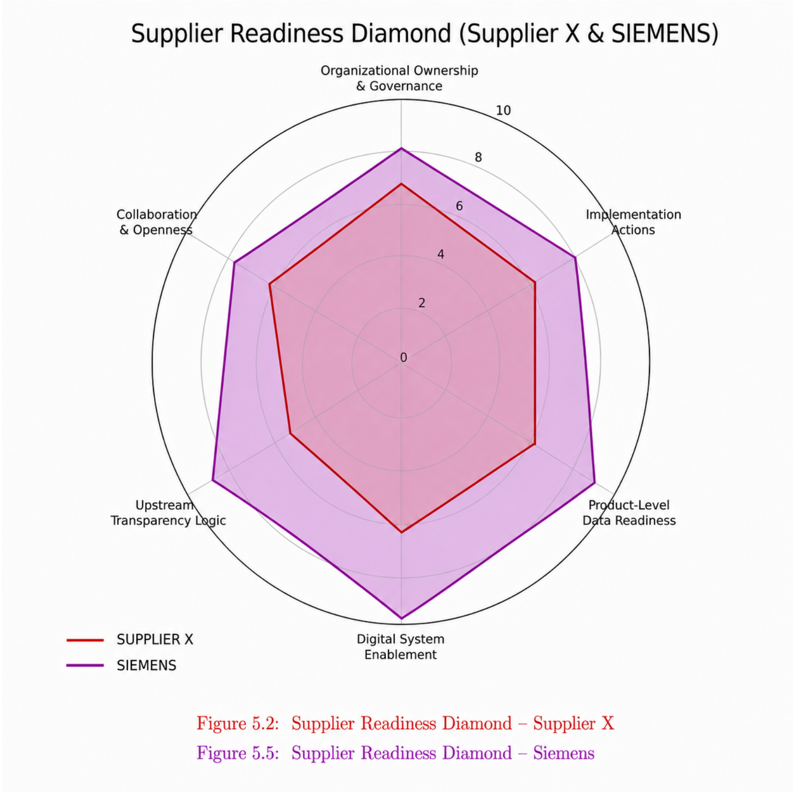


Figure 6.6: Supplier Readiness Diamond Comparison – Supplier X vs Siemens

Visually, the Supplier Readiness Diamonds reveal that both suppliers display relatively consistent strength across several key dimensions, particularly in organizational governance, product-level data readiness, and aspects of collaboration. While the absolute levels differ, the overall shape of Supplier X's configuration appears to mirror that of Siemens to a certain extent, suggesting a comparable underlying structure in how capabilities are distributed.

This resemblance is important, particularly in relation to the more fragmented spiky configurations discussed previously. While suppliers such as Laserstans and Plåtprodukter exhibit uneven capability development concentrated within narrower and more weakly connected areas, Supplier X demonstrates stronger development in dimensions that also appear central in the Siemens configuration. In this sense, Supplier X's capability development does not appear randomly distributed, but instead follows a pattern that is more aligned with a more advanced readiness configuration. From this perspective, the comparison provides an empirical indication that Supplier X's configuration may reflect an earlier stage of a more mature structural pattern. Rather than representing isolated capability development, the observed similarities suggest that Supplier X has established a foundational configuration that aligns with that of a more integrated system.

However, there are still important differences. The Supplier X capabilities are not yet uniformly developed in all dimensions, and certain areas, particularly the digital system enablement and aspects of upstream transparency, remain less mature compared to Siemens. This pattern further reinforces the interpretation that spillover effects from Supplier X's more developed capabilities have not yet fully propagated across the entire configuration. In particular, the remaining gaps are concentrated in dimensions that require a higher degree of integration, standardization, and coordination across both internal functions and external supply chain actors. Digital system enablement depends on the consolidation and structuring of product-level data into scalable and interoperable systems, while upstream transparency logic requires the extension of these structures beyond firm boundaries through formalized data flows and supplier coordination mechanisms.

As such, it is reasonable that these dimensions reflect later-stage development, as they rely on the prior maturation of foundational capabilities and their subsequent translation into broader system-wide and inter-organizational integration. The observed differences between Siemens and Supplier X therefore not only indicate that spillover effects have not yet fully materialized in Supplier X's case, but also suggest that the remaining gaps are concentrated in those capabilities that are more complex and integration-dependent.

6.2.3 Analysis

Building on the observed differences between fragmented and more transitional capability configurations, the case of Supplier X provides further insight into how increasingly coordinated readiness structures may begin to emerge over time. Rather than reflecting uniformly developed capabilities across all dimensions, the empirical material suggests that capability development becomes concentrated around specific domains that appear central for broader organizational integration. In Supplier X's case, comparatively stronger development is visible in areas such as governance, product-level data, implementation activities, and aspects of supplier interaction dimensions that also appear highly developed in the Siemens configuration. At the same time, other dimensions particularly digital system enablement and upstream transparency logic remain less mature, creating visible deviations within the overall profile. These differences do not appear random, but instead suggest that certain capabilities have developed earlier than others, while more integrative and system-dependent domains remain under development.

This pattern can be understood in relation to how capability development appears to become anchored in specific domains. The empirical material indicates that early investments are often directed toward capabilities that support the structuring, coordination, and management of product-level information, as well as governance mechanisms that enable coordination both internally and with suppliers. These domains appear to function as enabling structures through which organizations gradually expand their information-processing capacity. However, more advanced dimensions particularly those requiring higher levels of digital integration, interoperability, and inter-organizational coordination appear to depend on the extent to which these earlier capabilities have matured and become integrated across the broader organizational system. The observed gaps in digital system enablement and upstream transparency logic therefore suggest that the spillover effects from these more developed domains have not yet fully propagated across the entire configuration.

At the same time, progression toward a more integrated readiness structure would likely still require targeted efforts aimed at strengthening the remaining integrative capabilities. Advancing maturity should therefore not be understood as a self-reinforcing process that unfolds automatically, but as one that requires deliberate action to translate existing capabilities into more coordinated and system-wide solutions. In practice, further development of digital system enablement would involve the formalization and integration of product-level data into scalable and interoperable system architectures, while advancing upstream transparency logic would require more structured and enforceable mechanisms for supplier data collection, standardization, and coordination across multiple supply chain tiers.

In this sense, the identification of these domains as central is not based on theoretical prioritization alone, but emerges from consistent empirical patterns across the analyzed supplier cases. At the same time, this observation aligns with the broader logic of OIPT, which emphasizes that the development of integrative structures plays a central role in enabling coordination across increasingly interdependent activities and information flows.

6.2.3.1 Transitional vs Spiky Configurations

Taken together, the patterns suggest that uneven capability profiles can reflect different types of readiness structures. In some cases, the unevenness seems temporary, where important capabilities have started to develop and gradually support more coordination and integration across dimensions. In other cases, the unevenness appears more fragmented, where capabilities develop separately without creating stronger overall integration.

The empirical findings suggest that these fragmented structures are not mainly caused by a lack of individual initiatives, but rather by a lack of alignment between interdependent dimensions. Capability development often appears reactive and driven by specific operational needs or external pressures instead of a more coordinated long-term effort. As a result, capabilities develop more independently, limiting how much improvements in one area support the broader system.

This distinction is important because unevenness does not always reflect the same underlying situation. Fragmented structures indicate more long-term separation between capabilities, while transitional structures suggest that suppliers are gradually building more integrated systems and stronger coordination over time.

6.2.4 Relationship Between Readiness Stages and Capability Configurations

The patterns identified across the supplier cases suggest that different readiness stages may be associated with distinct forms of capability distribution and alignments, as illustrated in Figure 6.7. The purpose of the framework is not only to illustrate how supplier capability profiles may evolve over time, but also to demonstrate how different readiness stages may be associated with distinct forms of stage classifications and structural alignment across dimensions.

Importantly, the framework should not be interpreted as representing a fixed or universal development path. Rather, it provides a conceptual and empirically grounded illustration of how different capability configurations may emerge under varying levels of organizational development, coordination, and information-processing capacity. In this sense, the figure functions as an analytical lens for understanding how capability profiles and stage classifications interact, rather than as a deterministic maturity sequence.

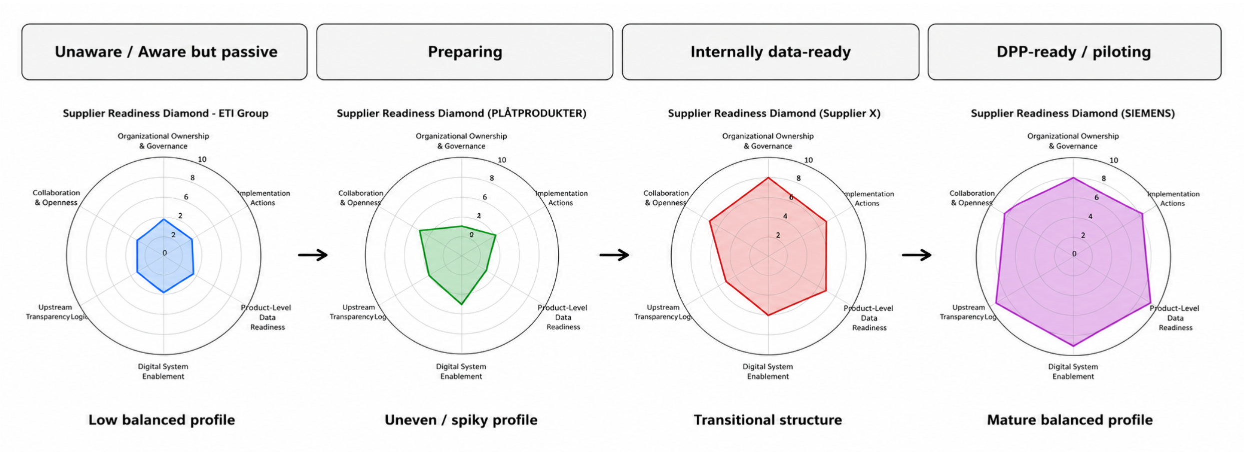


Figure 6.7: Supplier Readiness Diamond evolution through Stage Classifications

Within the framework, as visualized early-stage suppliers may exhibit balanced configurations due to uniformly low capability development across dimensions. As suppliers begin investing selectively in specific capability domains, configurations may become increasingly uneven or "spiky," reflecting differentiated development across the profile. In some cases, such imbalance may remain fragmented and weakly coordinated. In other cases, however, transitional configurations may emerge, where several structurally important dimensions begin to develop ahead of broader system-wide integration. Over time, as interdependencies between dimensions become increasingly coordinated and integrated, capability profiles may evolve toward more mature and balanced configurations.

At the same time, the framework also highlights that similar structural profiles do not necessarily imply similar levels of readiness. Balanced configurations, for example, may emerge both at low and high levels of capability development, while uneven configurations may reflect either fragmented or transitional forms of development. As such, supplier readiness cannot be understood solely through stage classifications or visual profile structures in isolation, but must instead be interpreted in relation to the broader configuration and coordination of capabilities across dimensions.

Figure 6.7 should therefore be understood not only as a summary of the GARO case, but also as a conceptual illustration of how readiness configurations may develop from low or uneven profiles toward more mature and balanced capability structures. In this sense, the figure extends the analysis from a supplier-by-supplier comparison toward a broader readiness-evolution logic. This logic is particularly relevant because readiness is not only a question of reaching a higher score, but of developing a more coherent configuration of interdependent capabilities. While this interpretation is grounded in the empirical findings from the GARO case, it also suggests that the framework may support analysis of readiness development in other product chains where capability balance and information-processing capacity are central.

6.3 What Constitutes Supplier Readiness for DPP?

While the stage classification provides a structured way of positioning suppliers along a progression of adaptation, it does not, in itself, determine whether suppliers are ready for DPP implementation. Similarly, the capability configuration captured through the Supplier Readiness Diamond, while highly informative, is not sufficient on its own to determine readiness.

Across the cases, suppliers at lower stages such as ETI appear balanced, but this reflects uniformly low capability development rather than actual readiness. At intermediate stages, such as Laserstans and Plåtprodukter, capability development remains uneven and fragmented. While certain elements may be in place, the overall configuration lacks the structure required to support DPP-related data flows. Supplier X represents a more advanced case, where several capabilities are actively being developed. However, the configuration remains uneven, indicating that key capability domains are not yet fully aligned. Despite clear progress, this imbalance continues to constrain overall functionality. While data strongly indicates that Supplier X is heading towards a balanced and ready profile such as Siemens, such continued development cannot be taken for granted, and must be apparent for them to be considered as DPP-ready.

Only in the case of Siemens do we observe both a high level of capability development and a balanced configuration across dimensions. Siemens can therefore be considered ready for DPP implementation, as the necessary structures, systems, and coordination mechanisms are in place to support DPP requirements in practice.

At the same time, readiness should not be understood as a permanent or static state. Even suppliers that can be considered ready such as Siemens at a given point in time remain dependent on continuous maintenance, coordination, and adaptation as regulatory requirements evolve and supply chain dependencies change. In this sense, readiness is not only something that must be achieved, but also something that must be sustained.

Taken together, these findings show that readiness cannot be inferred from stage classification or capability configuration in isolation. Instead, readiness emerges from the combination of sufficiently developed capabilities and their alignment across dimensions.

6.3.0.1 Organizational Patterns Across Supplier Readiness Profiles

A broader interpretation of the cases suggests that supplier readiness is shaped not only by internal capability development, but also by the market environment in which suppliers operate. In this study, *market environment* refers to external contextual conditions that may influence supplier readiness but are not part of the supplier's internal capability profile. These include factors such as regulatory pressure, customer demand, industry standardization, competitive pressure, and the availability of relevant technologies and data infrastructures.

This distinction is important because the Supplier Readiness Diamond captures internal and inter-organizational capabilities, while the market environment helps explain why such capabilities may develop differently across suppliers. In particular, suppliers operating in contexts where customers, competitors, or industry standards already reward transparency, documentation, and product-level data may face stronger incentives to develop DPP-relevant capabilities. By contrast, suppliers operating in more production- or cost-oriented environments may face weaker or later pressure to build integrated readiness structures.

Siemens represents the clearest case of the former. Both the interview material and Siemens' external positioning suggest that the company operates in a system- and information-intensive segment of low-voltage power distribution. Siemens' SENTRON portfolio is explicitly presented as combining components and software for "safe and transparent low-voltage power distribution," including protection, switching, measuring, monitoring, and communication-capable devices for buildings, industry, and infrastructure (Siemens, n.d.-a; Siemens, n.d.-b). In the interview, Siemens further describes how product data availability, certifications, QR-linked information, and supplier disclosure are already deeply embedded in daily practice, and that suppliers unwilling to provide the necessary information may be replaced. This suggests that, in Siemens' business environment, structured product data and transparency are not peripheral sustainability features, but commercially necessary conditions for participating in larger technical systems and customer solutions.

ETI appears different, despite operating within the same broader low-voltage electrical equipment domain. ETI offers a broad portfolio of protection and installation products for residential, commercial, industrial, and energy-related applications, and also provides extensive EPLAN-based engineering support and product libraries with more than 13,000 products (ETI, n.d.-a; ETI, n.d.-b; ETI, n.d.-c). This suggests that ETI positions itself strongly through product breadth, installation relevance, and engineering support. However, the case findings indicate that these capabilities have not yet been translated into the same degree of customer-facing, supply-chain-connected DPP functionality as in Siemens. In the empirical material, ETI shows general sustainability awareness, some LCA activity, and ERP support, but governance remains more strategic than operationally embedded, product data is still fragmented, and upstream transparency appears more passive than systematically managed. A plausible interpretation is therefore that ETI does not lack capability as such, but rather faces weaker or less immediate market pressure to convert its general technical and data-related sophistication into fully integrated DPP-readiness. In other words, ETI may compete in a context where technical functionality, portfolio breadth, and engineering support still matter more directly than full transparency and supply-chain-integrated environmental data.

Supplier X appears to occupy an intermediate position, but one that is closer to

Siemens than to ETI in terms of environmental pressure and customer logic. Supplier X presents itself as a supplier of power distribution solutions for panel boards, switchgear, and control boxes, and emphasizes reliability, safety, and clarity in critical electrical distribution systems (Supplier X, 2024; Supplier X, n.d.-a; Supplier X, n.d.-b). This suggests that Supplier X operates in a market where products increasingly function as part of larger electrical systems, making documentation, compliance, and digital product information more important to the customer value proposition.

What is particularly notable is that the external company information appears to support the empirical assessment of Supplier X as a transitional case. Supplier X has only recently begun to communicate sustainability more explicitly through its first dedicated sustainability report, and the company's CEO links this directly to a renewed 2024 strategy and an ambition to communicate environmental impacts openly, reliably, and systematically (Supplier X, 2024). This suggests that the company has recently taken more active initiatives in response to a changing market environment in which transparency, structured documentation, and sustainability communication appear to be becoming more strategically important.

Its transitional profile is therefore a result of a more recent strategic repositioning, where new sustainability-related initiatives and a stronger external emphasis on openness and systematic communication indicate that Supplier X is actively moving toward a more readiness-oriented organizational logic, explaining its transitional profile.

Laserstans and Plåtprodukter point in another direction. Rather than operating in strongly data-intensive or system-transparent market environments, these suppliers appear closer to a production-centric logic, where competitiveness is more likely shaped by manufacturing capability, quality, lead times, customer adaptation, and cost-efficiency. Public company information for Laserstans highlights environmental certification and manufacturing operations, while Gårö Plåtprodukter emphasizes company information and production-related capability rather than advanced data transparency or digital product-information logic (Gnosjö Laserstans AB, n.d.; Gårö Plåtprodukter AB, n.d.). This is consistent with the readiness profiles observed in the thesis, where both suppliers appear to have initiated certain sustainability-related efforts, but in a fragmented and more reactive manner.

This pattern is also visible among the metal and sheet-metal suppliers included in the study, particularly Laserstans and Plåtprodukter, where readiness appears more closely connected to operational efficiency, environmental management, and customer-driven documentation requirements than to fully integrated DPP-oriented data systems. DPP is viewed as relevant and feasible, but its development appears to be conditioned by upstream traceability constraints, commodity-based material structures, cost pressure, and concerns about European competitiveness. This suggests that, in more production- and material-oriented environments, readiness may be shaped less by strategic differentiation through transparency and more by selective adaptation to emerging customer or regulatory demands.

Taken together, the cases suggest that differences in readiness reflect not only differences in investment levels, but differences in what suppliers are rewarded for in their respective environments. In more system-oriented and information-intensive contexts, such as Siemens and increasingly Supplier X, structured product data, compliance, and transparency become commercially necessary because customers demand them and because products are embedded in larger systems that require them. In more installation-, portfolio-, or production-oriented contexts, such as ETI, Laserstans, and Plåtprodukter, the incentives to build fully integrated DPP-readiness appear weaker, later, or more fragmented. This may help explain why some suppliers evolve toward mature and balanced readiness configurations, while others remain either uniformly low or unevenly developed despite showing awareness and partial preparation.

6.4 Managerial implications

This section presents the managerial implications of the study. The first part focuses on GARO and how the framework can support supplier evaluation, development, and sourcing decisions. The second part discusses broader implications for firms preparing for DPP requirements in multi-tier supply chains. Together, the section shows how the Supplier Readiness Diamond can be used as a practical tool for assessing and managing supplier readiness.

6.4.1 Implications for GARO

For GARO, an important managerial implication of this analysis is that future supplier selection should not only assess current performance in terms of price, quality, and delivery, but also the type of market logic in which suppliers operate. The findings suggest that suppliers whose offerings are already embedded in larger technical systems, and for whom structured product data, compliance, documentation, and transparency form part of the customer value proposition, are likely to be better positioned for future DPP requirements. By contrast, suppliers operating in more production- and cost-oriented environments may still be viable, but are more likely to require clearer data demands, closer follow-up, and supplier development efforts if they are to become DPP-ready over time.

This has direct implications for how GARO should evaluate both existing and future suppliers. Rather than treating all suppliers as equally suitable as long as they meet current technical and commercial requirements, GARO may need to distinguish more clearly between suppliers that are structurally moving toward DPP-readiness and those that remain shaped by market environments where transparency and product data are not yet strategically central. In this sense, supplier evaluation should increasingly include not only current readiness, but also the likelihood that a supplier's business context will support further development toward integrated DPP capability.

Seen from this perspective, Siemens appears strategically attractive not only because it is currently the most readiness-oriented case, but because its market environment already rewards exactly the types of capabilities that DPP requires. Since Siemens operates in a system- and information-intensive context where components are embedded in larger technical solutions, structured product data, supplier disclosure, and transparency are not peripheral add-ons, but commercially necessary features of participation. This means that sourcing from such suppliers may reduce future compliance risk and strengthen the long-term DPP preparedness of GARO's own product system.

At the same time, the comparison with ETI suggests that GARO may need to reconsider the strategic role of suppliers that, while technically capable, do not appear to face equally strong incentives to translate those capabilities into fully integrated DPP-readiness. If suppliers such as ETI and Siemens provide functionally comparable components, continued sourcing from the less readiness-oriented supplier may become increasingly difficult to justify from a long-term strategic perspective. Where technical compatibility, cost conditions, and dependency exposure allow, GARO may therefore consider gradually increasing the role of more DPP-ready suppliers in future sourcing decisions. This does not imply that less ready suppliers should be replaced automatically, but rather that their long-term role may need to be reassessed if more readiness-capable alternatives exist.

Supplier X represents a different type of opportunity. Although not yet fully ready, the company appears to be moving in a direction that aligns increasingly well with DPP-related requirements. Its transitional profile, recent sustainability initiatives, and stronger external emphasis on systematic environmental communication suggest that Supplier X may be undergoing a more recent strategic repositioning toward a more readiness-oriented organizational logic. For GARO, this may imply that investment in supplier development, closer collaboration, or early strategic prioritization of Supplier X could be particularly valuable. In contrast to Siemens, which may already carry the pricing advantages or cost structures associated with mature readiness, Supplier X may still represent a supplier that is "on the way" rather than fully there. This could make it attractive for GARO to engage early, before higher levels of maturity are fully reflected in pricing or bargaining power.

For suppliers such as Laserstans and Plåtprodukter, GARO's managerial focus should be framed as structured supplier development and relationship reassessment rather than substitution. In more production-oriented supplier contexts, readiness gaps may be addressed by translating DPP-related expectations into concrete operational requirements. The framework developed in this study can support this process by helping GARO identify which requirements should be prioritized for each supplier, including minimum product-level data fields, standardized documentation templates, defined responsibility for data provision, digital storage routines, and recurring follow-up of traceability and data completeness. Beyond identifying specific requirements, the framework also emphasizes the importance of achieving balance across the readiness dimensions, since readiness is not determined by isolated strengths alone, but by how well the different capabilities are aligned and mutually reinforcing.

Taken together, this suggests that GARO should not only ask which suppliers perform best today, but which suppliers are most likely to remain strategically suitable under future DPP requirements. In practice, this means that GARO should increasingly prioritize suppliers operating in system-oriented and information-intensive environments, while using more active development, monitoring, or gradual substitution strategies for suppliers whose current market logic provides weaker incentives for integrated readiness development.

6.4.2 Broader implications for focal firms

A broader implication of the study is that DPP implementation should not only be seen as a technical or regulatory challenge, but also as something shaped by customer requirements and supplier relationships. The findings suggest that supplier readiness is influenced by what focal firms request, prioritize, and follow up on. If suppliers are mainly evaluated based on price, quality, and delivery performance, there may be weaker incentives to develop DPP-related capabilities such as traceability, transparency, and product-level data management.

This means that focal firms can influence supplier readiness through purchasing practices, supplier requirements, and long-term collaboration. For example, firms can include DPP-related requirements in supplier evaluations, RFQs, and supplier agreements, while also following up on data quality, traceability, and system development over time. Linking DPP-related progress to future sourcing opportunities or preferred supplier status may also create stronger incentives for suppliers to invest in these capabilities.

The findings are especially relevant for more production- and cost-focused suppliers, where readiness appears to develop more slowly unless customers provide clearer expectations and support. Here, the Supplier Readiness Diamond can help focal firms identify missing capabilities, understand whether supplier profiles are balanced or uneven, and adapt supplier development efforts accordingly.

In this way, the framework helps firms move beyond simply asking whether a supplier is ready or not. Instead, it supports a more nuanced understanding of where suppliers are in their readiness development and which dimensions need to be strengthened over time.

6.5 Conclusions

Taken together, the findings show that supplier readiness develops at different levels. Some suppliers have uneven or "spiky" capability profiles, where certain areas are more developed than others. In these cases, capabilities often develop separately, making coordination and information management more difficult. Other suppliers show more balanced and integrated capability profiles, where different capabilities support each other more effectively.

The findings also show that supplier readiness is not something fixed. Suppliers may develop at different speeds depending on factors such as priorities, resources, and customer requirements. From this perspective, supplier readiness is not only about strong individual capabilities, but also about how well different dimensions work together as an integrated system.

Beyond these case-specific findings, the study also makes a broader conceptual contribution. The Supplier Readiness Diamond provides a transferable assessment logic that extends beyond the specific GARO case. Although the framework was developed for DPP-related information requirements, its underlying logic is not limited to DPP alone. The Diamond conceptualizes readiness as a configuration of interdependent capabilities, where overall preparedness depends not only on individual capability levels, but also on the balance, alignment, and weakest-link constraints between them.

This means that the framework may be adapted to other supplier-readiness contexts where focal firms need to evaluate how prepared suppliers are for emerging requirements. Examples include sustainability reporting, traceability, circularity, digitalization, regulatory compliance, and supply chain risk management. In such applications, the general structure of the Diamond can be retained, while the specific dimensions, scoring anchors, and evidence criteria should be adjusted to the product, industry, regulatory setting, and supply chain structure under investigation. In this way, the contribution of the thesis lies not only in assessing supplier readiness for DPP within the selected GARO product value chain, but also in proposing a broader diagnostic logic for evaluating supplier preparedness in complex supply chain contexts.

6.5.1 Future Research

First, future studies could examine how supplier readiness develops over time. Since this study only captures one point in time, supplier readiness should be understood as dynamic rather than fixed. As DPP requirements become clearer or more demanding, suppliers that appear relatively ready under current expectations may need to adapt further. Future research could therefore explore how suppliers move between more fragmented, transitional, and integrated readiness profiles as regulatory requirements, data expectations, and implementation practices evolve.

Second, future research could apply the framework in other industries and supply chain settings. This would help determine whether the patterns identified in this study are specific to the selected case or reflect a broader logic of supplier readiness for DPPs.

Third, future studies could examine whether suppliers with more balanced and integrated capability profiles are better able to manage DPP-related data and implementation in practice once DPP requirements become operational.

Another area for future research concerns the role of focal firms in shaping supplier readiness. The findings suggest that readiness is influenced not only by suppliers themselves, but also by how focal firms structure requirements, coordinate data demands, and support supplier development.

Future research could also include direct access to Tier-2 and Tier-3 suppliers. In this study, lower-tier insights were obtained indirectly through Tier-1 suppliers, which limited the possibility of assessing lower-tier readiness directly. More explicit multi-tier studies could therefore provide a deeper understanding of how readiness differs across supplier tiers.

Finally, future research could further refine and extend the Supplier Readiness Diamond by adding additional or more detailed readiness dimensions, depending on the product, industry, and regulatory context. Such extensions could make the framework more fine-grained and adaptable to different types of supply chains. Future research could also explore how digital simulation, scenario modelling, or supply chain digital twins may support DPP readiness and implementation in complex supply chains.

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A

Interview Guide

This interview guide was used to collect qualitative data from suppliers regarding sustainability data availability, material traceability, digital documentation practices, and preparedness for increasing regulatory requirements, including the EU Digital Product Passport (DPP) and the Ecodesign for Sustainable Products Regulation (ESPR). The purpose of the interview was to assess structural capabilities related to data transparency and multi-tier supply chain visibility.

1. Company Background

1. Could you briefly describe your company and your role?
2. What components or materials do you supply to GARO?
3. In which countries do your production sites operate?

2. Sustainability Awareness and Governance

4. How would you describe your company's awareness and commitment to sustainability?
5. Do you have sustainability goals, KPIs, or internal programs?
6. Are these goals implemented consistently across all sites?

3. Data Availability and Structure

7. Which sustainability-related data can you currently provide (e.g., material composition, CO_2 emissions, energy use, hazardous substances)?
8. For which materials or processes do you currently lack available data?
9. Are you able to provide documentation such as:
    - Safety Data Sheets

- Certificates
- LCA results
- Environmental Product Declarations (EPDs)
- Material origin declarations

10. How do you collect and store sustainability data (e.g., Excel, ERP systems, LCA tools, manual records)?

4. Traceability and Upstream Supply Chain Visibility

11. Do you maintain traceability for the materials used in the components supplied to GARO?
12. To what extent do you have visibility into your Tier-2 and Tier-3 suppliers?
13. Without sharing confidential details, can you describe the types of upstream suppliers you rely on?
14. Are you able to identify the country of origin for key raw materials?
15. What are the main barriers to achieving full raw material traceability?

5. Regulatory Readiness (DPP / ESPR)

16. Are you familiar with the upcoming EU Digital Product Passport (DPP)?
17. What challenges do you anticipate in meeting future DPP and ESPR requirements?
18. How prepared is your organization to share digital sustainability data with customers?

6. Energy Use and Production Processes

19. Do you know what share of your production energy comes from renewable sources?
20. Do you have plans to increase the share of renewable energy?

7. Closing

21. Is there anything important we have not asked that you would like to add?

22. Would you be willing to participate in a follow-up conversation if necessary?

B

Conceptual Definitions of Diamond Dimensions

The six dimensions of the Supplier Readiness Diamond capture distinct but related capability domains relevant for DPP implementation. Each dimension reflects a structural capability area rather than general sustainability maturity.

D1. Organizational Ownership & Governance Refers to the existence of formal roles, responsibilities and governance structures related to DPP-relevant sustainability and regulatory compliance. The dimension assesses whether DPP-related responsibility is embedded in management systems rather than dependent on individual initiative.

D2. Concrete Implementation Actions Refers to observable and ongoing activities undertaken to prepare for or implement DPP-related requirements. The focus is on executed actions (projects, system changes, internal mapping) rather than stated intentions or future plans.

D3. Product-Level Data Readiness Refers to the availability, structure and granularity of sustainability and traceability data at product or article level. The dimension evaluates whether data is sufficiently structured to support DPP-related reporting and exchange.

D4. Digital System Enablement Refers to the technological infrastructure supporting storage, retrieval and exchange of DPP-relevant data. The dimension evaluates whether digital systems enable structured, scalable and interoperable data management.

D5. Upstream Transparency Logic Refers to the degree of structured insight and governance mechanisms applied towards Tier-2 and Tier-3 suppliers. The dimension assesses whether multi-tier traceability is based on formalized requirements and data flows rather than informal awareness.

D6. Collaboration & Openness Refers to the willingness and structural capability to share DPP-relevant data with customers and engage in joint clarification or development of data structures. The dimension evaluates proactive engagement rather than passive compliance.

C

Evidence-to-Score Chain

This appendix provides examples of how interview evidence was translated into readiness scores. The table does not reproduce full interview transcripts, due to confidentiality and readability considerations. Instead, it presents selected evidence excerpts or summarized interview evidence, the corresponding analytical interpretation, and the assigned score. The purpose is to make the scoring logic transparent and to illustrate how the anchored scoring rubric was applied across suppliers and dimensions.

Table C.1: Examples of the evidence-to-score chain: ETI, Supplier X and Laserstans

Supplier	Dimension	Interview evidence	Analytical interpretation	Score
ETI	Product-Level Data Readiness	LCA results are available for some products, but not all. Product-level CO_2 calculations are still under development, and EPDs are currently not provided.	Relevant sustainability data exists, but it is incomplete, unevenly available across products, and not yet fully structured for DPP-related product-level information requirements.	4
ETI	Upstream Transparency Logic	The supplier described limited visibility into second- and third-tier suppliers and noted that upstream emissions or material-origin reporting is not currently required from lower-tier suppliers.	Upstream visibility exists mainly at the direct supplier level, while systematic multi-tier data collection and traceability mechanisms remain weak.	3
Supplier X	Organizational Ownership & Governance	The supplier described established responsibility for quality, environment, and sustainability issues, but limited evidence was provided of a formal DPP-specific governance structure.	There is an organizational basis for handling compliance and sustainability issues, but DPP-related ownership appears only partly formalized.	5
Supplier X	Digital System Enablement	The supplier described the use of structured internal systems for product and compliance-related information, but did not provide evidence of automated or fully DPP-integrated data exchange.	Digital infrastructure supports relevant information management, but system integration and DPP-specific automation remain limited.	5
Laserstans	Upstream Transparency Logic	The supplier indicated limited visibility beyond direct suppliers and did not describe systematic mechanisms for collecting product-level data from upstream actors.	Traceability and upstream transparency are weakly developed, with limited evidence of structured lower-tier supplier information flows.	3
Laserstans	Collaboration & Openness	The supplier appeared willing to respond to customer requests, but the evidence did not show proactive DPP-related collaboration or structured information-sharing routines.	The supplier demonstrates basic responsiveness, but collaboration remains mainly reactive rather than systematically developed.	4

Table C.2: Examples of the evidence-to-score chain: Plåtprodukter and Siemens

Supplier	Dimension	Interview evidence	Analytical interpretation	Score
Plåtprodukter	Product-Level Data Readiness	The supplier provided limited evidence of structured product-level sustainability or material data and appeared to rely on less formalized information practices.	Product-level data availability is limited and not yet systematically organized for future DPP requirements.	3
Plåtprodukter	Digital System Enablement	The supplier did not provide evidence of integrated digital systems for managing DPP-relevant product-level information.	Digital system support for structured product-level data management appears weak or underdeveloped.	3
Siemens	Digital System Enablement	The supplier described structured systems and established processes for handling product and sustainability-related data, including customer-facing information processes.	The supplier demonstrates strong digital system support and a relatively advanced capacity to manage structured product-related information.	8
Siemens	Collaboration & Openness	The supplier described established routines for responding to customer information needs and engaging with sustainability and product-data requests.	Information-sharing practices are comparatively mature and support active collaboration around DPP-relevant data requirements.	7

D

Scoring Rubric

This appendix defines the anchored criteria used to assign 0–10 scores for each Supplier Readiness Diamond dimension. Scores reflect the extent to which DPP-relevant capabilities are formally implemented and embedded in organizational structures and systems. The scale is ordinal and used for structured qualitative coding. Scores are not aggregated. Anchors are defined at 0, 3, 5, 7 and 10. Intermediate values (e.g., 4 or 6) are assigned when empirical evidence falls between anchor definitions. Absence of evidence is treated as absence of structure.

General Interpretation of Score Levels

0–2	No identifiable structure or practice
3–4	Informal, ad hoc or reactive practices
5–6	Formalized but partial implementation
7–8	Systematic and organization-wide implementation
9–10	Fully integrated and externally aligned capability

D1. Organizational Ownership & Governance

0	No DPP/sustainability-related ownership identified
3	Informal responsibility; no formal governance structure
5	Defined role/function; limited integration into management routines
7	Governance structure established; responsibilities defined; linked to strategy
10	Fully integrated regulatory governance (KPIs, executive oversight, formal compliance routines)

D2. Concrete Implementation Actions

0	No actions taken
3	Monitoring regulation only
5	Initial preparatory actions started (e.g., mapping, early system assessment)
7	Structured implementation projects ongoing
10	DPP pilots or operational implementations underway

D3. Product-Level Data Readiness

0	No product-level sustainability/traceability data
3	Company/site-level data only
5	Partial product-level data available
7	Structured product-level datasets for most products
10	Complete, validated, machine-readable export-ready datasets

D4. Digital System Enablement

0	Manual record-keeping only
3	Spreadsheet-based data handling
5	ERP exists but no DPP-integrated data structure
7	Structured digital traceability workflows in place
10	Integrated, interoperable, API-ready architecture

D5. Upstream Transparency Logic

0	No insight into Tier-2/3 suppliers
3	Informal upstream awareness
5	Supplier requirements exist; limited structured enforcement
7	Systematic upstream data collection routines
10	Contractually enforced multi-tier traceability with validation mechanisms

D6. Collaboration & Openness

0	Refusal to share sustainability/traceability data
3	Shares compliance documents only
5	Shares sustainability reporting upon request
7	Active engagement in clarifying or developing data structures
10	Active DPP collaboration and pilot participation

E

Interviews

This appendix provides summarized versions of the supplier interviews used in the empirical analysis. Full interview transcripts are not reproduced in the thesis due to confidentiality considerations, readability, and the need to avoid disclosing sensitive company-specific information. Instead, the summaries present the parts of the interviews that were most relevant for assessing supplier readiness across the six dimensions of the Supplier Readiness Diamond.

The purpose of these summaries is to increase transparency regarding the empirical basis of the analysis while keeping the appendix focused and manageable. The summaries should therefore be read as condensed empirical material rather than complete transcripts. They were used together with interview notes, recordings, and the anchored scoring rubric when assigning readiness scores and developing the supplier assessments presented in Chapter 5.

Appendix E1: Interview – ETI

Role: Sustainability Manager
Company profile: Manufacturer of switches, fuses, and technical ceramics with production in Slovenia, Poland, and Bosnia

Summary:
The interview indicates that ETI demonstrates a relatively high level of sustainability awareness at the strategic level, with ESG integrated into the company's long-term direction and supported by formal sustainability reporting. The firm collects a range of sustainability-related data, including CO_2 emissions at the production-site level, material composition, and hazardous substances. However, product-level carbon footprint calculations are still under development, and LCA results are available

only for a limited subset of products. Traceability is maintained at the first-tier supplier level, but visibility into second- and third-tier suppliers remains limited. The main barrier to achieving full traceability is identified as the confidentiality of supplier data and the lack of upstream transparency. While ETI has established supplier requirements and codes of conduct, it does not yet systematically require second-tier suppliers to report emissions or material origin. Regarding regulatory readiness, the firm shows partial awareness of the upcoming DPP and expects that the primary challenge will be related to missing or incomplete data. Overall, the findings suggest that ETI can be characterized as having moderate readiness, with strong strategic commitment but remaining gaps in data granularity and upstream supply chain visibility.

Appendix E2: Interview – Siemens

Role: Product and sustainability data specialist
Company profile: Global manufacturer of electrical components, including circuit breakers, contactors, and protection devices, with extensive digital infrastructure and European-based production

Summary:
The interview indicates that Siemens demonstrates a very high level of sustainability maturity, with sustainability deeply integrated into both strategic direction and operational processes. The company has developed advanced digital systems that provide comprehensive product-level data, including technical specifications, certifications, and environmental information accessible through integrated platforms. This reflects a high degree of digitalization and readiness for future regulatory requirements.

The firm maintains strong traceability across its supply chain, supported by strict supplier requirements and extensive data availability. Sustainability data is systematically collected and managed, and the company enforces transparency by requiring suppliers to comply with environmental standards, with non-compliant suppliers being replaced if necessary. Furthermore, Siemens has implemented solutions such as digital product interfaces and data platforms that closely resemble the functionality required for Digital Product Passports (DPP).

Regarding regulatory readiness, the company appears well-prepared and already possesses many of the necessary systems and data structures required for compliance. Overall, the findings suggest that Siemens can be characterized as a highly advanced and DPP-ready supplier, with strong capabilities in data integration, traceability, and digital system enablement.

Appendix E3: Interview – Supplier X

Role: Senior Manager (Quality, Environment, and Sustainability)
Company profile: Manufacturer of safety switches, cable connectors, and electrical components with production in Finland and Poland

Summary:
The interview indicates that Supplier X demonstrates a high level of sustainability maturity, particularly in terms of data availability and environmental performance measurement. Sustainability is integrated into the company's strategic direction and supported by formal certifications such as ISO 14001, as well as ongoing initiatives to improve material efficiency and environmental impact.

The firm has conducted LCA calculations for the majority of its products and maintains comprehensive environmental data at both product and company levels. This places Supplier X ahead of many suppliers in terms of data readiness. Furthermore, the company actively collaborates with suppliers to obtain sustainability data, enabling relatively strong traceability, particularly for key materials and components.

While some challenges remain in ensuring the reliability of upstream data—especially from global suppliers—the company perceives minimal barriers to meeting future regulatory requirements. Overall, the findings suggest that Supplier X can be characterized as an advanced supplier with strong data capabilities and a high level of readiness for Digital Product Passport (DPP) implementation.

Appendix E4: Interview – Laserstans

Role: Quality and Environmental Manager
Company profile: Swedish manufacturer specializing in sheet metal processing, primarily working with steel, stainless steel, and aluminium components

Summary:
The interview indicates that Laserstans demonstrates a moderate level of sustainability maturity, primarily driven by operational efficiency and resource optimization rather than advanced digital systems. Sustainability practices are embedded in daily operations, with a strong focus on minimizing material waste, optimizing production processes, and complying with environmental regulations.

The company collects environmental data related to waste, energy use, and production efficiency, and evaluates performance over time. However, data systems remain relatively basic, with limited availability of product-level environmental data and no fully integrated digital infrastructure for sustainability reporting. Traceability is maintained through supplier communication, certifications, and documentation, but is constrained by the complexity of upstream supply chains, particularly in metal production.

Regarding regulatory readiness, the main challenge identified is system integration, specifically the ability to automate and connect data across systems to generate product-level environmental information. Overall, the findings suggest that Laserstans can be characterized as a transitional supplier, with strong operational practices but limited digital maturity and moderate readiness for Digital Product Passport (DPP) implementation.

Appendix E5: Interview – Plåtprodukter

Role: Sales representative
Company profile: Swedish supplier of sheet metal and metal components, primarily serving industrial customers with production based in Sweden

Summary:
The interview indicates that Plåtprodukter demonstrates a relatively low to moderate level of sustainability maturity, with a primary focus on company-level environmental management rather than product-level data capabilities. The firm has established sustainability initiatives, including CO_2 accounting across Scope 1, 2, and 3, and is in the process of developing a formal sustainability reporting frame-

work.

While the company has strong knowledge of its overall energy use and emissions, a key limitation lies in the absence of product-level environmental data, which is not expected to be fully implemented until the coming years. Traceability is relatively strong at the first-tier level, particularly for key materials such as steel, where suppliers can provide emissions data. However, visibility decreases significantly upstream, especially at the raw material level, where data becomes difficult and costly to obtain.

A critical barrier identified is the lack of customer demand for sustainability data, as many customers continue to prioritize cost over environmental transparency. Overall, the findings suggest that Plåtprodukter can be characterized as a developing supplier, with increasing sustainability awareness but limited data maturity and relatively low readiness for Digital Product Passport (DPP) implementation.

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