Organizational Perspectives on Digital Product Passport Adoption: Results from an Industrial Survey

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Abstract

Digital Product Passports (DPPs) are being introduced by the European Union to improve product transparency, traceability, and sustainability as part of the transition towards a circular economy. While existing research has primarily focused on technical solutions, empirical studies examining how organizations perceive DPP adoption and how ready they are for the transition remain limited. This paper presents the results of an industrial survey of 142 respondents from manufacturing and related industries. The study explores organizational perspectives on DPP adoption by examining organizations' current readiness, expectations about the potential value of DPPs, and perceptions of their adoption. The analysis first investigates these perspectives across the full sample and then examines whether they differ across organizational role groups using statistical analysis. The paper aims to improve the understanding of organizational perspectives on DPP adoption and to provide empirical insights that can facilitate the transition towards DPPs.

Keywords

Digital Product Passport, Circular Economy, Organizational Readiness, Organizational Perspectives

1. Introduction

The move towards a circular economy is in many ways enabled by digitalization and hence is data-intensive [1]. The circular economy aims to keep products, components, and materials in use for as long as possible through strategies such as reuse, repair, remanufacturing, and recycling, thereby reducing waste and the consumption of virgin resources [2]. One example of data necessity in the circular economy is product information informing actors throughout a product's lifecycle [3]. The data can help inform actors about what a product is made of, how it performs during its lifecycle, and how it can be recycled, remanufactured, or reused [3, 4]. It might sound quite trivial to associate some data with a product, but in practice, there are many issues. For example, the distribution of data among manufacturers, suppliers, customers, service providers, etc., is one hurdle, and the ownership and rights to update data throughout the product lifecycle are another.

In the European Union (EU), the recent Ecodesign for Sustainable Products Regulation (ESPR) [5]targets making products more sustainable through requirements on R-strategies (such as repairability, reusability, and durability) as well as information requirements [6]. A central part of the ESPR is the Digital Product Passports (DPPs), which are a mechanism for improving access to product data and strengthening traceability by attaching information to a product in a structured way [7].

It is evident that DPP adoption involves both technical and organizational barriers, as well as broader organizational considerations that must be addressed in practice. Companies adopting DPPs will need to know which data is required, which data they have, and what data they are missing [6]. In addition,

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they need to decide how the data is shared [6], who should be able to collect and maintain it [8], and how confidentiality is maintained [9]. There has been quite some work done on the benefits of DPPs, e.g., on transparency compliance, lifecycle management, new circular business models, and new ways of collaborating across the supply chain [10, 11, 12]. When it comes to barriers, the situation is similar, and barriers related to, e.g., standards (lack of them [13]), supply chain (complexity [14], immaturity among actors [15], interoperability [16], and data sharing reluctance [13]), finance (unclear payoff [10, 14], and implementation costs [14]) have been described.

Most of the existing research has so far focused on technical aspects of DPPs, e.g., on architectures, interoperability, standards, and enabling technologies related to storage and authentication [17, 18, 19]. These aspects are critical for building DPP systems in practice, but they touch very little upon what goes on inside organizations adopting DPPs, what expectations they have, how ready they are, and what barriers they perceive [13, 20]. DPP adoption involves several internal organizational functions, including engineering, management, quality, purchasing, and sales, as well as external supply-chain actors with different needs, responsibilities, and interests [8, 21]. Although both levels are important, this study focuses on perceptions reported by respondents working in different organizational roles. Their understanding of DPPs, the barriers they perceive as most significant, and the benefits they expect are relevant because successful adoption requires an understanding of these aspects as they shape organizational readiness and implementation priorities [13, 21, 20]. This work addresses the limited empirical evidence on how individuals in industrial organizations perceive DPP adoption: how prepared their organizations are, what benefits they expect, and what barriers they perceive. We present survey data collected at Elmia Subcontractor[1], one of the largest subcontractor fairs in northern Europe. Three research questions guided the work:

RQ1: How do organizations perceive their readiness and expected use of DPPs?
RQ2: How do organizations perceive the benefits and barriers of DPPs?
RQ3: How do perceptions of DPP adoption differ between organizational roles?

Based on 142 answers in a survey, we present empirical insight into where organizations are today in terms of readiness, perceived benefits, and barriers, and in addition, how these views shift depending on the organizational role. By doing so, we complement the technical perspective on DPP adoption.

2. Background & Related Work

2.1. Digital Product Passports

The idea behind DPPs is fundamentally simple: a structured digital record tied to a specific product, a batch of a product, or to a model of a product that can give actors throughout the lifecycle access to relevant information [6, 5]. The DPPs should not be static in the sense that they contain only information from, e.g., the manufacturer, but it is assumed that different actors at different stages in the lifecycle should be able to get access and provide information to the DPPs depending on their needs, roles, and access rights [4, 6, 8]. Because of this, DPPs need to not only provide product information, but also structures for how this information is provided, accessed, updated, and used. Information is crucial in the connection between DPPs and the circular economy. Different actors require different information, and reviews have shown that information in DPPs is expected to support all activities in the lifecycle, from design and manufacturing through use, maintenance, and end-of-life [7, 22, 23]. A designer might need information about materials and their composition [6], a manufacturer might need information about components, materials and origins [3], while a customer might need information about usage, durability and repairability [3] and maintenance providers might need information about spare parts, instructions and maintenance records [3], and recyclers might need information about disassembly, material composition, and hazardous substances [3, 24].

[1] https://www.elmia.se/en/subcontractor/

As mentioned, DPPs play a central role in ESPR, by providing better access to product data for actors while traceability is managed [5]. European Union [5] also emphasizes that different actors should be able to access different types of information, i.e., not all actors should be able to access the same information European Union [5]. This is very important because it implies that implementations of DPPs need to balance transparency and confidentiality of sensitive business information, intellectual property, and personal data [5, 6, 9].

Exactly what information DPPs are required to contain will not be the same for all products, but rather defined sector by sector under the ESPR [5]. Typical DPP information will include material composition, environmental information, product identifiers, compliance information, maintenance and repair information, spare parts information, disassembly instructions, recycling information, and traceability data [14, 25, 7, 3, 24].

2.2. Organizational Adoption of DPPs

As described, DPP adoption is a multifaceted problem, and it is not only a question of following a regulation or selecting a technical solution that is compliant with a regulation. Organizations need to understand what DPP adoption will mean for them, their products, and relationships with customers, vendors, and other actors. Furthermore, they need to figure out which product information is needed, where it is stored, who is responsible for it, and how it can be shared and protected. Previous studies, therefore, describe DPP adoption as both a technical and organizational challenge [20, 26].

Organizational readiness is one important aspect of adoption [13]. Organizations need to identify which data they already have, which data are missing, and which internal systems may need to interact with DPPs [3]. This can include systems for product information, supplier communication, logistics, customer relationships, regulatory reporting, and other forms of product and lifecycle data management [6]. DPP adoption, therefore, relies on existing digital capabilities and on clear routines for data ownership, data quality, and data maintenance [6, 16]. For many organizations, especially smaller ones, this may be extra difficult because they have limited resources and may not know what DPP requirements will mean for their own products and processes [15, 14].

Another aspect of adoption relates to the expected value of DPPs. Previous studies describe many possible benefits, including improved traceability, better product and lifecycle information, easier compliance, stronger customer trust, reduced counterfeit risks, improved decision-making, and support for circular economy activities such as repair, reuse, remanufacturing, and recycling [10, 11, 12]. These benefits depend on product data being available to different actors in the supply chain. Thus, DPP adoption may lead to better collaboration between manufacturers, suppliers, customers, service providers, and end-of-life actors, but only if these actors are also willing and able to provide information themselves [21, 8].

There are also a number of barriers to DPP adoption. Some of these barriers are technical, e.g., related to interoperability, data quality, integration with existing systems, and a general uncertainty about how the solutions are to be realized in practice [13, 16, 14]. Other barriers are more organizational, for example, the reluctance to share data with other actors [13, 16], especially if the data are sensitive and could reveal information about products, suppliers, customers, production processes, or business relationships [9, 16]. Unclear economic benefits can also slow down adoption, as there are questions around implementation costs [25], the business case and market value [10], and uncertainty about who should pay for [11] and maintain DPP-related systems [8].

Because DPPs affect multiple organizational functions, employees in different roles may assess adoption differently. Management roles may emphasize costs, compliance, strategy, risk, and supply-chain coordination [27]. Engineering, production, quality, and sustainability roles may focus more on product data, material information, process changes, and decision support [3], while sales roles may be more concerned with external information sharing, customer expectations, and sensitive business information [28]. Previous stakeholder-oriented research has primarily examined differences among actors in the wider DPP ecosystem [8, 21]. This study complements that perspective by examining differences among role groups within organizations.

Taken together, previous research shows that DPP adoption depends on more than technical aspects. Organizations need to understand their data, systems, responsibilities, expected benefits, and risks, while also coordinating between internal functions and supply-chain actors. However, much of the existing research still focuses on what DPPs could enable, how DPP systems can be designed, or how specific sectors and supply chains may prepare for implementation [22, 20]. This creates a need for empirical evidence on how industrial organizations are currently preparing for DPP adoption and how respondents perceive its expected benefits and barriers in practice. This paper addresses that need by examining organizational preparedness, expected use, perceived benefits, perceived barriers, and differences between organizational roles.

Following the sociotechnical perspective in IS [29], we view DPP adoption as involving interdependent technical and organizational elements. Technical aspects such as data availability, interoperability, standards, and system integration interact with organizational aspects such as roles, responsibilities, routines, and information sharing. From this perspective, organizational readiness for DPP adoption depends not only on technical capability but also on how these elements are aligned within and across organizations.

3. Method

3.1. Survey Design

This study is based on a questionnaire survey conducted during the Elmia Subcontractor trade fair in Jönköping, Sweden, in November 2025. Elmia Subcontractor is one of Northern Europe's largest events for the manufacturing industry. Numerous companies, including manufacturers, suppliers, technology providers, and industrial service organizations, come together at the event. Therefore, the venue provided access to organizations that are potential users of DPPs. Participation was anonymous, and no identifying information about individual respondents was collected.

The survey was designed to investigate industrial perspectives on DPPs from multiple organizational viewpoints. The questionnaire was developed by the authors for this study, and no formal pilot study was conducted. The complete questionnaire consisted of nine thematic sections covering organizational characteristics, respondent background, circular economy practices, DPP awareness and organizational readiness, information gaps throughout the product lifecycle, interaction with existing enterprise systems, perceived benefits of DPP adoption, perceived barriers to adoption, and cybersecurity barriers related to DPP implementation.

The questionnaire included both categorical and multiple-choice questions together with perception-based statements measured using six-point Likert scales ranging from Strongly disagree to Strongly agree (or Never to Constantly, depending on the question), supplemented with a Don't know/No opinion alternative where appropriate.

Although the survey investigated several aspects related to DPPs, this paper focuses specifically on organizational perspectives on DPP adoption. Consequently, the analysis includes questions concerning:

- organizational readiness and expected use of DPPs,
- information and communication gaps throughout the product lifecycle,
- expected interaction between DPPs and existing enterprise systems,
- perceived organizational benefits of DPP adoption,
- perceived organizational barriers to adoption.

The survey sections addressing circular economy practices and cybersecurity barriers are outside the scope of this paper.

3.2. Participants

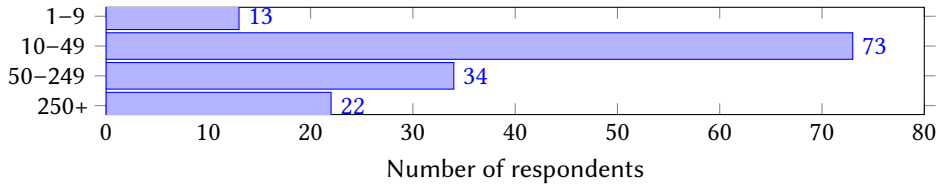
A total of 142 respondents from manufacturing and related industries participated in the survey. The unit of analysis was the individual respondent, who reported their perceptions of DPP adoption and their

Table 1
Aggregation of the original survey roles into the three role groups used in the statistical analysis.

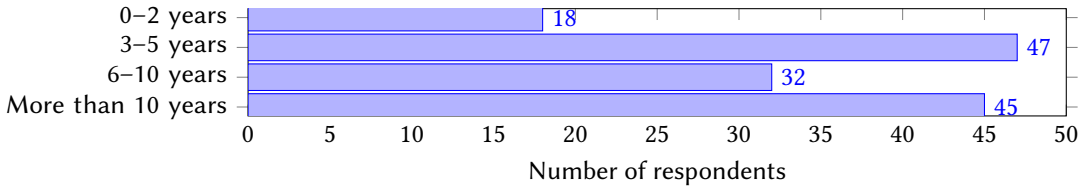
Role group	#	%	Original survey roles
Management	41	28.9	CEO, Managing Director, Sustainability Manager, Quality Manager, CFO
Sales	68	47.9	Sales, Key Account Management
Other Roles	33	23.2	Engineering, Production, Procurement, Maintenance, Technical Consulting, Marketing, Human Resources, Research, and other specialist roles

organizational context. The survey did not restrict participation to one respondent per organization; therefore, more than one respondent may have represented the same organization. To describe the sample, five background questions are reported in this paper. Participants were asked *"Describe the size of your company (number of employees);"* and *"How many years of experience do you have in your current role?"* The response categories and their distributions are shown in Fig. 1. They were also asked, *"What is your company's main country of operation?"* and *"Which industry sector do you work in?"* The distributions are shown in Fig. 2. For readability, countries with fewer responses were combined into *Other countries*, while less frequently represented industry categories were combined into *Other sectors*. Finally, participants were asked, *"What is your current role?"* The original role categories were aggregated into *Management*, *Sales*, and *Other Roles* for the statistical analysis. The aggregation was used to obtain sufficiently large groups for statistical comparison; however, the Other Roles category combines heterogeneous technical and operational functions. The grouping and the number of respondents in each group are shown in Table 1.

The respondents were from various organizations of different sizes, sectors and countries of operations, while Sweden formed the majority of responses. Figures 1 and 2 summarize the characteristics of the participating organizations and respondents.



(a) Company size

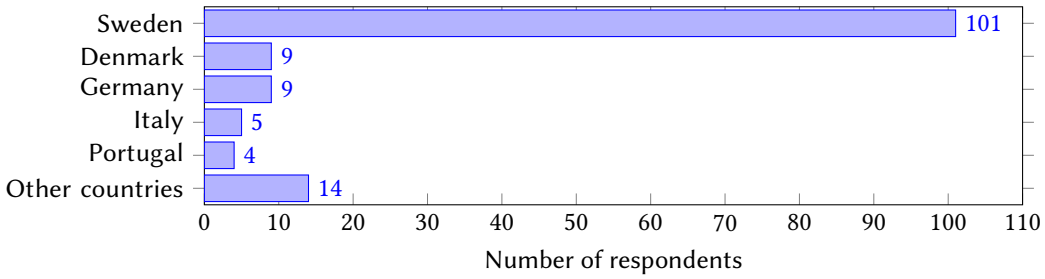


(b) Experience in current role

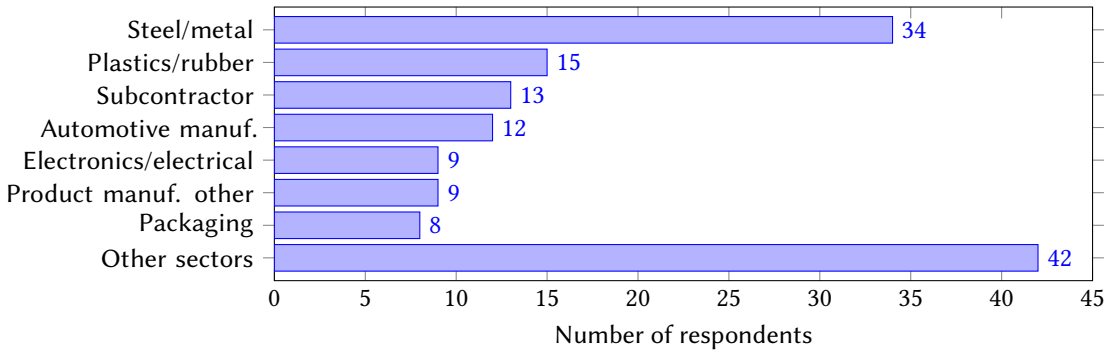
Figure 1: Respondent characteristics by company size and professional experience.

3.3. Data Analysis

The data were analyzed in two steps. First, descriptive statistics were used to summarize the survey results and describe organizations' perspectives on DPP adoption. This included organizational readiness, information gaps, expected interaction with existing enterprise systems, perceived benefits, and perceived barriers. Second, differences between the three organizational role groups were analyzed



(a) Main country of operation



(b) Industry sector

Figure 2: Respondent characteristics by country of operation and industry sector.

using Pearson's chi-square test for categorical variables and the Kruskal-Wallis test for the Likert-scale questions. The statistical comparisons were exploratory, and no correction for multiple testing was applied. An unadjusted significance threshold of $\alpha = 0.05$ was used, with results at $p < 0.05$ considered borderline. Given the number of comparisons, the results should be interpreted cautiously and as indications of possible differences between organizational roles rather than confirmatory evidence. For categorical questions, missing responses were retained as no-answer responses in the descriptive summaries. For the Likert-scale items, Don't know and No opinion responses were excluded when calculating mean values and conducting the Kruskal–Wallis tests.

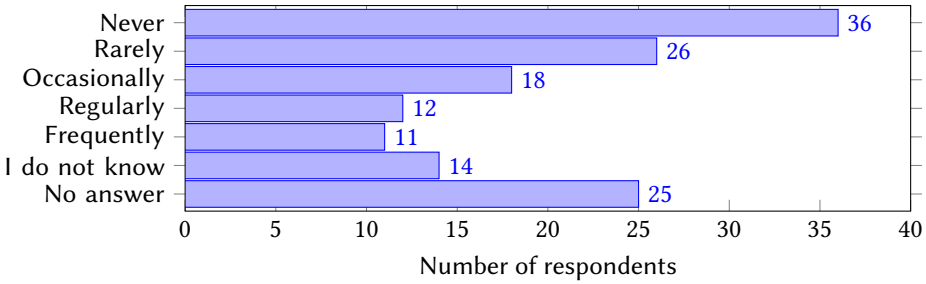
4. Results

This section presents the survey results in two parts. First, we describe the overall organizational perspectives on DPP adoption across all respondents. Second, we examine whether these perceptions differ across the three organizational role groups introduced in the previous section, i.e., *Management*, *Sales*, and *Other Roles*.

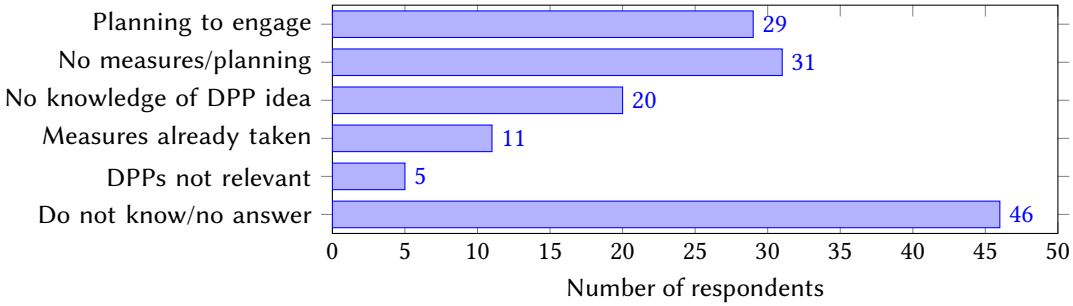
4.1. Organizational Readiness and Expected Use of DPPs

This subsection addresses RQ1 by looking at how close DPPs currently are to the respondents' work and organizations. We first report expected DPP use and company preparation. We then look at two related conditions for adoption: information gaps in current work and the existing systems that respondents expect DPPs to interact with.

Participants were first asked, *"In your work, do you see yourself using a Digital Product Passport?"* The response options and the number of responses in each category are shown in Fig. 3(a). The figure also includes a separate *No answer* category for the 25 respondents who did not answer this question. The results show that DPPs were not yet close to everyday work for many respondents. The largest group reported that they did not expect to use a DPP in their work, while another large group expected to use



(a) Expected DPP use in respondents' work



(b) Company preparation for DPP adoption

Figure 3: Expected use of DPPs and company preparation for DPP adoption.

one only rarely. Only 23 respondents reported that they expected to use DPPs regularly or frequently.

Participants were then asked, *"Has your company already taken measures to prepare for the introduction of Digital Product Passports?"* The response options are shown in Fig. 3(b). In the figure, the 22 respondents who selected the survey option *Do not know / no answer* were combined with the 24 respondents who did not answer the question. These 46 responses are shown together as *Do not know/no answer*. The company-level responses show a similar situation. Only 11 respondents reported that their company had already taken measures to prepare for DPPs. A larger group reported that their company was planning to engage with DPPs, but concrete preparation was still uncommon. At the same time, many respondents either reported no measures or no knowledge of the DPP idea.

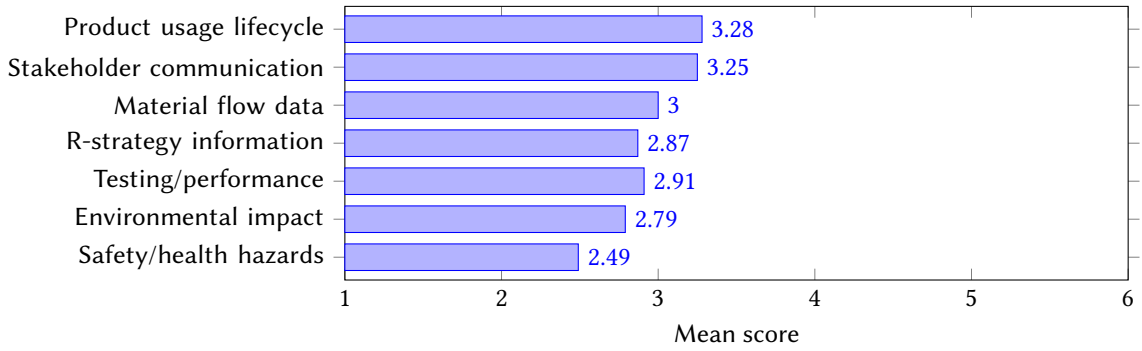


Figure 4: Information and communication gaps. Mean values are based on a 1–6 scale, where 1 indicates Never and 6 indicates Constantly. *No opinion* responses were excluded from the means.

Information gaps were also examined because DPP adoption depends on access to reliable product and lifecycle information. Respondents were asked, *"In your work, do you experience the following data, information or communication gaps?"* The seven gap items are shown in shortened form in Fig. 4. The original items concerned lack of data on safety and health hazards, lack of information on environmental impact, lack of data on product testing and performance, lack of data on product usage during the life-cycle, lack of material flow data, lack of R-strategy information, and communication with other

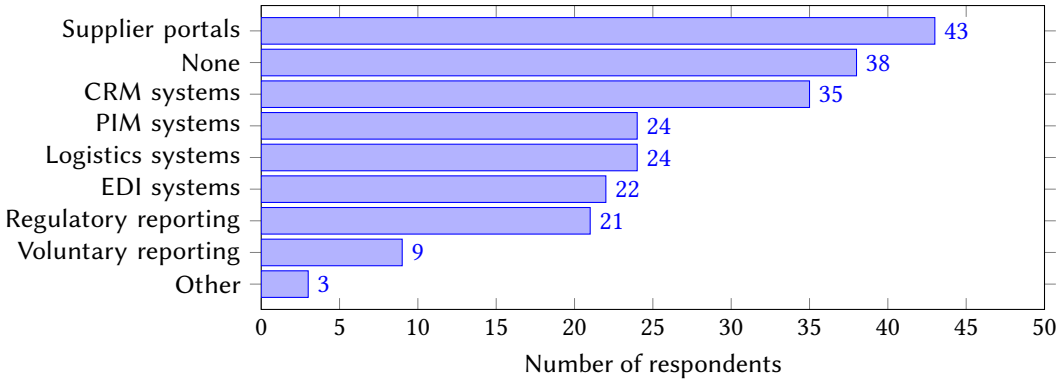


Figure 5: Existing systems expected to interact with DPPs. Respondents could select more than one option.

stakeholders in the supply chain. As shown in Fig. 4, all mean scores were below the midpoint of the 1–6 scale. The highest-rated gaps concerned product usage during the lifecycle and communication with other stakeholders in the supply chain. Lower scores were observed for safety and health hazards and environmental impact information.

Participants were asked, *"What type of existing systems do you envision Digital Product Passports to interact with (select all that apply)?"* The selectable options and the number of respondents who selected each one are shown in Fig. 5. Some labels are shortened in the figure; for example, *Logistics systems*, *PIM systems*, and *CRM systems* refer to Logistics Management Systems, Product Information Management systems, and Customer Relationship Management systems, respectively. As shown in Fig. 5, respondents most often expected DPPs to interact with supplier portals. That is followed by CRM systems, logistics systems, PIM systems, EDI systems, and regulatory reporting systems. However, 38 respondents selected *None*. This response is ambiguous: it may indicate that respondents expected no interaction with existing systems, or that they were uncertain about how DPPs would fit into the current digital infrastructure. The survey did not distinguish between these interpretations.

Overall, the results indicate that DPP adoption was still at an early stage among the surveyed organizations. Expected use was limited, concrete preparation was uncommon, and many respondents were still uncertain about how DPPs would connect to existing organizational information and systems.

4.2. Perceived Benefits and Barriers of DPP Adoption

This subsection addresses RQ2 by examining how respondents perceived the possible benefits and barriers of DPP adoption. The results are based on the total mean values across all respondents. Mean values are calculated from valid Likert-scale responses; *Don't know/No opinion* responses are not included in the means.

Regarding the expected benefits, participants were presented with *"Statements on the potential benefits of using a Digital Product Passport."* They rated their agreement with each statement on a six-point scale from *Strongly disagree* to *Strongly agree*, with an additional *I don't know* option. The benefit statements are shown in shortened form in Fig. 6. As shown in Fig. 6, respondents generally associated DPPs with several potential benefits. All benefit items had mean values above 4.0. Reduced risk of counterfeit products ($M = 4.85$), better data sharing across the product lifecycle ($M = 4.83$), and better data sharing across the supply chain ($M = 4.69$) were the highest-rated benefits. These were followed by easier compliance with environmental and circular economy regulations, enhanced consumer trust and brand protection, and enhanced decision-making through access to product information, with relatively high mean scores. The lower-rated benefit items were still above the midpoint of the scale. Improved product design or development processes had the lowest mean value ($M = 4.09$), followed by improved relationship with end users ($M = 4.25$) and improved product maintenance ($M = 4.31$). Overall, the benefit results suggest that respondents did not see DPPs only as a compliance instrument. They also connected DPPs to data sharing, traceability, decision-making, and supply-chain coordination.

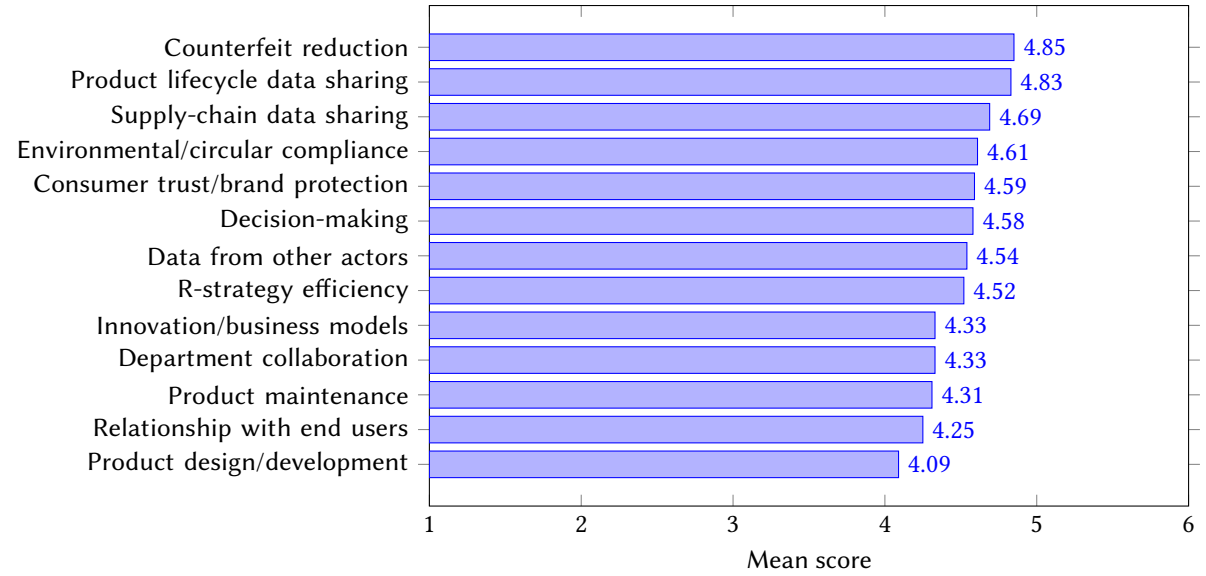


Figure 6: Perceived benefits of DPP adoption. Mean values are based on a 1–6 agreement scale, where 1 indicates *Strongly disagree* and 6 indicates *Strongly agree*. *I don't know* responses were excluded from the means.

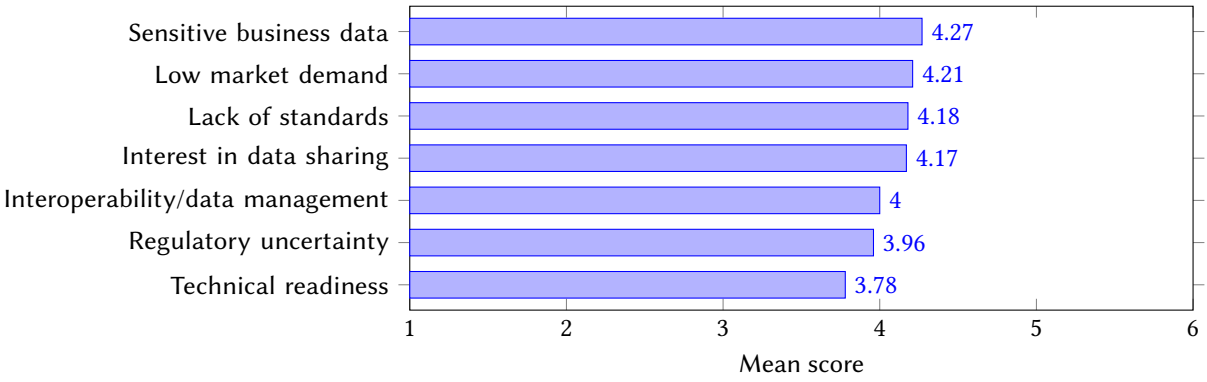


Figure 7: Perceived barriers to DPP adoption. Mean values are based on a 1–6 agreement scale, where 1 indicates *Strongly disagree* and 6 indicates *Strongly agree*. *I don't know* responses were excluded from the means.

For the barriers, participants were presented with *"Statements on the potential barriers to adopting or implementing a Digital Product Passport."* They rated their agreement with each statement on the same six-point scale from *Strongly disagree* to *Strongly agree*, with an additional *I don't know* option. The barrier statements are shown in shortened form in Fig. 7. The barrier ratings in Fig. 7 were also relatively high. The strongest perceived barrier was protecting sensitive business data in DPPs from unauthorized access ($M = 4.27$). This was followed by low market demand ($M = 4.21$), lack of standards ($M = 4.18$), lack of willingness to share data with external actors ($M = 4.17$), and interoperability and data management risks ($M = 4.00$). Among the listed barriers, the lowest mean score was for technical readiness ($M = 3.78$), followed by regulatory uncertainty ($M = 3.96$). Although these values are lower than the other barrier items, they are still above the midpoint of the scale. The barrier results show that respondents were concerned not only with technical implementation, but also with data protection, standards, market demand, and willingness to share data across organizational boundaries.

4.3. Differences Across Organizational Role Groups

This subsection addresses RQ3 by examining whether perceptions of DPP adoption differed between *Management*, *Sales*, and *Other Roles*. The analysis is organized according to the same themes as the previous subsections: readiness and expected use, information gaps and system interaction, perceived

benefits, and perceived barriers.

First, there were no statistically significant differences between role groups in expected DPP use or company preparation. Expected use of DPPs in respondents' work did not differ significantly across role groups ($p = .165$), and neither did company preparation for DPP adoption ($p = .700$). This suggests that the early-stage character of DPP adoption observed in the total sample was not specific to one role group. Rather, limited use, limited preparation, and uncertainty appeared across the organization.

Second, no significant role-group differences were found for the experienced information and communication gaps. The Kruskal-Wallis tests were non-significant for all information-gap items, including lack of data on safety and health hazards ($p = .63$), environmental impact ($p = .56$), product testing and performance ($p = .99$), product usage during the lifecycle ($p = .72$), material flow data ($p = .85$), R-strategy information ($p = .71$), and communication gaps with other stakeholders ($p = .92$). Similarly, expected interaction between DPPs and existing systems did not differ significantly across role groups. The closest result was for regulatory reporting systems ($p = .10$), while the other system categories were further from the significance threshold. The analyses did not detect statistically significant role-group differences in the information-gap or system-interaction items.

The lowest unadjusted p-values among the perceived benefits were found for improved relationship with end users ($p = .005$), enhanced decision-making through access to product information ($p = .005$), and increased collaboration between departments ($p = .03$). Table 2 presents the corresponding mean ratings across role groups. Given the exploratory nature of the analysis and the absence of correction for multiple comparisons, these results should be interpreted cautiously.

Table 2
Perceived benefits with the lowest unadjusted p-values in the role-group comparisons. Values show mean score with valid responses in parentheses.

Perceived benefit	Management	Sales	Other Roles	p
Improved relationship with end users	4.30 (20)	3.86 (43)	5.00 (21)	.005
Enhanced decision-making through access to product information	4.67 (21)	4.19 (36)	5.14 (21)	.005
Increased collaboration between departments	4.71 (21)	3.90 (39)	4.73 (22)	.03
Better data sharing across the supply chain	5.27 (22)	4.43 (42)	4.61 (23)	.05

The descriptive results in Table 2 show that *Other Roles* received the highest mean ratings for improved relationships with end users and enhanced decision-making through access to product information. *Management* and *Other Roles* also gave higher mean ratings to increased collaboration between departments than *Sales*. For better data sharing across the supply chain, the highest mean was found among *Management*. However, since no post-hoc pairwise comparisons were conducted, these patterns should not be interpreted as statistically established differences between specific role groups. Two additional benefit items had relatively low unadjusted p-values: improved product design or development processes ($p = .06$) and better data sharing across the product lifecycle ($p = .06$).

Among perceived barriers, the lowest unadjusted p-value was for protecting sensitive business data in DPPs from unauthorized access ($p = .001$). Two additional barrier items had borderline results: risk of interoperability and data management ($p = .05$), and lack of willingness to share data with other actors ($p = .05$). Table 3 presents the corresponding descriptive ratings across role groups.

The barrier results show a different pattern from the benefit results. *Sales* respondents gave the highest mean ratings to all three barrier items in Table 3, especially the protection of sensitive business data. This is notable because sales and key account roles are often close to customer relationships, market expectations, and information exchange with external actors. The result, therefore, suggests that data exposure, interoperability, and willingness to share data may be particularly visible concerns from a market-facing position. The remaining barrier items did not differ significantly across role groups: technical readiness ($p = .12$), regulatory uncertainty ($p = .69$), lack of standards ($p = .23$), and low market demand ($p = .18$).

The role-group analysis shows that differences were selective rather than general. Preparedness,

Table 3
Perceived barriers with the lowest unadjusted p-values in the role-group comparisons. Values show mean score with valid responses in parentheses.

Perceived barrier	Management	Sales	Other Roles	p
Protecting sensitive business data in DPPs from unauthorized access	4.00 (24)	4.88 (41)	3.35 (20)	.001
Risk of interoperability and data management	3.96 (23)	4.31 (35)	3.47 (19)	.05
Lack of willingness in sharing data with other actors	3.72 (18)	4.56 (36)	3.91 (22)	.05

expected use, information gaps, and expected system interaction did not differ significantly between the three role groups. The differences appeared mainly when respondents evaluated the value and risks of DPP adoption. *Other Roles* and *Management* tended to rate several decision-making, collaboration, and data-sharing benefits highly, while *Sales* respondents expressed stronger concerns about sensitive data, interoperability, and reluctance to share data. This indicates that DPP adoption should not be treated as a single organizational viewpoint. Different role groups may agree that DPPs are relevant, but they appear to emphasize different parts of the adoption problem. This reinforces a socio-technical perspective in which the value and challenges of a digital system depend partly on the perspectives, responsibilities, and work practices of the organizational groups involved [30].

5. Discussion

Regarding RQ1, the results suggest that DPP adoption is still at an early stage. Most respondents did not expect to use DPPs regularly in their own work, and only a small number reported that their company had already taken concrete measures to prepare for them. This indicates that DPPs are not yet part of everyday organizational practice in many of the surveyed companies. For many organizations, the first step is understanding what data will be required, where that data should come from, who should be responsible for it, and how DPPs would connect to existing systems and external actors [6, 16].

The results show that the potential benefits of DPPs are already recognized, despite the limited level of preparation reported in the sample. At the same time, there was substantial uncertainty about expected use and company preparation. This suggests that many organizations may see the potential value of DPPs without yet having a clear understanding of what adoption will require in practice. This is an encouraging finding in the context of an environmentally motivated regulation such as the DPP, as respondents already perceive potential benefits despite the limited level of preparation. Such positive expectations may provide favorable conditions for future adoption, although this study does not examine whether these expectations translate into actual adoption. This is consistent with previous work that describes DPP implementation as an organizational adoption challenge shaped by technological and organizational factors, rather than solely as a technical design problem [13, 20]. Viewed from a sociotechnical perspective, the findings illustrate this interdependence. Limited organizational preparation exists alongside concerns about data, interoperability, responsibilities, and information sharing, suggesting that DPP adoption requires coordinated technical and organizational change rather than technical implementation alone.

Concerning RQ2, respondents saw value in DPPs beyond regulatory compliance. This supports previous work that argues DPPs should not be understood only as a compliance mechanism but also as a potential source of strategic and operational value [27, 12]. Respondents rated data sharing, decision-making, counterfeit prevention, and circular economy activities positively. The high scores for data sharing across the supply chain and product lifecycle are especially relevant, since one of the main purposes of DPPs is to make product information available across organizations, systems, and lifecycle stages [21, 6].

At the same time, the barrier results identify several factors that may hinder adoption, particularly

those related to trusted data sharing. Protecting sensitive business data, lack of standards, regulatory uncertainty, interoperability and data management risks, low market demand, and reluctance to share data with other actors all point to a similar underlying issue. DPP adoption requires organizations to make product information more transparent, but firms also need to protect commercially sensitive knowledge. This dynamic between transparency and protection is also discussed in previous work, e.g., in Berger et al. [9] and Kemmner et al. [16]. From a sociotechnical perspective, this also points to potential misalignment between the collective benefits of data sharing and the costs and risks faced by individual actors. The role-group differences suggest that transparency may be valued differently across organizational functions. Previous research suggests that these challenges may be particularly relevant for smaller organizations, which can face resource constraints and uncertainty regarding DPP requirements [14, 15].

The information-gap results show that the highest-rated gaps concerned product use during the lifecycle and communication with other stakeholders. This information may be held by different actors and at different stages of the product lifecycle. The relatively low reported information gaps, alongside high expected benefits, may indicate that respondents see DPP value not only in addressing current deficiencies, but also in enabling future coordination, transparency, and regulatory compliance. Because respondents assessed gaps in relation to their current work, they may not yet encounter information fragmentation that becomes visible when data must be shared across organizational and lifecycle boundaries.

Concerning RQ3, the results suggest that some perceptions of DPP adoption may vary between organizational roles, particularly regarding perceived benefits and barriers. However, the statistical comparisons were exploratory, and these patterns require further investigation. No statistically significant differences were detected in expected DPP use, company preparation, information gaps, or expected system interaction. The descriptive findings suggest that limited readiness and uncertainty were present across the three role groups. Previous research has focused primarily on differences and coordination among stakeholders in the wider DPP ecosystem [8, 21]. This study complements that work by examining differences among role groups within organizations. The limited preparedness was not limited to a particular role group but was broadly shared between Management, Sales, and Other Roles.

The role differences appeared mainly in how respondents rated the benefits and barriers. The Management group had the highest mean for better data sharing across the supply chain. Other Roles group had the highest means for improved relationships with end users and enhanced decision-making. These patterns may reflect differences in how the groups view the use and value of product information, but the survey did not examine the reasons behind them.

In the descriptive results, Sales respondents gave the highest mean rating to concerns about protecting sensitive business data. They also gave relatively high mean ratings to interoperability and data-management risks, and lack of willingness to share data with other actors. Although these patterns may indicate differences in how organizational roles perceive the barriers to DPP adoption, they should be interpreted cautiously given the limitations of the statistical analysis. One possible explanation is that sales and key account roles are more directly involved in customer communication and external information exchange. This may make them more aware of concerns related to sharing product information, protecting sensitive business data, and meeting customer expectations [28]. This may reflect a structural rather than attitudinal constraint: market-facing roles often manage organizational information boundaries and must balance increased transparency with the protection of commercially sensitive information. This reflects a broader socio-technical challenge of aligning technical system requirements with existing organizational practices and responsibilities [31]. DPP adoption may therefore create a tension between data-sharing requirements and established commercial practices. The broad Other Roles category should therefore be interpreted cautiously, as it combines functions such as engineering, production, and procurement that may differ substantially in their responsibilities, information needs, and interaction with DPP-related systems.

Differences between roles may be useful in DPP adoption because they can bring attention to different aspects. For example, in this survey, the Management group emphasized the potential benefit of supply-

chain data sharing while the Sales group expressed concerns about sensitive data and interoperability. Involving these perspectives could help organizations identify implementation barriers, potential benefits, and possible business risks.

The results also clearly show that having digital infrastructure alone is not enough for DPP adoption. Organizations also need reliable product data, clear responsibility for that data, links to relevant systems, and rules for sharing and protecting information. This highlights that DPP data governance is both organizational and technical, since data quality and maintenance depend on clearly assigned responsibilities among the actors who create and use the data [32]. These issues may be especially relevant for smaller organizations with limited resources, although this study did not compare companies by size.

The findings also indicate that uncertainty about the practical requirements of DPP implementation may slow down the adoption. For example, organizations may hesitate to invest in new processes or systems when it is still unclear which data must be provided, which standards and formats will apply, and what sector-specific requirements they need to fulfill. Clearer guidance on standards, data formats, access rules, and sector-specific requirements could help organizations understand what they need to do. This aligns with previous studies identifying a lack of standardization and uncertainty of implementation requirements for DPP adoption [13, 14].

5.1. Limitations

This study has several limitations. The sample was collected at a trade fair and is not statistically representative of all manufacturing organizations. The sample is also dominated by Swedish and northern European respondents. The role-group analysis required aggregating several smaller role categories into Management, Sales, and Other Roles, which may obscure important socio-technical differences between functions. Some questionnaire items combine related concepts, which limits the specificity with which individual aspects can be interpreted.

The statistical analyses were exploratory. No correction for multiple comparisons was applied, increasing the risk of false-positive findings. The Kruskal–Wallis tests did not include post-hoc comparisons, and no effect sizes were reported, limiting conclusions about specific group differences and their magnitude. Some chi-square tests may also be affected by small expected cell counts. Therefore, the reported differences between organizational roles should be interpreted cautiously.

Furthermore, Don't know/No opinion responses were excluded from the means and statistical tests, reducing the valid sample for some items. For example, only 84 of 142 respondents provided numerical ratings for improved relationships with end users. Non-response was not examined across role groups and may bias comparisons. The figures also omit valid sample sizes and measures of spread. Since uncertainty about DPP adoption is itself an important finding, these responses deserve further investigation.

Finally, all measures are based on self-reported perceptions collected within the same survey, and the findings may therefore be affected by common method bias. The study captures individual respondents' perceptions rather than organization-level assessments or actual implementation behavior. As multiple respondents may have come from the same organization, the observations should not be interpreted as independent organization-level responses.

6. Conclusions

This study examined how industrial organizations view the adoption of Digital Product Passports. The results show that adoption is still at an early stage. Most respondents did not expect to use DPPs regularly in their work, and only a small number reported that their companies had already taken preparatory measures. At the same time, respondents identified several possible benefits, particularly reduced counterfeit risk and better data sharing across the product lifecycle and supply chain.

The main concerns were related to protecting sensitive business information, market demand, lack of standards, willingness to share data, and interoperability and data management. Exploratory

comparisons also suggested possible differences between organizational roles in some benefit and barrier ratings, although these findings require further investigation. This suggests that DPP adoption will require both organization-wide preparation and attention to the concerns of different role groups.

Overall, the results suggest that DPP adoption will depend on more than choosing the right technical solution. Companies will also need to decide who is responsible for the data, how its quality is checked, what can be shared, and with whom. As DPP requirements become more concrete, future studies should examine how companies deal with these questions in practice.

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Declaration on Generative AI

During the preparation of this work, the authors used Grammarly and ChatGPT 5.5 to perform grammar and spelling checks, improve writing style, and to get help in generating LaTeX code for tables and figures. After using these tools, the authors reviewed and edited the content as needed and take full responsibility for the publication's content.

References

[1] E. Kristoffersen, F. Blomsma, P. Mikalef, J. Li, The smart circular economy: A digital-enabled circular strategies framework for manufacturing companies, Journal of Business Research 120 (2020) 241–261. doi:10.1016/j.jbusres.2020.07.044.

[2] J. Kirchherr, D. Reike, M. Hekkert, Conceptualizing the circular economy: An analysis of 114 definitions, Resources, Conservation and Recycling 127 (2017) 221–232. doi:10.1016/j.resconrec.2017.09.005.

[3] S. F. Jensen, J. H. Kristensen, S. Adamsen, A. Christensen, B. V. Wæhrens, Digital product passports for a circular economy: Data needs for product life cycle decision-making, Sustainable Production and Consumption 37 (2023) 242–255. doi:10.1016/j.spc.2023.02.021.

[4] C. Plociennik, M. Pourjafarian, A. Nazeri, W. Windholz, S. Knetsch, J. Rickert, A. Ciroth, A. do Carmo Precci Lopes, T. Hagedorn, M. Vogelgesang, W. Benner, A. Gassmann, S. Bergweiler, M. Ruskowski, L. Schebek, A. Weidenkaff, Towards a digital lifecycle passport for the circular economy, Procedia CIRP 105 (2022) 122–127. doi:10.1016/j.procir.2022.02.021, the 29th CIRP Conference on Life Cycle Engineering, April 4 – 6, 2022, Leuven, Belgium.

[5] European Union, Regulation (EU) 2024/1781 of the European Parliament and of the Council of 13 June 2024 establishing a framework for the setting of ecodesign requirements for sustainable products, amending Directive (EU) 2020/1828 and Regulation (EU) 2023/1542 and repealing Directive 2009/125/EC (Text with EEA relevance), 2024. URL: http://data.europa.eu/eli/reg/2024/1781/oj.

[6] M. Jansen, T. Meisen, C. Plociennik, H. Berg, A. Pomp, W. Windholz, Stop guessing in the dark: Identified requirements for digital product passport systems, Systems 11 (2023) 123. doi:10.3390/systems11030123.

[7] A. Zhang, S. Seuring, Digital product passport for sustainable and circular supply chain management: A structured review of use cases, International Journal of Logistics Research and Applications 27 (2024) 2513–2540. doi:10.1080/13675567.2024.2374256.

[8] J. Paeplow, I. Jussen-Lengersdorf, J. Schweihoff, T. Schoormann, A. Gieß, F. Möller, A stakeholder theory perspective on digital product passport implementation, Journal of Industrial Ecology 30 (2026) 433–446. doi:10.1007/s44498-026-00029-9.

[9] K. Berger, R. J. Baumgartner, M. Weinzerl, J. Bachler, J.-P. Schöggl, Factors of digital product passport adoption to enable circular information flows along the battery value chain, in: Proceedings of the 30th CIRP Life Cycle Engineering Conference, volume 116 of *Procedia CIRP*, 2023, pp. 528–533. doi:10.1016/j.procir.2023.02.089.

[10] A. Chaudhuri, B. V. Wæhrens, H. Treiblmaier, S. F. Jensen, Impact pathways: Digital product passport for embedding circularity in electronics supply chains, International Journal of Operations & Production Management 45 (2025) 1213–1226. doi:10.1108/IJOPM-01-2024-0012.

[11] A. Gieß, F. Möller, Exploring the value ecosystem of digital product passports, Journal of Industrial Ecology 29 (2025) 561–573. doi:10.1111/jiec.13621.

[12] F. Psarommatis, F. Konstantinidis, V. Azamfirei, G. May, Identification of the benefits from the use of digital product passport in a value chain and single organizations, IFAC-PapersOnLine 58 (2024) 301–306. doi:10.1016/j.ifacol.2024.09.199.

[13] F. Abedi, U. A. Saari, L. Hakola, Implementation and adoption of digital product passports: A systematic literature review, in: 2024 IEEE International Conference on Engineering, Technology, and Innovation (ICE/ITMC), 2024, pp. 1–9. doi:10.1109/ICE/ITMC61926.2024.10794320.

[14] C. Sandionigi, A. Alcayaga, Implementing the Digital Product Passport in the EEE Sector: Drivers, Barriers, Opportunities, and Challenges, Report, CIRPASS-2 Consortium, 2026. URL: https://doi.org/10.5281/zenodo.18623400. doi:10.5281/zenodo.18623400.

[15] J. Büchel, A. Neligan, Digital product passport: Finding the right balance between transparency for circularity and added red tape, Intereconomics 60 (2025) 160–164. doi:10.2478/ie-2025-0031.

[16] F.-A. Kemmner, H. Legenvre, A.-P. Hameri, Sharing data to implement the circular economy: The case of digital product passports, Industrial Management & Data Systems 125 (2025) 2854–2873. doi:10.1108/IMDS-04-2024-0403.

[17] S. Nowacki, G. M. Sisik, C. M. Angelopoulos, Digital product passports: Use cases framework and technical architecture using dlt and smart contracts, in: 2023 19th International Conference on Distributed Computing in Smart Systems and the Internet of Things (DCOSS-IoT), IEEE, Pafos, Cyprus, 2023, pp. 373–380. doi:10.1109/DCOSS-IoT58021.2023.00067.

[18] I. Illán García, F. D. Muñoz-Escoí, J. Arjona Aroca, F. J. Fernández-Bravo Peñuela, Digital product passport management with decentralised identifiers and verifiable credentials, arXiv preprint, 2024. doi:10.48550/arXiv.2410.15758. arXiv:2410.15758.

[19] Z. Zhang, J. Gu, R. Li, W. Lian, C. Ma, J. Tian, Bridging digital and green transitions: A literature review of digital product passport systems, Renewable and Sustainable Energy Reviews 228 (2026) 116600. doi:10.1016/j.rser.2025.116600.

[20] F. Stiksma, M. van Sinderen, J. L. Rebelo Moreira, Digital product passport adoption in the electrical and electronic equipment sector: A socio-technical transition perspective, IFAC-PapersOnLine 59 (2025) 488–493. doi:10.1016/j.ifacol.2025.09.084.

[21] S. F. Jensen, J. H. Kristensen, A. Christensen, B. V. Wæhrens, An ecosystem orchestration framework for the design of digital product passports in a circular economy, Business Strategy and the Environment 33 (2024) 7100–7117. doi:10.1002/bse.3868.

[22] H. Wicaksono, A. Mengistu, A. Bashyal, T. Fekete, Digital product passport (dpp) technological advancement and adoption framework: A systematic literature review, Procedia Computer Science 253 (2025) 2980–2989. doi:10.1016/j.procs.2025.02.022.

[23] P. K. F. Wan, S. Jiang, Enabling a dynamic information flow in digital product passports during product use phase: A literature review and proposed framework, Sustainable Production and Consumption 54 (2025) 362–374. doi:10.1016/j.spc.2025.01.014.

[24] R. H. E. M. Koppelaar, S. Pamidi, E. Hajósi, L. Herreras, P. Leroy, H.-Y. Jung, A. Concheso, R. Daniel, F. B. Francisco, C. Parrado, S. Dell'Ambrogio, F. Guggiari, D. Leone, A. Fontana, A digital product passport for critical raw materials reuse and recycling, Sustainability 15 (2023) 1405. doi:10.3390/su15021405.

[25] A. Alcayaga, H. Berg, N. Hoffmann, H. Brüggmann, F. Maus, The Digital Product Passport (DPP) for the Circular Economy: Recommendations for Policy, Business and IT, Deliverable D5.2, CIRPASS Consortium, 2024. URL: https://doi.org/10.5281/zenodo.11127410. doi:10.5281/zenodo.11127410.

[26] P. Wlazlak, A. Moscati, U. Seigerroth, P. Johansson, E. Bergström, A. Briggert, R. Z. Kebede, J. Kävrestad, R. Stolt, Adopting digital product passports: a sociotechnical perspective and research agenda, IOP Conference Series: Materials Science and Engineering 1342 (2026) 012033. doi:10.1088/1757-899X/1342/1/012033, paper presented at the 12th Swedish Production Symposium, 24–26 March 2026, Luleå, Sweden.

[27] L. M. Haase, L. S. Lythje, E. B. Skouboe, M. L. Petersen, More than legislation: The strategic benefits and incentives for companies to implement the digital product passport, Journal of Circular Economy 2 (2025). doi:10.55845/CAXG2280.

[28] S. Auh, B. Menguc, Knowledge sharing behaviors of industrial salespeople: An integration of economic, social psychological, and sociological perspectives, European Journal of Marketing 47 (2013) 1333–1355. doi:10.1108/03090561311324354.

[29] S. Sarker, S. Chatterjee, X. Xiao, A. Elbanna, The sociotechnical axis of cohesion for the is discipline: Its historical legacy and its continued relevance, MIS Quarterly 43 (2019) 695–719. doi:10.25300/MISQ/2019/13747.

[30] P. M. Bednar, C. Welch, Socio-technical perspectives on smart working: Creating meaningful and sustainable systems, Information Systems Frontiers 22 (2020) 281–298. doi:10.1007/s10796-019-09921-1.

[31] G. Baxter, I. Sommerville, Socio-technical systems: From design methods to systems engineering, Interacting with Computers 23 (2011) 4–17. doi:10.1016/j.intcom.2010.07.003.

[32] H.-E. Nissen, What or whom do knowledge-managers manage?, in: J. G. Cegarra (Ed.), Proceedings of the 13th European Conference on Knowledge Management, Academic Conferences and Publishing International Limited, 2012, pp. 839–847.