

Product-as-a-service from B2C retailers' perspective: a framework of challenges and mitigations

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62

Abstract

Purpose – Product-as-a-Service (PaaS) has the potential to enable closed-loop supply chains (CLSC) and decrease environmental impact, but it is only applied on a small scale. The purpose of this paper is to explore and develop a framework of challenges and corresponding mitigations encountered by Business-to-Consumer (B2C) retailers when transitioning to PaaS.

Design/methodology/approach – Data collection drew on a qualitative interview study with two industry experts and four PaaS B2C retailers from different Dutch industries.

Findings – A framework was developed linking 26 challenges in eight clusters—financial, product-related, supply chain-related, consumer-related, human resources, research and development/technology, regulatory and industry-related—to 24 mitigations. The mitigations were elaborated, and theoretical insights for matching challenges with mitigations were provided.

Research limitations/implications – This study expands PaaS literature to the generally under-researched retail context. It contributes to CLSC literature by applying it to a less-studied context, thereby revealing many supply chain-related challenges and mitigations encountered by B2C retailers.

Practical implications – The framework offers practical guidance to retail managers for overcoming or preventing challenges in PaaS, in their endeavours toward adopting environmentally sustainable practices.

Social implications – The study creates awareness about environmental sustainability and the potential to reduce societal impact, in which a PaaS-enabled CLSC is one step.

Originality/value – Studying PaaS and CLSC in a retail context is timely and novel.

Keywords B2C retailer, Environmental sustainability, Circular business model, Servitisation, Closed loop supply chain

Paper type Research paper

1. Introduction

United Nations' Sustainable Development Goals urge companies to adopt environmentally sustainable practices (e.g. [Lin et al., 2022](#)). To this end, multiple researchers—including [Dagilene et al. \(2022\)](#), [Vadakepatt et al. \(2021\)](#), [Patwa et al. \(2021\)](#) and [Vermunt et al. \(2019\)](#)—showed the need to move from linear, forward supply chains where responsibility for product recovery lies on final customers, to closed-loop supply chains (CLSC). “A CLSC integrates a forward supply chain with a reverse supply chain, which is especially urgent for recoverable products . . .” ([Coenen et al., 2018](#), p. 2). Recoverable products can be reused or recycled instead of wasted, which is an environmentally sustainable practice ([Sakao and Nordholm,](#)



2021; Oliveira *et al.*, 2021). Product responsibility must lie at an actor that has enough environmental sustainability knowledge. To enable CLSC, a circular business model is required. Product-as-a-Service (PaaS) is such a circular business model (Zhao and Wang, 2021; Patwa *et al.*, 2021; Delafenestre, 2019; Vermunt *et al.*, 2019). With PaaS, customers gain access to products by leasing, renting (Fota *et al.*, 2019) or subscription (Hussain *et al.*, 2023), but do not get responsibility or ownership (Vermunt *et al.*, 2019). PaaS is under-researched (Oliveira *et al.*, 2021; Sakao and Nordholm, 2021).

PaaS is mainly found in Business-to-Business (B2B) contexts, where product responsibility lies on, for example producers, whose responsibility already is described in literature (Tat *et al.*, 2023; Fargnoli *et al.*, 2018). To expand PaaS-enabled CLSC into Business-to-Consumer (B2C) contexts, product responsibility should be regained from less sustainability-knowledgeable consumers to retailers (Khan *et al.*, 2022; Antikainen *et al.*, 2021; Bolton, 2019). B2C retailers are the supply chain actor closest to consumers, both in the forward and the reverse supply chains (Dagiliene *et al.*, 2022; Vadakkepatt *et al.*, 2021; Poolen *et al.*, 2020). B2C retailers' perspectives are relevant when transitioning to PaaS, since CLSCs succeed or fail with their decisions. Retail represents a significant sector (Björklund *et al.*, 2016), and knowledge on retailers' product responsibilities is lacking (Kalimo *et al.*, 2015). Expanding the knowledge on PaaS-enabled CLSC in B2C represent unrealized environmental sustainability potentials; such expansions are encouraged by Zhao and Wang (2021) and Moro *et al.* (2020).

Consumers are increasingly focusing environmental sustainability (Tat *et al.*, 2023; Gupta and Mukherjee, 2022). PaaS has the potential to improve it (Gupta and Mukherjee, 2022; Vadakkepatt *et al.*, 2021; Zhao and Wang, 2021; Borg *et al.*, 2020). Thus, retailers need to facilitate consumer behavior and understanding around environmental sustainability (Lin *et al.*, 2022).

Practically, PaaS is in use, but on a small scale (Antikainen *et al.*, 2021). Existing literature fails to provide the reasons why (Fota *et al.*, 2019), focusing on drivers instead of challenges (e.g. Dagliene *et al.*, 2022). Various challenges—including low consumer acceptance (Rombouts, 2019) and low management involvement (Oliveira *et al.*, 2021)—have been indicated. Systematic overviews of challenges in PaaS are rare in scientific literature, with one exception of Vermunt *et al.*'s (2019) broader overview of challenges to several circular business models, which did not specifically address retailers. This is in line with retailing being generally under-researched (Dagiliene *et al.*, 2022; Bolton, 2019). To expand PaaS into B2C context, knowledge about the associated challenges for retailers would be a first step. Research Question (RQ1) was formulated thusly: *What challenges have B2C retailers encountered when transitioning to PaaS?*

Awareness of the challenges does not improve environmental sustainability. A next step is to identify appropriate mitigations to match with challenges. Matschewsky *et al.* (2018) stated that studies on mitigating challenges in PSS are lacking, confirming this research gap. Retailers play an important role in securing environmental sustainability in their supply chains (Dagiliene *et al.*, 2022; Vadakkepatt *et al.*, 2021; Björklund *et al.*, 2016), and more research on guiding retailers in how to develop environmental sustainability was requested by Bolton (2019). To uncover the environmental sustainability potential, RQ2 is formulated thusly: *How can challenges that B2C retailers encounter when transitioning to PaaS be mitigated?*

The purpose of this paper is to explore and develop a framework of challenges and corresponding mitigations encountered by B2C retailers when transitioning to PaaS.

2. Literature review

The research gaps identified mean that the possibilities to build up a specific, strong frame of reference are limited. This section outlines few studies of potential challenges and

mitigations, with three inherent types of weaknesses, that hinder a deductive approach in the study.

2.1 Potential challenges when transitioning to PaaS

One weakness is that little research focuses on challenges for PaaS and instead focuses on challenges in relation to the broader concept Product-Service Systems (PSS) (e.g. [Rombouts, 2019](#)). [Antikainen et al. \(2021\)](#) showed that a successful transition is only possible with non-trend sensitive products. One identified challenge is customer acceptance, which is higher in B2B than B2C in terms of confidentiality and trust ([Antikainen et al., 2021](#); [Oliveira et al., 2021](#)). [Antikainen et al. \(2021\)](#) identified another challenge in the B2C environment: consumers' need for ownership of products. Consumers' needs and barriers differ, a situation that requires adaptation ([Zhao and Wang, 2021](#); [Borg et al., 2020](#)). It would be interesting to study if these challenges also are valid for PaaS.

Another weakness is that some specific and recent studies focusing on PaaS are gray, not peer-reviewed, literature. [Kuipers \(2021\)](#) provided the most extensive overview of challenges when transitioning to PaaS, clustered as organizational, financial and regulatory. Organizational barriers include a hesitant company culture, limited willingness to collaborate in the supply chain, a lack of customer awareness and interest, operating in a linear system but freeloading on the wave of PaaS, conservative industry, lack of support from senior management, lack of expertise and lack of an ideal management information system. Financial barriers include the low cost of virgin materials (significantly cheaper than reused materials), high upfront investment costs (as designing reverse logistics is costly), high investment risk, lack of data to prove financial viability, cash-flow problems, difficulty defining which party pre-finances, limited circular procurement, limited funding for circular business models, lack of standardization and the service being more expensive in the long term than buying. Regulatory barriers include obstructive laws and regulations, a lack of global consensus, the taxing system and building decrees ([Kuipers, 2021](#)). [Poolen et al. \(2020\)](#) showed that not every consumer wants to be environmentally sustainable. In addition, the complexity of value creation means that PaaS cannot always be created ([Marek, 2020](#)). Similarly, [Parker \(2021\)](#) noted the challenge in distinguishing what is included in the service. It raises the question whether similar challenges can be identified in scientific peer-reviewed studies.

A third weakness is that B2C retailers are not addressed, as knowledge on retailers' product responsibilities is lacking ([Kalimo et al., 2015](#)). Consumers can be expected to have less knowledge than professional purchasers. Different challenges can therefore be encountered. [Vermunt et al. \(2019\)](#) divided or clustered barriers to several different circular business models (into the following categories: financial (e.g. high upfront investment costs), organizational (e.g. administrative barriers in contracts), lack of knowledge/technology, supply chain (e.g. lack of partners), market (e.g. resistance from customers) and institutional (e.g. deterrent legislation). In their empirical evaluation of PaaS, all these barriers (except for knowledge/technology and supply chain) were identified. A contribution could be to study to what extent these general barriers apply specifically to B2C retailers dealing with consumers.

2.2 Potential mitigations to challenges encountered when transitioning to PaaS

No study focusing on mitigations of challenges encountered when transitioning to PaaS for B2C was identified. Furthermore, "mitigation" has a lot of synonyms, a fact that makes searching for the concept difficult. A broader scope had to be taken to identify mitigations to challenges in the literature, broadening to PSS as well as B2B companies. Therefore, similar weaknesses as in the literature about challenges were noted. [Matchlessly et al. \(2018\)](#) researched B2B companies overcoming barriers in transitioning to PSS; the mitigations were

focusing on assessment of customer value creation and having a PSS facilitator, including product life cycle and cost considerations. Matschewsky *et al.* (2018, p. 2163) also suggested that “implementing PSS in a separate internal organization may lead to a new, forward-thinking mindset.” Parida *et al.* (2014, p. 51) suggested that capabilities in “business model design, partner network management, integrated development process and service delivery network” are mitigations, but they did not discuss these in detail. In 2009, Sundin *et al.* recommended inter-organizational knowledge-sharing and a learning network approach as mitigations. Badenhorst (2017) recommended that management should focus on, for example information systems and staff training/development programs. Having the circular business as an additional business was suggested by Matschewsky *et al.* (2018). In contrast, Parida *et al.* (2014) highlighted necessary capabilities, such as an integrated development process, when transitioning to PSS; this corresponds to the mitigation of including reverse logistics in the development (Badenhorst, 2017). Han *et al.* (2020) add that PaaS is particularly suitable for high-priced products.

To conclude, a small number of potential mitigations were identified, even after broadening the scope to PSS and B2B. In addition, no clustering of mitigations was found, nor were challenges and mitigations matched up with each other. Altogether this highlights the need for empirical research with an inductive approach.

3. Methodology

Given the lack of specific literature base, a qualitative research design with an inductive and theory-building approach suited the exploratory purpose and research questions (Yin, 2018), appropriately building on the introduced concepts. As noted by Gioia *et al.* (2012), advances in knowledge that are too strongly rooted in what we already know delimit what we can better understand, highlighting an advantage with an inductive approach. The research design complemented the seemingly dominant quantitative approach to studying CLSC in retail, exemplified by Pereira *et al.* (2023) and Fota *et al.* (2019), in areas with stronger literature bases. Section 3.1 describes data collection; Section 3.2 describes the analysis and framework development and Section 3.3 discusses the validity and reliability.

3.1 Data collection

The literature review was conducted on the databases DiVA, Business Source Premier, EBSCO, OneSearch, Taylor & Francis, Google Scholar and SAGE to identify literature (including gray literature) published within the last 5 years. The keywords used were “PaaS”, “PSS”, “challenges”, “retailer”, “B2C”, “CLSC”, “forward and reverse supply chain” and “environmental sustainability” (abbreviations as well as full terms).

The empirical data was collected in a multi-interview setup. No sampling frame existed, so a sample was taken from the target population: retailers that operate in the Dutch B2C market using PaaS. The choice of the Dutch market was motivated by the Netherlands being frontrunners, having high research density in PaaS and due to its governmental regulations pushing companies to become more circular and environmentally sustainable by 2050 (Government of the Netherlands, 2022). Due to the low accessibility of relevant in-depth information, two industry experts (coded IndEx1–2) on PaaS were first interviewed, who then suggested other potential respondents (coded R1–4). Thus, non-probability sampling was used—specifically, an indirect form of convenience sampling known as snowball sampling—to select the most information-rich cases and thereby allow the researchers to meet the research objectives (Saunders *et al.*, 2019). Data saturation was considered when the number of cases was established; rules in exploratory research disagree as to when saturation is reached and thus findings are valid (Saunders *et al.*, 2019). With this limited sampling criteria,

an appropriate sample size was determined at four retailers. Details about the respondents (and their codes for empirical data) are given below:

- (1) Industry Expert 1 (IndEx1)—Director of Sustainable Capital Markets; works in the finance industry, with a background in PaaS research.
- (2) Industry Expert 2 (IndEx2)—Co-founder of a retailer offering kitchen-as-a-service; has a research background and contributes to an industry-specific blog.
- (3) Sustainability Support Coordinator, Retailer 1 (R1)—offers bikes-as-a-service as a monthly subscription model, including service and repairs.
- (4) CEO, Retailer 2 (R2)—offers jeans-as-a-service.
- (5) Marketing Executive, Retailer 3 (R3)—offers white goods-as-a-service with pay-per-use, stimulating sustainable and less-frequent product usage.
- (6) Sustainability Manager, Retailer 4 (R4)—offers furniture-as-a-service.

The empirical data was collected through semi-structured interviews. This method was evaluated being relevant, as some questions can be predetermined and thus consistent across all interviews, while leaving the interviewer free to engage with the answers given by the respondent (Saunders *et al.*, 2019). The respondents were provided with information about the research purpose. As this research was carried out during the COVID-19 pandemic (in 2022), Zoom was used. It is acknowledged that this increases the risks for missing mimics, as well as technical difficulties and therefore misinterpretations; however, efforts were made to allay these issues. Each interview lasted 40–55 min and was conducted by three researchers, who took notes. Interviews were conducted in Dutch and translated into English.

3.2 Analysis and framework development

Coding was used to analyze the interviews (Saunders *et al.*, 2019), to create connections between data and the (limited) literature. After transcriptions, the researchers coded all interviews individually and compared them to identify coding patterns. The three stages of coding (Saunders *et al.*, 2019) were used: open coding, axial coding and selective coding. Open coding concerns the division of data in categories or clusters, based on the research questions. Identifying first order concepts (the different challenges and mitigations) lead into second order themes (the eight clusters), following Gioia *et al.* (2012). In the following step, axial coding seeks to determine the relationship between those clusters. Lastly, selective coding brings those relationships together to create a framework. This strategy is iterative, intensive and time-consuming (Saunders *et al.*, 2019). The identified coding matched with the literature or, more often, provided new findings. The data was analyzed cross-case, in search of validating patterns or rival cross-case patterns (Yin, 2018) to understand differences between the companies and the literature.

3.3 Validity and reliability

To increase the construct validity (Yin, 2018), semi-structured but fairly open interview questions (Appendix 1) were derived from the literature (Saunders *et al.*, 2019). During the interviews, three researchers were present, to avoid interpretation bias and increase internal reliability (Yin, 2018; Saunders *et al.*, 2019). Individual notes were consolidated post-interview for greater reliability and sent to respondents for verification. This, along with the fact that respondents demonstrated that they understood the questions, increased the validity (Saunders *et al.*, 2019). External validity is further elaborated in 5.4 Limitations. The inter-rater reliability (IRR) requirements described by McAlister *et al.* (2017) require a score of 75%

or higher, for reliable coding. The average IRR score calculated by the researchers was 82%. Which is sufficient to establish that the interviews were coded reliably, systematically and consistently, minimizing subjectivity and thereby contributing to the study's reliability. Overall validity of the study was enhanced through the inclusion of ethical aspects. Examples include respondents' consent regarding anonymity and respecting the privacy and confidentiality of the participants. Therefore, the study faces a low likelihood of social desirability bias, which contributes to its validity. Altogether, the study was conducted with well-constructed research design and suitable methods.

4. Analysis and discussion

The literature has identified some challenges when transitioning to PaaS and provided two suggestions on how to cluster challenges. In light of the collected data, the division of challenges by Kuipers (2021) was expanded to include more specific clusters, as many challenges fell under Kuipers's (2021) organizational cluster. The new clustering has some resemblance to Vermunt *et al.* (2019). Challenges and mitigations are divided in eight clusters: finance, product-related, supply chain-related, consumer-related, human resources (HR), research and development (R&D)/technology, regulatory-related and industry-related.

4.1 RQ1: What challenges have B2C retailers encountered when transitioning to PaaS?

B2C retailers transitioning to PaaS encountered 45 challenges, mentioned by the three entities: literature, industry experts or PaaS retailers. The challenges were sorted into the eight clusters. By marking the origins of each challenge with "X", it is clear at which entities they were encountered, as displayed in Table 1. The 26 challenges that could be matched with at least one mitigation (italicized and numbered, for easier referencing) are included in the analysis and framework development. This also meant that all those nine challenges that were encountered by all three entities, were included. They were placed on top in each cluster. These nine constitute the most important challenges that B2C retailers have encountered when transitioning to PaaS.

The financial cluster comprises ten challenges. Just four are linked to mitigations, indicating that this cluster is particularly challenging. The shift toward using reused materials will remain slow while *virgin materials are significantly cheaper than reused materials (1)* (Kuipers, 2021; IndEx1; IndEx2; R1; R2; R3; R4). IndEx1 said, "There are more costs involved at the end than in the beginning"; the challenge of *high upfront investment costs (2)* is found in the products being offered and in the design of reverse logistics, which is costly and time-consuming (e.g. Kuipers, 2021). Closely related is the *high investment risk (3)*. From the financial perspective (IndEx1), this risk is higher for B2C, due to the multitude of consumers and the flexibility of their contracts. Lastly, the *lack of data proving financial viability (4)* is challenging in the transition to PaaS (Kuipers, 2021), especially when proving financial viability to an investor. IndEx1 states that funding is harder for a B2C PaaS retailer: "Banks can finance PaaS, but they currently support more B2B since proving financial viability is easier."

The product-related cluster has five challenges, all with matched mitigations. To start, *PaaS is not suitable for every product (5)*. Retailers must consider whether their product is suitable in terms of recyclability and consumer acceptance. Han *et al.* (2020) noted that high-priced products are particularly suited for PaaS. In addition, PaaS requires *non-trend-sensitive products (6)*, to enable longer life cycles (Antikainen *et al.*, 2021). Closely related to that is *correct product design (design for disassembly) (7)*; this was mentioned by both industry experts and all retailers, exemplified by the following quote: "To extract the value in returned products, preparing for reuse can be costly unless design for disassembly is included" (R4).

Cluster	Challenge	Encountered by Literature	Industry experts	PaaS retailers
Financial	<i>Virgin materials are significantly cheaper than reused materials (1)</i>	X	X	X
	<i>High upfront investment costs (2)</i>	X	X	X
	<i>High investment risk (3)</i>	X	X	X
	<i>Lack of data proving financial viability (4)</i>	X		
	Cash-flow problems	X	X	
	Translating pay-per-use to certain industries			X
	Difficulty in determining which party pre-finances	X		
	Limited circular procurement	X		
	Trade-off sustainability and cost/profit			X
	Limited funding for circular business models	X		X
Product-related	<i>PaaS is not suitable for every product (5)</i>	X	X	X
	<i>Non-trend-sensitive products (6)</i>	X	X	
	<i>Correct product design (design for disassembly) (7)</i>		X	X
	<i>Product complexity (8)</i>		X	X
Supply chain-related	<i>Lack of standardization (9)</i>	X		
	<i>Complexity of value creation (10)</i>	X	X	X
	<i>Limited willingness to collaborate within the supply chain (11)</i>	X		X
	<i>Finding the right supply chain partners (12)</i>			X
	<i>Designing and formalizing reverse logistics (13)</i>	X	X	X
Consumer-related	Locked into partnerships		X	
	<i>Lack of consumer awareness and interest (14)</i>	X	X	X
	<i>Consumer acceptance/trust and confidentiality issues (15)</i>	X	X	X
	<i>Consumer's need for ownership (16)</i>	X	X	
	<i>Service is more expensive than buying in the long term (17)</i>	X		X
	<i>Crowding out of "sustainable" careful consumers (18)</i>			X
	Different needs and barriers	X	X	
Human resources	Consumer does not want to be sustainable	X	X	
	<i>Lack of expertise (on a management level) (19)</i>			X
	<i>Lack of employee knowledge/expertise (20)</i>	X		X
	Lack of support from senior management	X		
	Hesitant company culture	X		
	Educating employees			X
Research and development	Finding the right personnel			X
	<i>Circularity of materials/need for research in technology/R&D (21)</i>			X
	<i>Lack of research in PaaS and B2C (22)</i>	X		
	R&D makes product obsolete			X
	Lack of ideal management information system	X		
Flattening the curve of improvement			X	

Table 1.
Clustering and origin
of mitigated challenges

(continued)

Cluster	Challenge	Encountered by		PaaS retailers
		Literature	Industry experts	
Regulatory	<i>Taxing system (23)</i>	X	X	
	<i>Obstructive laws and regulations (24)</i>	X		X
	<i>Lack of global consensus (25)</i>	X		
	<i>Building decrees</i>	X		
Industry-specific	<i>Operating in a linear system (freeloading on the PaaS wave) (26)</i>	X	X	X
	<i>Lively second-hand market in the Netherlands</i>			X
	<i>Conservative industry</i>	X		

Source(s): Author's own work

Table 1.

Similarly, *product complexity (8)* complicates recycling: a lot of different materials make recycling and finding the right partners difficult, mentioned by IndEx2, R1 and R2. This challenge is also linked to the challenge of *lack of standardization (9)* mentioned by Kuipers (2021).

The supply chain-related cluster comprises five challenges, of which four have mitigations. The link between PaaS and supply chain was pointed out by Delafenestre (2019). The *complexity of value creation (10)* was stressed by Parker (2021) and Marek (2020) in terms of what is included in the service, and respondents focused on the practical implications of creating an attractive revenue model for PaaS. The literature and PaaS retailers agreed about the *limited willingness to collaborate within the supply chain (11)*, with one stating that “the more we work together [. . .] the harder it becomes to separate from that partner” (IndEx2). Hence, it is very important to choose supply chain partners carefully, as it is costly to change. This is closely linked to the challenge of *finding the right supply chain partners (12)*, although PaaS retailers disagreed with each other on this: R1 and R2 are continuously looking for better supply chain partners, after which they can be locked in, making it difficult to switch (IndEx2). Furthermore, as R2 specified, “You can’t be circular without being close to your supply chain partners.” *Designing and formalizing reverse logistics (13)* was mentioned by Badenhorst (2017), and both types of respondents confirmed that this is part of their continuous improvements.

The consumer-related cluster—critical in B2C contexts—consists of seven challenges, of which five have mitigations. One is the *lack of consumer awareness and interest (14)*, illustrated by R3: “98% of Dutch consumers still buy a washing machine.” Closely related to that is *consumer acceptance (15)*, involving trust and confidentiality issues (mentioned by, e.g. Antikainen et al., 2021; Oliveira et al., 2021), together with *consumers’ need for ownership (16)* (Antikainen et al., 2021). As R2 said, “They say they want an environmentally sustainable product, but don’t buy it”. Another challenge is that *service is more expensive than buying in the long term (17)*; consumers might not get involved with a PaaS retailer when the service costs more than buying the product: “You don’t only look at what is cheaper (buying or leasing) but also the value of the service; it is the service model that makes it interesting” (R4). All these factors come together in the challenge *crowding out of “sustainable” careful consumers (18)*, which means that the business model is less applicable to the masses.

Six challenges are linked to HR, of which two have no matching mitigations. The *lack of expertise (on a management level) (19)* in working with PaaS was stressed by PaaS retailers. This is also connected to the challenge of *lack of employee knowledge and experience (20)*. For example, R1 stated: “Mechanics all have their ways of working [. . .] when one handlebar is

broken and the other one is worn, they are likely to replace both, causing a greater outflow of materials." Only when environmental sustainability is seen as a driver of employee behavior and embedded in the company culture, it will succeed.

Five challenges comprise the R&D/technology cluster, of which two have mitigations. The *circularity of materials/need for (costly) research in technology and R&D (21)* is a key challenge, because it is connected to the idea of environmentally sustainable PaaS. As IndEx2 stated: "You see that if it is too costly to repair or refurbish, then companies just throw it away." However, respondents did not agree. Due to the frequent interactions that occur when the consumer is kept in the CLSC, gathering data is easy: "The company is very data-oriented and most of the decisions are data-based" (R1). In addition, the literature has only just begun to address this topic, which means another challenge is a *lack of research in PaaS and B2C (22)* (Antikainen *et al.*, 2021; Moro *et al.*, 2020; Matschewsky *et al.*, 2018), limiting the theoretical framework on which retail managers can build.

Four challenges comprise the regulatory cluster, of which three have mitigations. An inconvenient *taxing system (23)* makes PaaS less attractive (Kuipers, 2021). Industry experts mentioned the taxation of virgin materials, which makes it more attractive to consider reused materials. This is connected to the challenge of *obstructive laws and regulations (24)*, another challenge that PaaS retailers experience: "Government regulations would help in achieving circularity and motivating companies to increase their environmental sustainability level" (R4). IndEx1 disagreed that laws and regulations are challenges, mentioning the positive impact of certain regulations in the EU circular economy plan on increasing the popularity of PaaS. At the same time, only some governments use regulations on virgin materials to incentivize the use of reused materials, which highlights the *lack of global consensus (25)* (e.g. Government of the Netherlands, 2022; Kuipers, 2021).

The industry-related cluster consists of three challenges, of which one is linked to a mitigation. The respondents mentioned that some companies that started as rental companies are now "freeloading" on the wave of PaaS for marketing purposes, *operating in a linear system (but freeloading on the PaaS wave) (26)* (Kuipers, 2021) without applying a CLSC. IndEx1 mentioned that some companies that were using the business model rebranded themselves as being environmentally sustainable, stating: "They get a new consumer pool who buy it [. . .] but their intentions were not necessarily environmentally sustainable."

4.2 RQ2: How can challenges that B2C retailers encounter when transitioning to PaaS be mitigated?

The mitigations presented here are heavily based on the empirical findings. Some respondents even gave examples from other studied retailers (data validation). The 24 identified mitigations are divided into the same clusters as the challenges, but this does not mean they are exclusively used to mitigate challenges from the same cluster: for example, a financial challenge can be mitigated by a regulatory mitigation. Mitigations can be used for multiple challenges, and challenges have multiple mitigations.

In the financial cluster, two mitigations were found. Literature and some respondents agreed that PaaS could be a *side business* alongside selling products, to overcome the high investment costs and risks (Matschewsky *et al.*, 2018; IndEx1; IndEx2; R2). Furthermore, Han *et al.* (2020) and IndEx1 agreed that PaaS is especially suitable for products priced above the *price bar* of €150, which overcomes the product suitability challenge.

The product-related cluster has two mitigations. First, IndEx2, R1 and R2 agreed that *increasing circularity* can overcome the non-trend-sensitive product challenge. "All these factors combined makes it way more interesting to take back the product and reuse it for the highest possible value" (IndEx2). Furthermore, companies need to *design for sustainability/disassembly*: thinking about circularity from the start of the design process increases the

opportunities to close the supply chain (Parida *et al.*, 2014; IndEx1; IndEx2; R1; R4). The best mitigation will not make a retailer environmentally sustainable if it is not intended.

The supply chain-related cluster was central, with eight mitigations. First, *communication with suppliers* is necessary to integrate processes within the supply chain, after which companies can *work intensively with suppliers* to increase the circularity of their product (IndEx1; IndEx2; R1; R2; R3; R4). This can eventually lead to a *shared responsibility* with suppliers (R1; R3): “We recycle with a partner” (R3). In addition, as stated by Parida *et al.* (2014), an *integrated development process* is necessary when moving to PaaS. IndEx1 and R2 added that the *network design* itself is another potential through which to achieve environmental sustainability. R4 offered a more practical tool—*introducing a scorecard for suppliers*—to increase supplier integration and sustainability focus: “We see a shift, we see them moving and being more ambitious.” Furthermore, as Badenhorst (2017), R1, R2, R3 and R4 all stated, creating a CLSC is not possible without *including reverse logistics in the development/integrating the parties*. “We have to think about our return logistics [. . .] and how to integrate it in the supply chain together” (IndEx2). The reverse supply chain should be included in the network design to create a seamless process. The final mitigation in this cluster was offered by R1 and involves choosing a *centralized waste partner* to minimize the logistical burden of separating waste.

The consumer-related cluster has six mitigations. *Close contact with consumers/regular check-ups* are necessary to understand the customers’ needs and better respond to market changes (IndEx2; R1). For example, R1 explained, “There is a lot of interaction with consumers. The company is very data-oriented and most of our decisions are data-based.” *Increasing consumer awareness* is crucial to changing buying patterns, educating consumers and reducing consumers’ need for ownership (R1; R3). Additionally, as mentioned by IndEx1 and R2, *transparency* is needed to reduce the knowledge gap for consumers and to increase acceptance. Through the *use of social media*, consumers can be educated about their environmental footprint, which can enable their transition(s), since the “hassle of ownership really became a thing” (IndEx2). Furthermore, *offering a discount* can help overcome the need for ownership as well as reduce the complexity of value creation (R2). The last mitigation which also resolves the former issue, is an *ownership-free society* (IndEx2).

In the HR cluster, one mitigation was found: *increase employee awareness/knowledge* by educating them about the environmental sustainability. Furthermore, during the hiring processes, the focus should be on engagement with environmental sustainability (R1). For example, R1 said: “Oftentimes, sustainability is just a team within a company that tries to get people on board. It should be the other way around, everybody should make such decisions.” The R&D/technology cluster consists of three mitigations. There should be an *increased usage of data*, which can be utilized during design to increase product circularity. With respect to mitigating the lack of data, lack of expertise and lack of knowledge among consumers, employees and suppliers, *knowledge-sharing* (Sundin *et al.*, 2009) is crucial. In addition, new knowledge should be obtained by *working with universities on R&D*. “We were funded from academic research by TU Delft and really focused on academic perspectives (R3).” The regulatory cluster consists of two mitigations. The first is government regulations *limiting linear business models* and stimulating sustainable business models (Oliveira *et al.*, 2021; IndEx1; IndEx2; R2; R3). IndEx1 stated: “If you tax virgin materials, then automatically the value of the materials becomes bigger, it is an incentive to do more with the product.” Closely related to this is the need for a *government push to stimulate circular business models* and to motivate consumers to make more sustainable choices.

The most prominent and useful mitigation, in terms of how many challenges they mitigate (shown by the number of ovals far right in Figure 1), is having PaaS as a side business, the use of social media (educating consumer) and working with universities on R&D, that match five

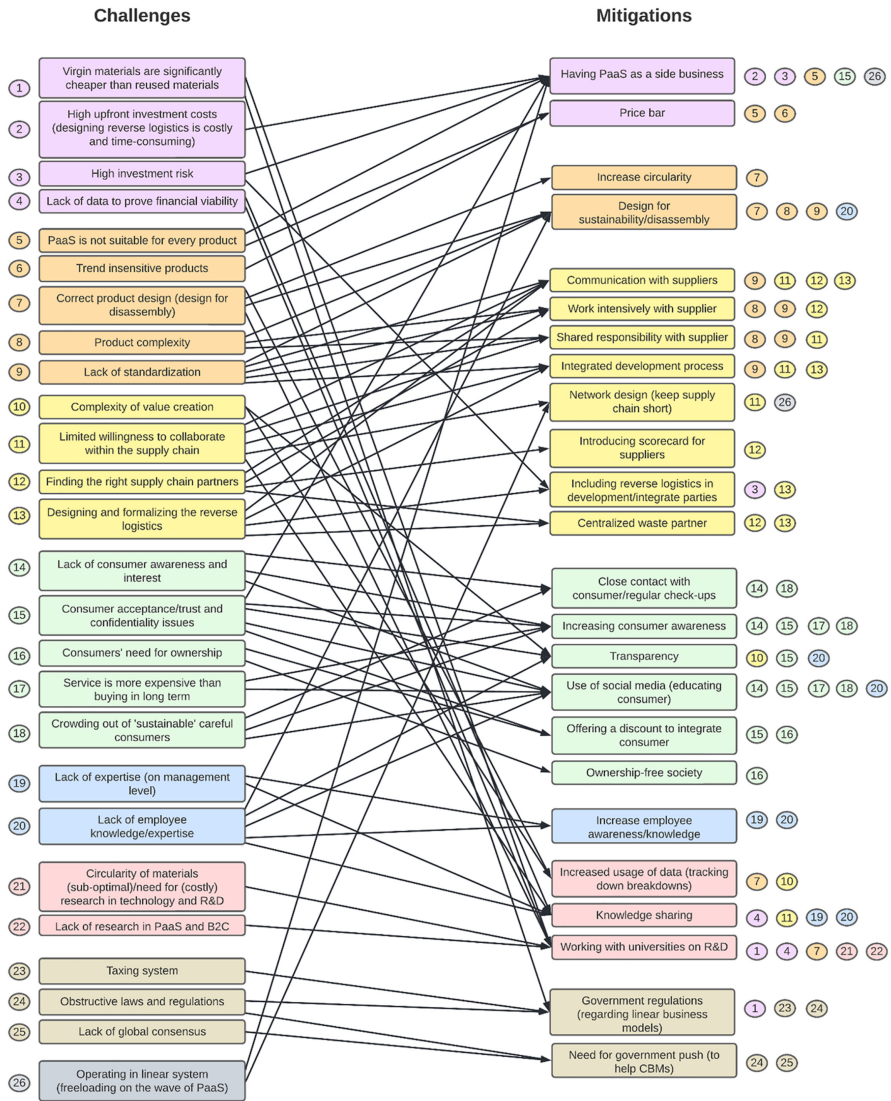


Figure 1. Framework – challenges and matched mitigations for PaaS B2C retailers

Source(s): Authors' own work

challenges each. Design for sustainability/disassembly, communicating with suppliers, increasing consumer awareness and knowledge sharing match four challenges each.

4.3 Presenting a framework of challenges and matched mitigations for PaaS B2C retailers

The findings of the study—grouped in eight clusters and displayed with different color codes—are shown in [Figure 1](#). Clustering is used for both challenges and mitigations, with the focus on organizing the challenges (left side). Matches between challenges and mitigations are displayed; since most challenges are linked to several mitigations, color-coded numbers are provided as a complement.

5. Conclusion, contributions, limitations and further research

The purpose of this paper was to explore and develop a framework of challenges and corresponding mitigations encountered by B2C retailers when transitioning to PaaS. Linear supply chains induce a risk that product responsibility moves to the consumers, and decisions are not taken by the most sustainability-knowledgeable actor. B2C retailers can take back product responsibility and use PaaS to enable CLSC that offer consumers recoverable products and increased environmental sustainability ([Pereira et al., 2023](#)). The framework divides 26 identified challenges into eight clusters: financial, product-related, supply chain-related, consumer-related, HR, R&D/technology, regulatory and industry-related. The framework also comprises 24 mitigations, with most challenges being matched with several mitigations.

5.1 Contributions to literature

The paper bridges gaps between literature and practice. No identified study has focused on B2C retailers when addressing PaaS challenges and mitigations. The related literature suffered from weaknesses as not being PaaS-specific, being less scientific and not addressing B2C retailers. This exploratory study can therefore be a first step in a theory-building approach (e.g. [Yin, 2018](#)). It contributes to the body of knowledge on PaaS, expanding it to the generally under-researched context of retail ([Dagiliene et al., 2022](#); [Bolton, 2019](#)) by identifying and clustering challenges for B2C retailers when transitioning to PaaS. Addressing B2C retailers is an expansion and responds to the gap in literature pointed out by, for example [Zhao and Wang \(2021\)](#) and [Moro et al. \(2020\)](#). Contributions built particularly on [Kuipers \(2021\)](#) and [Vermunt et al. \(2019\)](#) by developing their clusters and some of their challenges. The study also contributed by providing empirically identified challenges to B2C retailers and by matching challenges with mitigations. A concrete contribution is the developed framework. The study further contributes to CLSC literature by expanding it to a less-studied context. Method-wise, by applying a complementary qualitative research design, many supply chain-related challenges—as pointed out by [Tat et al. \(2023\)](#)—and even more mitigations encountered by B2C retailers, were revealed.

5.2 Managerial contributions

This study shows new ways for retail managers to meet ([Tat et al., 2023](#)) and support ([Dagiliene et al., 2022](#)) consumers' environmental awareness. The developed framework offers practical contributions and guidance to managers at PaaS retailers in the B2C industry, by matching challenges with potential mitigations. It highlights the important role of supply chain-related issues for retailers, particularly when it comes to mitigations. The insights from industry experts and respondents from different retail industries can offer practical examples supporting an expansion of PaaS among B2C retailers. One managerial contribution, exemplifying how the results can be applied in different contexts, is the fact that many financial challenges were not possible to match with mitigations. This can be a signal to financiers and banks. Assessing the economic and commercial impacts is beyond the purpose of this study. The practical use of this framework is twofold. First, it can be used as a reactive

approach, by managers encountering certain challenges and looking for possible mitigations. The following potential scenario indicates how the framework can be used: a retail manager struggling with consumer acceptance (challenge 15 in [Figure 1](#)) can discover five potential mitigations (e.g. give a discount to make (re)integration more attractive). Second, retail managers can use the framework as a proactive approach, by identifying future challenges and preventively mitigate. For instance, a retail manager that foresees a lack of expertise on a management level (challenge 19 in [Figure 1](#)) can prevent this by increasing employee awareness/knowledge and sharing knowledge.

5.3 Social and environmental sustainability contributions

This research provides social contributions in terms of creating awareness about environmental sustainability (e.g. [Tat et al., 2023](#)) and footprints with the potential to improve societal benefits, as a PaaS-enabled CLSC is one step toward that goal. This can support retailers in developing their important supply-chain-related role in securing sustainability ([Dagiliene et al., 2022](#); [Bolton, 2019](#)). There were HR challenges that could not be matched with mitigations, such as the need for educating employees, which send signals to different educators. PaaS knowledge also has the potential to reach university curriculums, influencing teaching in supply chain management and sustainability. The low implementation rate of PaaS indicates the presence of challenges. The identified mitigations, ranging from consumer education to sustainable design of products, offer a pathway for retailers to navigate these challenges while simultaneously conducting environmentally and societally conscious business. As retailers embrace PaaS business models, they can not only raise awareness about sustainable consumption, but also influence public attitudes and actively contribute to lessening environmental footprint. This study can serve as a catalyst for fostering sustainability awareness and ultimately affect and improve quality of life.

5.4 Limitations

One tool used to minimize bias-related limitations was individual coding by three researchers and the calculation of IRR scores. The scarcity of topic-specific and scientific literature is one limitation, as the scope of the literature had to be widened to capture PaaS challenges. As the study, beyond two industry experts (in finance and kitchens), comprised four retailers in four industries (bikes, jeans, white-goods and furniture), with a geographical focus on the Netherlands, limitations regarding generalizability or external validity should be recognized. At the same time, addressing several industries could generate knowledge that carefully can be applied in several contexts.

5.5 Future research

As a next step in a theory-building approach, the framework could be further tested by investigating various hypotheses or propositions, in line with suggestions from [Yin \(2018\)](#). Future research should investigate those 19 challenges for which no mitigations were identified; especially for the financial, HR and R&D/technology clusters of challenges, which were only touched on in [Kuipers \(2021\)](#) and [Marek \(2020\)](#). [Table 1](#) can assist in understanding their origin; from literature, industry experts or PaaS retailers. The economic and commercial impacts of the study display opportunities for further research. In addition, future research should be conducted in other countries to determine the generalization of the findings. It would be relevant both to go deeper into one of the studied industries and increase the external validity there, and into other industries.

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Appendix Interview guides

Industry experts

RQ1

- (1) What are possible reasons for retailers to work with PaaS?
- (2) PaaS is seen as an environmentally sustainable business model. What are reasons for companies to not use it?
- (3) What do you think are the biggest challenges that PaaS retailers encounter?

RQ2

- (1) How do retailers mitigate the respective encountered challenges when transitioning to PaaS?

PaaS retailers

- (1) Can you explain the business model and the supply chain that your company is working with?
- (2) Who holds the ownership of the products?

RQ1

- (1) PaaS is seen as an environmentally sustainable business model. What do you think are reasons for retailers to not use it?
- (2) Which challenges have you encountered when transitioning to PaaS?

(1) How did your company mitigate the encountered challenges when transitioning to PaaS?

Source(s): Author's own work

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