



B2B manufacturers in pursuit of Product-as-a-Service: Motivations, barriers, and approaches[☆]

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1. Introduction

Many manufacturers in the business-to-business (B2B) and business-to-consumer (B2C) sectors have shifted their practices from selling products to providing integrated product-service solutions that focus on creating comprehensive value propositions for their customers, following a path commonly referred to as servitization. This phenomenon has prevailed for over two decades (Raddats et al., 2019), leading to a paradigm shift in the way that manufacturers compete. Rather than relying on traditional product differentiation, product-based manufacturers are increasingly pursuing long-term customer relationships (Kamalaldin et al., 2020), revenue stability (Wang et al., 2018), and swift adaptation to changing market dynamics (Coreynen et al. 2020) through service-oriented business models and strategies.

Influenced by technological advances and market changes, the servitization wave has evolved through different eras (Vandermerwe and Erixon, 2023). At its core is the idea that manufacturers should embrace product-as-a-service (PaaS) business models, which shift the value exchange by transitioning customers from product ownership to access-based utilization. While PaaS schemes have been around for several years and explored by such pioneers as Rolls-Royce, Philips, Xerox, and Michelin, the literature provides limited insights into what manufacturers need in order to develop and implement such service-oriented business models alongside their traditional product sales models (Benedettini, 2025). PaaS involves a much stronger service orientation in value creation and value capture than other servitization routes, and thus a significant shift away from traditional sale-based models. Consequently, establishing a PaaS business model has substantial impacts on organizational activities and functions – including offer development, sales, technology adoption, financial management, and customer engagement (Kowalkowski and Ulaga, 2024) – which makes it pivotal to comprehend the associated challenges. However, notable

knowledge gaps persist regarding the complexities and challenges that manufacturers encounter when adopting PaaS business models, as well as the factors associated with the growing interest in these models by industrial manufacturers.

First, existing research predominantly focuses on explaining the idea of PaaS, how it differs from other forms of servitization, and its potential to drive competitive advantage and growth. For instance, recent literature has mainly focused on theorizing the alignment of PaaS business models with the emergence of the circular economy (Kühl et al., 2020; Benedettini, 2025) or the uptake of subscription offers (Vandermerwe and Erixon, 2023), with less attention given to the role that PaaS business models actually play in the evolution of strategies and plans of today's manufacturers. Second, there remains a scarcity of research concerning companies that are still in the process of developing, implementing, and scaling their PaaS business models. Existing research generally focuses on a few front-runners that are highly experienced in PaaS implementation. However, many manufacturers have only recently embarked on a PaaS journey. Third, there is limited understanding of the challenges posed by external forces that shape the operating environment in which manufacturers pursue PaaS models, such as technology advances, accounting rules, and regulatory/legal constraints. Despite increasing research in the PaaS area, the primary focus has been on implementation issues that are internal to the firm or related to its relationships with customers and channel partners.

Against this backdrop, this paper seeks to empirically explore the drivers behind current manufacturers' PaaS initiatives and the complexities associated with their establishment. More specifically, we address the following research questions:

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- What motivates manufacturers to pursue the adoption of PaaS business models?
- How do manufacturers navigate the exploration, design, and deployment of PaaS business models?
- How do external factors affect the overall complexity for manufacturers of implementing PaaS business models?

The present study focuses on B2B settings. In B2B, PaaS business models typically concern complex offers involving capital-intensive products (Grubic and Jennions, 2018) and highly advanced service components (Parida and Jovanovic, 2022). Moreover, unlike their B2C counterparts, B2B offers are often highly customized and resort significantly to digital technologies to suit the idiosyncratic needs of individual customers (Korkeamäki et al., 2021).

The present study makes three main contributions. First, we shed light on how B2B manufacturers currently sense, interpret, and explore PaaS business model opportunities beyond their potential value. Generally, these manufacturers do not adopt PaaS models to drive growth by leveraging their digital expertise or opening new avenues for innovation, as existing literature would suggest. Instead, they respond to shifts in customer expectations, loyalty, and competition that could erode their market share and revenues. Second, we empirically document the challenges of adopting PaaS business models and emphasize how such transitions necessitate fundamental changes in financial management, digital capabilities, and partnership methods. Lastly, we identify key regulatory and institutional barriers, including accounting standards, data privacy laws, and financing constraints, which critically influence the scalability and success of PaaS initiatives. By framing PaaS adoption as a market-driven response rather than merely a strategic innovation-led organizational initiative, we offer a fresh perspective on how manufacturers can effectively align the PaaS business model within a dynamic market. Together, our findings highlight the significance of external stakeholders, including regulators, investors, and industry bodies, in shaping the future of PaaS adoption.

The remainder of the paper is structured as follows. The next section, based on a literature review, establishes a theoretical backdrop to our study. Section 3 presents the research approach and methods applied, while Section 4 presents and discusses our empirical findings. In Section 5 we respond to our three research questions, synthesize our results, and introduce a conceptual framework capturing manufacturers' transformation for PaaS. Finally, Section 6 offers conclusions and their implications for research and managers, limitations of the study and avenues for further research.

2. Conceptual background

PaaS business models imply a shift whereby manufacturing companies move from selling products to offering service solutions (Cusumano et al., 2015). In contrast to conventional sales models, the PaaS business model employs a service mindset where customers are charged based on the value generated by product use (Agrawal and Bellos, 2017; Gao et al., 2023), shifting performance, organizational, technological, financial, and supply chain risk to the manufacturer (Gebauer et al., 2017; Sjödin et al., 2022). Consequently, customers benefit from the capabilities and outcomes of the product without needing to own or maintain it (Whalen & Whalen, 2020; Windahl et al., 2004).¹

¹ Marketing a product's functional result or application instead of the product itself fundamentally changes how value is created and captured, leading to a different business model. However, at the heart of PaaS business models is a unique market offering, where the provider commits to delivering all resources and activities necessary to achieve a specified output of customer value. Consequently, we use the terms *PaaS business models* and *offerings* interchangeably.

In the context of B2B product industries, the PaaS paradigm is increasingly being touted as the next driver of business growth; many manufacturers of capital equipment and industrial durable goods are considering upgrading their service-based value propositions through the introduction of PaaS offerings (Beneditini, 2025; Kowalkowski and Ulaga, 2024). The inclusion of intelligence capabilities and connectivity into products, along with developments in data processing and analytics, have increased the technical and economic feasibility of such offers (Sjödin et al., 2022; Burger et al., 2024). While market saturation and challenging economic conditions reshape the opportunity space for manufacturing companies, they also offer new business opportunities that focus on customer utility and value (Böhm et al., 2016).

However, adopting or implementing a PaaS business model introduces significant organizational complexities and implies fundamental changes in ways of working, technology choices, capability needs, etc. As such, it represents a challenging endeavor for companies of all sizes, whether they are start-ups or large established manufacturers. Industrial executives need help to figure out why some advantages of PaaS offerings are accelerated in the current market landscape. As their companies embrace the PaaS model, they also need help to articulate and manage the many, and often unfamiliar, challenges they will face during such a transformative journey. While PaaS is not a novel concept (Grubic and Jennions, 2018), its practical requirements have been insufficiently studied and have evolved in parallel with technology developments and new institutional (regulatory, competitive, etc.) forces acting on the market. These considerations motivated us to undertake an empirical exploration of the motivations, as well as overall approaches and challenges, that currently characterize the adoption of PaaS business models by industrial manufacturers. Over time, the PaaS concept has been addressed by three areas of literature: servitization, business model innovation, and subscription services. Since these areas provide the conceptual foundation of our study, we deem it useful to summarize their key insights regarding integrating PaaS offerings into manufacturers' competitive strategies.

2.1. PaaS offerings in the servitization literature

The servitization literature typically describes PaaS offerings as the most advanced form of service provision that manufacturing firms may embrace (Grubic & Jennions, 2018; Parida and Jovanovic, 2022; Kramer et al., 2024). Adopting a PaaS business model is interpreted as the endpoint of an organizational transformation from being a product manufacturer to a service provider (Oliva & Kallenberg, 2003), a process whereby product-based firms progressively enhance their service offerings and assume increasing responsibilities for customers' operational activities (Windahl & Lakemond, 2010; Fliess & Lexutt, 2019). As research on servitization has developed, several generic frameworks have illustrated the transformation path leading to PaaS provision and outlined intermediate stages of service transition (Fliess & Lexutt, 2019; Soellner et al., 2024). Notwithstanding some early exceptions (e.g., Oliva and Kallenberg, 2003), researchers have highlighted that firms can follow different transition trajectories (e.g., Penttinen & Palmer, 2007; Matthyssens & Vandenbempt, 2010; Corneynen et al., 2017), which have implications for resource configuration and adaptation. This area of study has clearly focused more on offering typologies of ideal transition paths from products to services than on providing practical evidence of PaaS implementation and adoption. Similarly, Hypko et al. (2010), Hou and Neely (2018), Grubic and Jennions (2018), and others have conceptualized PaaS business models, fostering a rich and engaging debate about their defining characteristics. Despite the specific conceptualization, this literature has widely recognized the transfer of risk to the provider as an inherent feature of the PaaS value proposition (Bond et al., 2020). Therefore, scholars like Korkeamäki et al. (2021) and Karatzas et al. (2022) have questioned whether and when manufacturing firms can benefit from moving towards a PaaS business logic. Some studies have advocated for

a contingency perspective, suggesting that PaaS business models are better suited to certain industry contexts than to others (Cusumano et al., 2015; Worm et al., 2017). Nevertheless, the emphasis on the role of industry conditions has piqued interest in understanding how firm-level factors influence the potential outcomes of PaaS offerings, including aspects such as technical and dynamic capabilities (Ulaga and Reinartz, 2011; Gebauer et al., 2017), organizational architectures (Heirati et al., 2023), and alignment with service network partners (Parida & Jovanovic, 2022), which can support successful PaaS implementation. However, this narrative has portrayed PaaS business models as challenging and still largely uncharted territory for most manufacturing firms. Servitization studies have consistently found that the prevalence of PaaS offerings actually remains limited across many B2B industries (e.g., Ulaga and Reinartz, 2011; Kowalkowski et al., 2015; Soellner et al., 2024).

2.2. PaaS offerings in the literature on business model innovation

Research in the field of business model innovation has drawn on business model theory to analyze PaaS offerings as a vehicle for corporate transformation and growth, directing attention to the development of specific transformation guidelines. Visnjic et al. (2017) considered Amit and Zott's (2001) categories of value drivers of business model innovation for digital start-ups and explored the specificities they present in PaaS contexts. Sjödin et al. (2020) utilized a well-established three-phase process framework of business model innovation to discuss the common journey that enables providers and customers to create and capture value from PaaS offerings. Visnjic et al. (2018) applied the notion of open business models to describe the implications of involving suppliers and partners in PaaS provision. Those studies show that revamping the business model toward a PaaS orientation is a complex endeavor that often conflicts with the existing business logic, design structures, and activity system of B2B manufacturing firms. Other studies have concentrated on specific aspects of business model innovation, providing guidelines to manage design-related and operational elements of PaaS implementation, such as adopting new value-based revenue models (Linde et al., 2023), predicting the residual value of products for financial risk assessment (Fallahi et al., 2023), and achieving systematic coordination between changes in strategic dimensions and operational aspects (Mutha et al., 2022; Agrawal & Bellos, 2017). In these ways, the business model literature has highlighted the need for practical advice about how to successfully implement PaaS offerings. A sub-stream of this literature has explored the notion of circular business model innovation, noting that the PaaS approach has the potential to generate environmental benefits from supply chain circularity since the provider (who is in control of the product over the life-cycle) is incentivized to minimize resource use to increase profits. However, the connection between PaaS business and circularity remains largely theoretical, raising the question of whether PaaS offerings truly represent a shift toward a more sustainable business logic in manufacturers' plans and intentions.

2.3. PaaS offerings in the literature on subscription services

PaaS offerings are attracting attention in the emerging literature on subscription services, being referenced as an extension of the traditional concept of subscriptions (that is, market offerings where customers are granted access to a service in return for a periodically recurring fee) from the software, IT, and digital media sectors (Kowalkowski & Ulaga, 2024). Within this literature, PaaS offerings are conceptualized as product-based subscriptions that adopt usage-oriented or outcome-oriented accounting, rather than periodic accounting (Burger et al., 2024). The complex and capital-intensive product component, the long-term contractual agreement (Riesener et al., 2020), the integration of resources between provider and customer (Kowalkowski & Ulaga, 2024), and the focus on the needs of individual customers

(Vandermerwe & Erixon, 2023) have been highlighted as further characteristics that differentiate PaaS offerings from other recurring revenue offers, especially those typically found in B2C markets. Research on subscription services has developed alongside the discourses of servitization and business model innovation, remaining predominantly disconnected from those streams (Kowalkowski & Ulaga, 2024). Broadly, such research emphasizes the idea of subscriptions as a trend that is gathering momentum and is expected to become increasingly prevalent across product-centric industries. These studies suggest that while only a few pioneers have added PaaS offerings to their portfolios thus far, pursuing PaaS growth will emerge as a strategic priority for many B2B manufacturers (Burger et al., 2024). At the root of this perspective is the notion that new customer generations seek to switch from the traditional capital expenditure model, based on one-off product sales, to an operational expenditure model based on recurring payments for valuable outcomes achieved through product functioning and use (Nansubuga & Kowalkowski, 2024). Nevertheless, subscription research links the growing interest in PaaS offerings in B2B markets to the Industry 4.0 era, noting that the progressive addition of sensors to industrial products and the associated data flows enable the provision of connected services and functions at an increasing rate (Burger et al., 2024). Recognizing the importance of these developments, scholars have argued for a better understanding of the PaaS paradigm, as well as for more empirical research that highlights the critical factors associated with its adoption. Kowalkowski and Ulaga (2024) analyzed different types of B2B subscription (PaaS-type) offerings, along with their implementation requirements and growth potential. Other recent studies have discussed the characteristics of the PaaS paradigm in particular B2B sectors, proposing managerial strategies or procedural instructions for implementation (e.g., Riesener et al., 2020; Nansubuga & Kowalkowski, 2024) or exploring specific obstacles to implementation (e.g., cybersecurity risks; Schuh et al., 2021). With the notable exception of Burger et al. (2024), few studies have provided empirical evidence on how manufacturing firms are interpreting PaaS opportunities and the overall changes and complexities that accompany the adoption of the PaaS paradigm.

3. Method

Given the nascent nature of PaaS business models in B2B contexts, we applied a qualitative research approach, which is well-suited for exploratory research (Flick, 2022) and studying complex phenomena that are not yet well understood (Homburg et al., 2017). To effectively capture and reduce the complexity of concepts and achieve a clear understanding of the phenomenon (MacInnis, 2011), we followed the methodical approach outlined by Gioia et al. (2013) for capturing concepts and developing inductive theory as our guiding framework.

Our research design consisted of four interconnected phases. First, we carried out initial unstructured exploratory interviews to gain a preliminary understanding of PaaS initiatives within B2B manufacturing contexts. Second, we examined relevant literature to establish our frame of reference and direct further data collection, enabling us to position our research within existing knowledge. Third, we broadened our data collection with semi-structured interviews with key informants who have extensive experience in firms' initiatives and exploration of PaaS. Finally, we analyzed the data using the structured coding process described in Gioia's methodology and triangulated our findings with secondary data, such as websites and annual reports from the companies represented by key informants. Throughout the analysis, we adopted an abductive approach and constantly compared emerging themes and existing literature.

3.1. Case selection and description

The selection of case companies followed a purposive sampling in the first stage, followed by selective sampling in the second stage,

Table 1
Overview of semi-structured and initial interviews.

ID	Industry (SIC) ^a	Employees	Interviewee Role	Duration [h]
Semi-structured Interviews				
1	Mining Machinery	13 k+	Head of Productivity Services	1
2	Transportation Equipment	100 k+	Director Business Innovation	2
3	Transportation Equipment	100 k+	Director	1
4	Engineering Services	90 k+	Project Manager	1
5	Truck Finance Leasing	1 k+	Incentive Manager	1
6	Industrial Machinery and Equipment	40 k+	VP Sales and Development	1.5
7	Internal Combustion Engines	1 k+	VP Strategy	1
8	Aircraft Manufacturing	15 k+	Director of Product	1
9	Transportation Equipment	100 k+	Innovation Manager	1.5
10	Electrical Appliances	10+	CEO	1
11	State Commercial Banks	15 k+	Head of PaaS Solutions	1
12	State Commercial Banks	500+	PaaS Expert	1
Initial interviews				
13	Transportation Equipment	100 k+	Global Director Connected Services	1
14	Industrial Machinery and Equipment	40 k+	VP Sales and Development	1
15	Internal Combustion Engines	1 k+	VP Strategy	1
16	Internal Combustion Engines	1 k+	Innovation Manager	1
17	Financial Services	50+	Manager	1
18	Transportation Equipment	100 k+	Innovation Manager	2
				Total 21 h

^aFor anonymity, companies were classified in alignment with the SIC (Standard Industrial Classification) code by Mergent Intellect ([mergentintellect.com](https://www.mergentintellect.com)).

where the emerging findings helped us to decide who to interview next (Homburg et al., 2017). For our purposive sampling, we concentrated on B2B manufacturing companies currently exploring and evaluating PaaS-based offerings rather than those that have already completed this process and are offering such services. We attempted to gather insights from various industries and geographical locations so that we could enhance the results beyond a specific type of industry setting. This diverse selection was intentional, allowing us to identify common patterns and challenges across different contexts, potentially leading to more generalizable findings. For our interviews, we collaborated with managers and experts involved in various strategic decisions related to PaaS implementation, acknowledging the crucial role these decisions play in shaping outcomes. To capture a range of perspectives, we sought to interview individuals at different levels of the organizational hierarchy and from various functional areas. Data were collected from companies with sizes ranging from over 10 employees to global manufacturers with more than 100,000 employees. Table 1 displays the roles of the individuals we interviewed, reflecting the extensive experience of our interviewees. Following the approach of Gioia et al. (2013), we relied on knowledgeable agents who possess deep, experience-based insights into PaaS adoption. Given the small population of companies that fit our purposeful sampling criteria, the interview sample size reached theoretical saturation and was deemed representative.

3.2. Data collection

The primary data source of our study was in-depth semi-structured interviews with 16 key informants: six unstructured initial interviews and 12 that followed the semi-structured design using an interview guide designed to capture both retrospective and real-time accounts of PaaS experiences (Homburg et al., 2017). Total interview duration was 21 h. The guide helped the interviewers adapt the flow of the conversation based on the interviewee's role and firm context (Brinkmann & Kvale, 2018). Apart from questions covering the company and its operations, the guide addressed areas such as their current portfolio of offerings, drivers and barriers with respect to PaaS, the content and design of PaaS offerings, and pricing and business models. The 12 semi-structured interviews were recorded, transcribed, and further reviewed and verified by the researchers. Personal content and commercially sensitive information were redacted from the transcripts.

3.3. Data analysis

To analyze the data obtained from the interview, we adhered to the principles of open and axial coding. The first stage (first-order analysis) involved open coding, during which we identified informant-driven concepts while preserving their original terminology. We conducted an in-depth analysis of the raw interview transcripts, pinpointing and highlighting phrases and concepts directly connected to our research objectives. In the second stage (axial coding), we organized these concepts into first-order concepts based on conceptual similarities. This process was iterative and collaborative, involving the research team. Multiple researchers contributed to the coding process to ensure inter-coder reliability. We consistently compared the emerging concepts, refining them until we reached a consensus that accurately represented the respondents' personal experiences with PaaS offerings and business models. At this stage, we translated the insights of knowledgeable agents into research-centric themes (second-order themes) informed by our literature review. To enhance the reliability of our findings, we employed triangulation by analyzing the annual reports of the respective companies. In the third stage, we identified aggregate dimensions that provided a theoretical framework for understanding PaaS adoption. Here, we adopted a more abstract and theoretical approach, drawing from existing literature while also being responsive to new concepts. The identified aggregate dimensions offered a higher-level categorization that bridged the gap between the respondents' experiences and theoretical constructs. The developed coding structure is presented in Fig. 1.

4. Findings

In this section, we present and discuss the key outcomes of our exploratory study. The coding structure (see Fig. 1) results from an interactive process intended to organize and synthesize the interview findings. The structure comprises four aggregated dimensions: (1) Motivation for adopting PaaS, (2) Interactive and iterative exploration of PaaS offerings, (3) External factors affecting PaaS adoption, and (4) Internal factors influencing overall complexity. These four dimensions provide a synthesis of the 11 second-order themes within the coding structure. Below, we discuss the key findings of our study, organized according to the structure of the aggregated themes and the second-order themes.

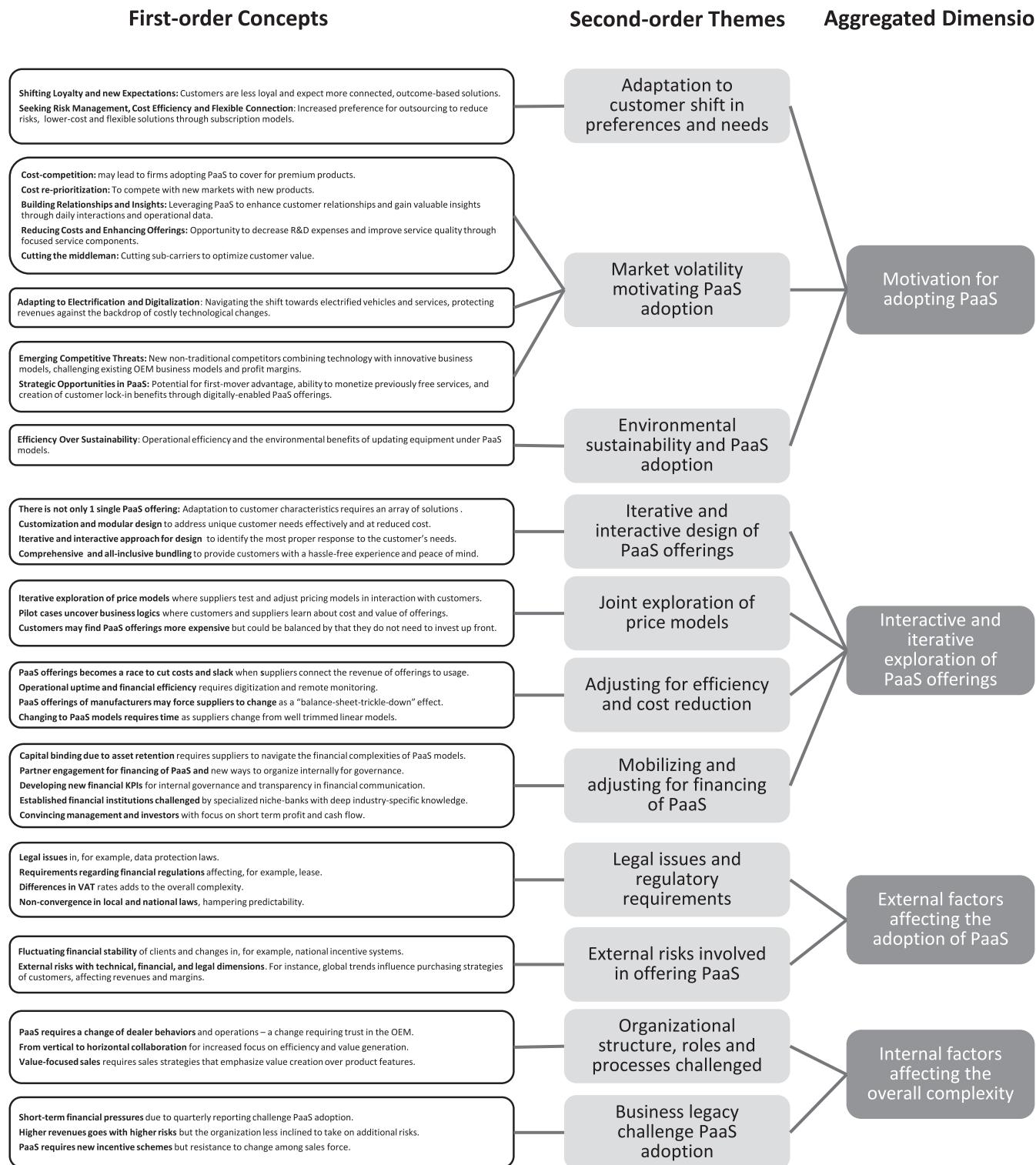


Fig. 1. The coding structure resulting from analyzing data from interviews.

4.1. Motivation for adopting PaaS

4.1.1. Adaption to customer shift in preferences and needs

Manufacturing firms are adopting PaaS business models by recognizing shifts in customer needs and preferences. Our data indicate that customers are becoming less loyal and increasingly interested in new arrangements that may offer more direct responses to their needs. For instance, one manager suggested:

"I believe that the loyalty will look very different in the years to come because there are new generations of customers coming in and they are not that loyal to the Volvo, Caterpillar or John Deere. They just look at the cost per ton, they look at risk for the carbon footprint, or the emission risk, or whatever their KPI is related to – and based on that they choose a vendor." (ID 1)

A significant concern raised was that focusing on developing premium products would no longer make companies aligned with customer

needs and preferences and would therefore provide a competitive advantage only if combined with new ways of doing business. As one interviewee summarized, a provider who can help the customers address the question “*will I reach my targets for tomorrow?*” (ID 1) will win because that is what is important to the customers, not whether they have cutting-edge product features.

Relatedly, there is a growing expectation among customers for opportunities to connect with suppliers using subscription, consultancy, or performance methods instead of traditional transactional or contract methods. Many customers in professional industrial markets expect equipment manufacturers to restructure their offerings towards flexible agreements that enable the purchase of varying capacity, like companies such as Spotify and Netflix have done in the consumer market. Additionally, the interviewees shared the view that customers have discovered the possibility of increasing their end-to-end benefits by outsourcing certain operations to other players who will take the risk (economic, financial, legal, etc.) of the operations. Taken together, our data indicate that the market dynamics caused by a shift in customer needs and expectations are central for motivating PaaS adoption.

4.1.2. Market volatility motivating PaaS adoption

Adopting a PaaS business model poses a significant financial and reputational risk by challenging the traditional transactional contract practices. On the other hand, in a highly volatile market, it serves as a strategic measure when adapting to a dynamic landscape. As one respondent said, adapting to market dynamics is essential because failing to do so means “*taking the risk of being left out*” (ID 8).

A key driver behind this shift is the growing awareness among industrial manufacturers that PaaS offerings can help them respond effectively to the market dynamics shaped by technological advancements and the increasing influence of the myriad actors in the market. This is forcing companies to re-think their traditional business models as they “*need to get into businesses where we are not typically have been strong*” (ID 2). Our interviews imply intensifying competition, with new entrants emerging from multiple directions, including non-traditional competitors who are integrating innovative technologies with novel business models. Simultaneously, we see evidence that such market dynamics allows companies to cut costs by optimizing their processes and procedures “[getting] rid of the sub carrier [and] taking a bit of their profit as well” (ID 2).

Moreover, the interviewees stated that many manufacturing companies would be moving towards PaaS offerings to protect their profits. There are already players who buy large numbers of equipment units and then sell the capacity-as-a-service, becoming an intermediary providing solutions that the equipment OEM could have provided. Nevertheless, such players get the best equipment price because they buy large amounts of equipment, which reduces the OEM’s margins on the product side. Our interview data revealed that this situation is now seen as a serious threat in many markets and indicates that industrial manufacturers see the opportunity to build a first-mover advantage by being better and faster than other players in bringing PaaS offerings to the market.

One interviewee raised a well-known challenge for B2B manufacturers – how to monetize service offerings: “*Historically, we have been given away a lot [of services] for free ... there is a journey there to do*” (ID 1). Hence, adopting PaaS gives manufacturing organizations the ability to charge for services that were previously provided for free. This is especially important given that technological advances are revealing a range of new and interesting opportunities in the field of digitally enabled services, as one informant highlighted:

“... we have our digital tools as well because we are now starting to track where our rock tools are used and how long they lasted because part of these contracts is understanding what is happening. So, if you have a good understanding of which drills are used and which rock tools and why they are failing, then you can do things.” (ID 6)

Another interviewee raised the issue that digital services are quickly becoming ‘manufacturer-agnostic’; that is, their provision is not related to the equipment of a specific OEM. PaaS offerings have grown in significance since agnostic services have emerged in the market. One informant for example explained that “*at that stage, with an easy tablet setup, the customers can get the flexibility that they are looking for. And then, the one that it is easier to do the business with will win*” (ID 1). Here, PaaS arrangements create customer lock-in benefits that may help fend off competition from third-party providers of agnostic digital services.

4.1.3. Environmental sustainability and PaaS adoption

Although manufacturers and their customers face increasing pressure to address sustainability and climate change issues, our interviewees paid relatively little attention to such matters. Even when they brought up circularity as a topic related to PaaS, it could be overshadowed by other factors deemed more critical; for example: “*circular solutions and business models are promoted by that they are more effective – not primarily by sustainability as a driver*” (ID 9). However, one of the interviewees explained that when the manufacturer remains the owner of the product, they can more freely upgrade equipment, which (in the case of engines, for example) would also provide benefits for the environment.

The interviewees repeatedly emphasized another theme as a primary driver behind the growing interest among B2B manufacturers in adopting the PaaS business models concern technology shifts. Technological developments are an essential threat to manufacturing companies and this threat may drive the need to change the business models of B2B firms. Specifically, several of the interviewees mentioned the upcoming shift in the heavy vehicle industry from combustion and diesel engines to electric engines – as driven by sustainable initiatives – as a core change and challenge. One interviewee described the situation as follows:

“*Everyone understands that their [electric vehicles’] overall effect on the planet is less than the diesel alternative. However, less known is the situation that there are fewer moveable parts in an electric vehicle. In the longer run, this means that the aftermarket business will go down as there will be a drop at around 50 percent in terms of spare parts.*” (ID 13)

The interviewees also noted that electric vehicles are more expensive to manufacture, so customers should be expected to become increasingly price-conscious. In such a context, PaaS contracts may be essential to manufacturers of premium products to protect their revenues and profit. One interviewee concluded: “*as a result, there will be less choice for suppliers not to switch over to a PaaS business model.*” (ID 13), because of the sustainability initiatives forcing a circular mindset.

4.2. Iterative and interactive design of PaaS offerings

4.2.1. Iterative and interactive design for customized PaaS offerings

Several interviewees felt that offering PaaS entails a journey into uncharted territory for most firms. The interviews noted that the design of service offerings is still in its early stages, viewing PaaS as a solution that involves a great deal of customization. The specific characteristics of the setting, operations and business of each customer, as well as a variety of different revenue models, results in a range of possible offerings. For example, one manager explained that “*I think the span of an asset-as-a-service or equipment-as-a-service [...] it’s not one thing, it’s an array of different solutions*” (ID 7). Moreover, many customers expect equipment manufacturers to structure their offerings as flexible agreements that enable the purchase of varying capacity – a requirement that adds further variety to the design of offerings.

Another sought-after feature is the bundling of all required aspects of using the equipment part of the PaaS offering. One interviewee explained that “[PaaS] are all-inclusive, meaning that if the customer wants a truck from us, it should be insurance, tires, taxes, everything, like everything bundled together, so they don’t need to think about anything” (ID 5). Such

requirements causes the number of “modules” to combine in different ways and grow even further. One respondent explained, “we are more in a stage of taking baby steps here towards equipment-as-a-service rather than having it rolled out on a large scale. So, I think for the time being, almost every case is very customized” (ID 8).

To meet and fulfill customers’ needs, companies will need to consider how to include customer-process-related and vendor-agnostic services into their offering to the customer, and the design of service offerings requires the incorporation of new aspects that have previously been out of scope for manufacturing companies. For example, one interviewee argued that, for PaaS offerings, “[t]he relationship with the customer is much more related to what keeps our customers awake at night” (ID 1). Another interviewee said, “[w]e need to understand more of the usage of the product, and also what risks are associated with that use” (ID 2).

This requires an iterative and interactive approach for design where supplier and customer jointly and stepwise develop knowledge of how the offering and its related business logics should be shaped, especially as the most obvious solution is not always the best response to the customer’s needs. One interviewee explained that “it was all about teaching people to order like the thing they want, not ...you know, the product – to understand that if you define what it is that you want – and leave it to the experts to solve that problem, well, then you’ll get a lot of different solutions” (ID 10).

Pilots involving customers seem to be one way in which OEMs interact with customers and simultaneously identify and manage risks that could be involved with the PaaS offerings. To reduce the unknowns, one manager explained that instead of combining new technology with new business models, their pilot involves well-known technology because it is “driving unknown technology in unknown business models of business offers at the same time can be a bit [challenging] ... you don’t know if it goes wrong, it’s hard to know what the hell happened” (ID 7).

4.2.2. Joint exploration of price models

This study shows that the implementation of value-based pricing models does not follow a straight line. Several interviewees revealed that they sometimes have to test different prices, evaluate how they are working, both for themselves and for the customer, and then adapt to discover a reasonable price model:

“We have a service, we charge €1600/month and then you can run six big borers or four borers and a big excavator or wheel-loader, and you can see where these machines are, and you can monitor where they are at what time, and you can also monitor the roads, and you can actually optimize the whole site. And, of course, some customers have bought and installed the system, and they have reduced their fuel consumption by 10 percent. Of course, the gain [for them] is far beyond the €1600 that they pay per month; it is probably close to €1600 every second day. And here comes the business model, how we all get a fair share of that.” (ID 1)

A common denominator of the interviewees is that they view their companies as service companies rather than as product manufacturers, implying that they should implement a subscription business model. There are no pre-made models, so manufacturers must try their way forward. An important argument in transitioning toward a value-based pricing model is to understand that the company is moving from selling products to offering solutions to its customers.

“How do we set the price? We have to admit that we have limited experience so far, but our interpretation is that we should look at ourselves more like a consulting company. Why should we give away our knowledge for free if we know that we can bring something to the table.” (ID 1)

The same manufacturer stated that this situation is evidence that they are now in the service business and must therefore adopt the mindset of being problem-solvers for their customers.

“I think at the other end of the scale – we will probably start to look at what does this means for the customer, what is important for the

customer. And that question we haven’t, I think, earlier asked ourselves often enough. I think we have been very focused on building good machines, but we haven’t necessarily been focused on how this can help you in your daily business.” (ID 1)

To further their understanding of the business logic of a PaaS offering, suppliers and customers jointly explore costs and value creation through pilots. Through pilots, customers understand the cost of current business models, which, according to some interviewees, is not always fully clear to the customer. One interviewee explained that “it’s not cost-efficient to buy things instead of buying them as a service. It’s not cost-efficient to not have experts taking care of your materials; the problem is that our customers do not really understand their costs” (ID 10). While pilots can help customers understand the costs and value creation mechanisms of PaaS offerings, suppliers may simultaneously gather critical data regarding the cost of their offerings and how the new business model will impact revenue flows.

4.2.3. Adjusting for efficiency and cost reduction

Interviewees highlighted the importance of developing offers that enable customer productivity, which also emphasizes the need for internal efficiency of the supplier. PaaS offerings should enable high productivity connected to low cost. Hence, providers must design their offerings with efficiency and cost in focus, which has implications for how the supplier organizes. One interviewee explained that “since you’re cutting a lot of the slack in the in the system then, financially, efficiency becomes sort of very, very important actually” (ID 7), and continued, “[m]y experience historically of this type of revenue stream, where you connect your revenue to usage [...], is that it ultimately becomes a cost race” (ID 7).

Moreover, as the productivity and efficiency of the customer’s operation establishes key attributes, uptime and availability of the equipment, the customer uses are crucial. To ensure that such requirements are met, the providers of PaaS offerings draw on digitization and remote connectivity to monitor status and health. One interviewee summarized the benefits as follows: “We can analyze and understand and see how we should use this data then then I mean we can increase the availability for the customer [...] and the customer can have higher availability and earn more money” (ID 4).

When manufacturers explore and develop PaaS-based offerings, a less obvious implication is that the manufacturer’s suppliers could also be required to adapt their offerings and business models. The PaaS model inherently changes the nature of capital expenditure for customers. Offering “as-a-service” shifts the product used from the customers’ balance sheets to operational expenditures. This shift is not only attractive for customers looking to streamline their financials, but also puts pressure on suppliers to adapt. An expert elaborated on the perspective of being a supplier to OEMs:

“And as they [the OEM] move towards ‘as a service’, the natural consequence to that is that [...] they would like to buy the ingoing component as a service. Why wouldn’t they? I mean then they don’t own anything.” (ID 7)

Several interviewees emphasized the need for manufacturers to recognize that transitioning to PaaS requires time. Although manufacturers have long invested in their existing operations and business models, they seem to underestimate the necessary changes. For example, one expert in the financing sector stated:

“there is an impatience in a way ... but I have a linear business model that works today and they make profits and then something else comes into play here [...] Imagine what it takes to build a functioning linear business model ... to build factories that have many years to break even on all investments and that.” (ID 12)

The same interviewee highlighted that manufacturers appear to expect that having pilots with customers should promptly be successful and deliver results “as if everything should be exploding and becoming

profitable in a second" (ID 12), while another pointed to the impatience of investors with respect to establishing new business models (ID 10). Another underscored that customers adopting PaaS offerings must also acknowledge that such changes involve time: *"A customer might start with buying pipes but in the end they buy liquid flow uptime instead, and this transformation typically takes quite some time"* (ID 17).

4.2.4. Mobilizing and adjusting for financing of PaaS

Our findings suggest that the transition to PaaS models significantly impacts the financial structure and capital binding of companies. The interviews reveal a concern over the increased capital binding associated with owning assets and selling their capacity. One respondent said:

"When you move from owning assets and selling the capacity, of course, the biggest discussion you have there is the capital binding. We have historically sold the machines to the dealers, the dealers to the customers and off a balance sheet. If you suddenly have [millions of dollars] on your balance sheet, that is not necessarily in favor of the stock exchange..." (ID 1)

Changing to PaaS also introduces complexities in terms of communicating with capital markets and shareholders, particularly when explaining why key performance indicators change drastically due to adopting PaaS offerings. Companies face challenges maintaining transparency and ensuring that their financial metrics are evaluated appropriately against relevant competitors. As one interviewee explained:

"It is problematic to explain to the capital markets why your KPIs change that fast and what has happened [...]. Suddenly you have a balance sheet that is 50 percent bigger than it was a couple of years ago. This cannot be correct." (ID 2)

To address issues related to the binding of capital, the implementation of PaaS models could necessitate the involvement of financial partners, such as banks and financial institutions. The challenge is further amplified for smaller companies that may lack the necessary financial history or reputation to secure substantial funding. As one interviewee explained, *"You will have to have someone who can finance your whole solution and your balance sheet – banks, financial institutions, etc."* (ID 2).

However, it remains to be seen which kind of financial institutions will be investing in PaaS. One interviewee, who is an expert in PaaS and financing, doubted that traditional and larger banks will be fit to finance PaaS, arguing that the bank needs deep and specialized knowledge in the specific industry: *"I think there will be banks that are specialists in industries [...] we will certainly find the 'furniture PaaS bank' that specializes in furniture, sofas, residual value and disposal channels"* (ID 12).

Another aspect that firms must contend with is the potential for higher profitability in traditional product sales, at least in the short term. This is also reflected in challenges with shareholder expectations, as one interviewee explained: *"Investors have never been really happy [...] It is not as scalable as software [...] and we had a couple of investors that came in hoping to sell a product and riding on that brand"* (ID 10).

4.3. External factors affecting the adoption of PaaS

4.3.1. Legal issues and regulatory requirements

The interviews reveal that data is increasingly viewed as a vital component for companies optimizing their operations for a PaaS business model. A data-centric approach enables organizations to better understand how their offerings deliver enhanced experiences by optimizing output and quality in service delivery. However, there are external risks tied to this opportunity in the form of the legal complexities and global inconsistencies in data protection regulations, which imply a significant challenge: *"I suppose data sharing really depends on where in the world you are in terms of sort of how strict they are with data sharing"* (ID 6).

The interviews reveal that companies typically address regulatory

requirements regarding data in one of three ways: (1) deferring the issue to the future, (2) outsourcing to third-party experts, or (3) managing data processing contractually in-house with the intention of complying with regulations to the best of their ability. One interviewee argued that *"[i]t's a big topic – we won't go into any contract if we don't have something concrete in place around, you know, data privacy and protection"* (ID 6). Furthermore, companies seem to expect even more regulatory challenges with data in the future: *"[A]nd there you needed to have the telematics data, and then when you have the telematics; then we come into the data access and the data privacy and that is the next step"* (ID 3).

Taken together, this suggests that industry and governance have shaped a landscape where companies are grappling with the dual demands of leveraging data for competitive advantage and navigating the complex web of data protection laws. Furthermore, regarding the ability to navigate regulatory challenges, other external risks highlighted included financial regulations, operational lease criteria, and evolving environmental regulations. The flexibility of PaaS models implies that firms also need to navigate the complexities of contract durations and the potential for equipment replacement or its reallocation. This flexibility is advantageous for efficiency, but requires careful regulatory consideration as the classification and duration of leases, particularly distinguishing between operational and financial leases, needs to be considered when designing PaaS. This distinction is essential because operational leases often need longer terms to qualify as off-balance sheet arrangements.

Moreover, European Union (EU) regulations, particularly those promoting circular business models, are increasingly shaping the PaaS landscape. These regulations, which aim to reduce waste and encourage recycling, are seen as favorable for the adoption of PaaS models. However, compliance with these regulations can be challenging, especially when transitioning from traditional product-based models to service-oriented offerings. The role of government enforcement in promoting circular business models varies significantly, both locally and nationally, affecting financial motives. This inconsistency can create uncertainty for firms in the PaaS landscape.

Lastly, financial regulations pose challenges to firms. The question of ownership and eligibility for incentives or tax reductions also emerges in PaaS models. When the OEM remains as the owner of the equipment, it is unclear whether they can benefit from such incentives and this ambiguity can affect the financial viability and attractiveness of PaaS offerings. Also, the differences in VAT rates for products and services and the complexities involved in exporting to different jurisdictions add layers of complexity to PaaS models.

4.3.2. External risks involved in offering PaaS

This study shows that a significant challenge to PaaS is the prevailing economic pressure that compels customers to prioritize lower prices over potentially superior solutions. This short-term financial decision-making can adversely affect the adoption of PaaS models. As one respondent explained, *"Economic pressure forces companies to buy at the lowest price, not to buy the best solutions"* (ID 10).

This sentiment underscores a fundamental challenge in PaaS offerings: the need to demonstrate long-term value to customers who are often driven by immediate cost savings. Firms must also contend with the potential for higher profitability in traditional product sales, at least in the short term. This is also reflected in challenges with shareholder expectations, as one interviewee explained: *"Investors have never been really happy [...] It is not as scalable as software [...] and we had a couple of investors that came in hoping to sell a product and riding on that brand"* (ID 10).

Furthermore, sudden economic downturns may result in a shift in priorities, with a growing inclination towards cost-effectiveness over quality. Such change in behavior presents an additional hurdle for PaaS providers: *"With the economic downturn now, we're seeing that people are not really interested in buying quality anymore"* (ID 10). Despite these challenges, there is a strong ambition within companies to increase

revenue from services and to adopt a more service-minded approach.

As several interviewees highlighted, offering PaaS entails a journey into uncharted territory. One manager explained, “*I think that understanding how big the risk actually is for this business model is what’s a bit scary*” (ID 5). Another stated:

“[T]his is an interesting business model; that is, we make money when they make money and we bleed when they bleed, which means that just for financial self-preservation, we need to make sure that these things actually work, because if it breaks, it’s not only our customer’s problem – immediately it becomes our problem.” (ID 7)

It also becomes obvious that PaaS offerings involve risks related to technical, financial, and legal dimensions. One interviewee referred to technical risks involved in the use of the equipment, asking rhetorically “*Will the equipment fail? Have we specified the wrong equipment for the customer process?*” (ID 2), and later also address financial risks by asking, “*What happens if that company gets into financial problems? Or their markets fail?*” (ID 2). Moreover, with a focus on the legal aspects involved, another interviewee said, “*[t]here is a lot of discussion with legal counsels on both sides [provider and customer] about who is actually taking the risk and what will happen when things go wrong*” (ID 2).

4.4. Internal factors affecting the overall complexity

4.4.1. Organizational structure, roles and processes challenged

When companies adopt the PaaS business model, they not only confront market challenges, but also grapple with internal dynamics that can either facilitate or impede the transformation. For instance, one respondent referenced the organizational transformation:

“One of the most difficult challenges that we have is that we need to change dealer behaviors and the trust in us as a company and all those things because we will then to great extent actually direct their business and that’s not something that we have done before.” (ID 7)

In terms of internal factors that add complexity, our findings also point toward the need to complement the sales channel in several aspects. The transformational shift from focusing on product features to customer priorities and satisfaction regards just one of the changes:

“Companies seem to struggle [...], understanding their customer, that is how they create value, what value they appreciate and want to occur. This is difficult because that changes over time. A customer might start with buying pipes but in the end, they buy liquid flow uptime instead, and this transformation typically takes quite some time...” (ID 17)

Hence, the competencies of sales representatives need to be widened in terms of embracing a fuller understanding of the customer’s business purpose, and their customers’ business purpose. The focus on customers’ needs and the importance of a value-based proposition is clear, as one interviewee stated: “*‘peace of mind’ is one of the key things that we [...] offer...*” (ID 9). Another explained: “*I would say maybe that the peace of mind is one of the key things that we use to legitimize the price ... [we explain] that we take care ... you don’t need to worry if it breaks down*” (ID 5).

The sales force of PaaS companies must also transform how they communicate the very nature of the offering, from a physical good to value, from products to service, and from transactional business models to subscription or other types of models where the outcome of the customer is in focus. However, for sales representatives, PaaS implies quite a dramatic change, which is why other parts of the organization feel they might resist this transformation. For example, one respondent simply stated that: “*[S]ales management are very traditional. They resist change*” (ID 11).

4.4.2. Business legacy challenge PaaS adoption

When companies adopt the PaaS business model, they not only confront market challenges, but also grapple with internal dynamics that can either facilitate or impede the transformation. One

complicating factor regards short-term financial pressures, for instance influenced by quarterly reporting, which adds complexity to PaaS as the company’s financial situation might appear less profitable than is actually the case.

Our data also reveal problems with a stubborn organizational climate as it might not seek change or not have the appetite for risk that today’s business climate requires. As one interviewee said, “*if we take more risk and so on, we earn more money, as we have higher profit margins*” (ID 5).

Additionally, as a result of the changes resulting from introducing PaaS offerings, the classical incentivization schemes, which have promoted the sales of a capital good, must be restructured to instead embrace the proposition of offering value-creation for customers. Instead of incentivizing salespeople to chase the next customer, manufacturers must ensure attention to customer retention, personalization, and customer value-creation. One interviewee argued that:

“the incentives for the sales channel are very different. I mean, they are basically incentivized to sell a truck and once they sold the truck, they get the bonus, and then they go to the next customer that’s more profitable on a personal level in [their] wallet.” (ID 2)

5. Discussion

Here, we return to the three research questions introduced in [Section 1](#) and articulate a response based on our findings from the empirical study. Furthermore, drawing on this, in [Section 5.4](#) we introduce a conceptual framework that visualize key dimensions and dynamics of manufacturers transformation for PaaS.

5.1. What motivates manufacturers to pursue the adoption of PaaS business models?

Our first research question explores: “What motivates manufacturers to adopt PaaS business models?” The empirical findings highlight a range of drivers in an increasingly volatile market. A key motivation stems from the perception that customer loyalty is declining, with buyers placing greater emphasis on risk, operational costs, and profitability. Rather than viewing PaaS adoption primarily as an avenue for innovation (e.g., [Linde et al., 2023](#); [Sjödin et al., 2020](#)), manufacturers see it as a strategic response to intensifying competition that threatens their market share and revenue streams. In line with this, companies recognize the need to offer new solutions prioritizing value-in-use and the flexibility of subscription-based models over the traditional appeal of premium product ownership.

In this highly volatile market, manufacturers often face competition from unexpected competitors from vastly different industries who are not constrained by technological and operational legacies. These competitors leverage technological advancements alongside innovative business models. Additionally, companies that acquire large volumes of equipment to offer equipment as a service pose a growing threat, compelling manufacturers to take strategic measures to safeguard their business. In response, manufacturers seek to establish a first-mover advantage, sharpen their competitive edge, and improve their ability to monetize services, which has long been a challenge for B2B manufacturers ([Mustak et al., 2023](#); [Witell & Löfgren, 2013](#)).

Manufacturers also recognize that digital services are becoming “manufacturer-agnostic,” meaning they are no longer tied to the specific equipment of an OEM. In this context, a key motivation for adopting the PaaS business model is its potential to enable customer lock-in, helping manufacturers fend off competition from third-party service providers ([Windahl & Lakemond, 2010](#); [Fliess & Lexutt, 2019](#)). Additionally, manufacturers are increasingly drawn to the opportunity to engage in their customers’ operations and daily activities. The creation of relational capital, built on fine-grained information sharing and an in-depth understanding of how customers generate value, offers performance

benefits to suppliers (Sjödin et al., 2020) and creates a new opportunity to improve product offerings, since the large amount of operational data gained from the customers can be fed back into product development processes and suggest effective product changes (Burger et al., 2024; Kastalli & Van Looy, 2013; Kindström & Kowalkowski, 2014). Finally, governmental policies and technological advancements are key drivers of PaaS business model adoption. One of the most significant shifts is electrification, which, in certain industrial contexts, has led to a considerable decline in aftermarket sales of service hours and spare parts. This transition has also resulted in higher product prices, making price-sensitive customers hesitant to make the necessary substantial investments. As a result, both manufacturers and customers are seeking new business models to address these concerns, so the PaaS business model might offer a way to attract customers who might otherwise be reluctant to invest due to high upfront costs, uncertainties about reliability, or concerns over residual value.

5.2. How do manufacturers navigate the exploration and design of PaaS-based offerings?

Our second research question seeks to answer how manufacturers navigate the exploration and design of PaaS-based offerings. While extant literature predominantly focuses on explaining the PaaS idea (e.g., Kühl et al., 2020; Benedettini, 2025) and the uptake of subscription offers (Vandermerwe and Erixson, 2023), and often focuses on experienced front runners, we have chosen to put our spotlight on the manufacturers that consider, or have recently embarked on, a journey towards PaaS offerings. Implementing PaaS business models has far-reaching implications for the organizational structures, processes and customer engagement (Kowalkowski and Ulaga, 2024) and our study aims to further the knowledge about how firms approach the pursuit of PaaS.

As several interviewees highlighted, offering PaaS entails a journey into uncharted territory for most firms. This journey becomes both iterative and interactive according to the data collected. First, the data show that the journey involves understanding how to design the PaaS offerings and determine the key characteristics, what elements to include, how to include customer process-related and vendor-agnostic services into the offering, and how to ensure that the requirements for customization can be met. Indeed, as scholars have discussed, integrating resources and focusing on the specific needs of individual customers are important characteristics of PaaS offerings (e.g., Vandermerwe & Erixson, 2023; Kowalkowski & Ulaga, 2024). Accordingly, as one of the interviewees highlighted, the result is not only one PaaS offering but an array of possible offerings.

Second, the price of the PaaS offerings and their respective business logics need to be determined. Also here, the path builds on iteration and supplier-buyer interaction, a process whereby supplier and customer jointly and stepwise develop knowledge of the cost of current solutions, how to create value of new PaaS offerings, and how the PaaS business logics should be shaped. The iterative approach, with a focus on open dialogue and knowledge-creation, is especially important as the most obvious solution is not always the best response to the customer's needs. Pilots is a format that suppliers and buyers often engage in for such iterative and interactive exploration. Several interviewees emphasized the need for manufacturers to have patience and acknowledge that a change to PaaS may take time, especially as we are talking about challenging current (linear) business models that rely on long and heavy investment in processes, organizations, and facilities.

Third, productivity and efficiency are among the key criteria that customers expect from PaaS offerings. Given that suppliers, through their offerings, often become more deeply embedded in the operations of their customers, the strive for efficiency not only becomes a challenge related to the customer's operations, but will also have implications for the way that supplier organizes. The "race for efficiency" results in a strive to cut slack, reduce costs, and improve efficiency throughout the supply chain, a quest that can ultimately also involve the suppliers of the

manufacturer designing PaaS offerings.

Fourth, the journey into uncharted territory also involves the quest for a solution to the financing of PaaS offerings. The interviews reveal concerns over the increased capital binding associated with owning assets and selling their capacity. Although some manufacturers currently invest in maintaining fleets of equipment, PaaS suppliers in the making are now exploring ways to ensure external financing. Among the possible options, larger and well-established banks are showing a growing interest in the financing of PaaS offerings. However, within the banking community there appear to be doubts about whether traditional and larger banks will be fit for financing of PaaS. There are opinions that, to manage financing of PaaS, the bank needs deep and specialized knowledge in the specific industry – knowledge about the products themselves as well as areas such as residual value and channels for disposal of products that have been "retired" from PaaS fleets.

5.3. How do external factors affect manufacturers offering PaaS business models?

Finally, we sought to examine how external factors affect manufacturers offering PaaS business models. Our results show that several factors affect manufacturers in offering PaaS. One of the most frequently mentioned factors regards the collection and use of data in relation to data protection regulations. Manufacturers that offer PaaS need to design solutions that are robust, reliable and provide output as expected. The use of digitization and remote connectivity to monitor status and productivity can help manufacturers avoid disruptions and enable necessary maintenance to be performed to ensure uptime. Therefore, manufacturers strongly rely on access to data regarding the use and status of equipment that build up a certain PaaS offering, and need to develop practices that not only meet laws and regulations but also exceed the expectations of their customers and address their own financial concerns, which is generally a function of uptime (Tabares et al., 2023).

Moreover, manufacturers are challenged by complexities regarding financial regulations and policies concerning VAT and incentives, such as governmental acts regulating environmental incentives that stimulate the sales of electrified vehicles, which frequently differ between countries.

Viewed from a distance, it becomes clear that PaaS faces difficult external and internal challenges with respect to the business models. One crucial factor that comes into play is that when products are no longer sold to customers in a traditional transaction, manufacturers must address the change concerning financial flows and capital binding. This process not only needs engagement in deliberations with the customer, but must also involve and reach agreement with financial institutions in the form of a bank to cover for liquidity problems that might result from delayed payment. If the PaaS offering appears uncertain, for example, it might be unclear to the bank how much the customer will use the offering; financial bodies may decide not to support the transition into new business models like PaaS. Finally, as a shift to PaaS also encompasses organizational transformation, companies adopting PaaS business models grapple with internal dynamics that can either facilitate or impede the required shift. Thus, the manufacturers themselves may encounter internal resistance as owners, internal departments, or shareholders find it hard to accept the vision of a long-term generation of profit. Instead, prioritization of short-term financial gains, or goals aligned with one's own incentivization structure rather than the organization's overall goals, may flourish. Evidently, the sales department must develop its knowledge of customer's operations, business logics and holistic needs. As part of this, incentive schemes and bonus structures must be adapted to reflect the specific nature of PaaS. Existing structures, typically based on the idea of selling a product and offering service such as maintenance, collide with PaaS, where the focus is on generating accumulated value over time.

5.4. Manufacturers transforming for PaaS: A conceptual framework

Clearly, the path of manufacturers that navigate towards PaaS business models contains its fair share of unknowns, complexities, and challenges. Manufacturers striving towards new offerings and previously untested business models must grasp and manage the combined effects from a complex bundle of drivers that vary over time and may involve contradictory objectives. Moreover, manufacturers must master new technologies, adapt the design of their products, and re-shape their processes and organizational structures to increase efficiency, reduce slack, improve the reliability and robustness of their product-based solutions, and develop competitive pricing models. To achieve this, manufacturers must resolve uncertainty regarding financial regulations, unknown pricing models, operational risks, and the expectations of shareholders and owners. Moreover, the exploration of PaaS offerings and business models not only concerns the manufacturers themselves; it also requires iterative steps and thorough interaction with customers.

The conceptual framework in Fig. 2 visualizes and summarizes key elements of the journey that manufacturers experience when transforming for PaaS offerings. With the circular design and bi-directional arrows connecting the seven areas (Legal and Political Landscape, Pricing and Business Models, Organization & Operations, Design of PaaS Offerings, Financing of PaaS Offerings, Market Dynamics, Customer Requirements), the framework underscores the iterative and interactive process required, and that manufacturers (in interaction with their customers) must decide upon trade-offs when designing offerings, adapting organizations and processes, and developing pricing strategies and business models.

6. Conclusions and implications

By addressing manufacturers' growing need for knowledge and guidance to support successful implementation of PaaS offerings, as well as responding to scholars' calls for more empirical research highlighting the critical factors associated with adoption of PaaS, this research has sought empirical evidence of how manufacturers navigate the transition for PaaS business models. Hence, while the extant literature predominantly looks to explain the PaaS idea, and often focuses on experienced front runners, we have chosen to study manufacturers that are considering, or have recently embarked on, the journey towards PaaS offerings. Our study indicates that manufacturers are primarily shifting to PaaS in an attempt to respond to challenges with respect to customer expectations and loyalty, and competition that may erode their market share and revenues. Moreover, we empirically document that a manufacturer's journey towards PaaS involves an iterative and interactive path involving customers as well as partners.

6.1. Managerial implications

As the findings presented in Section 4 and the discussion in Section 5 show, navigating partly uncharted territory towards introducing PaaS offerings could be challenging for manufacturers. Drawing on our findings, we specifically point to the following implications for firms and managers.

Adopting PaaS business models is a strategic move that provides opportunities to safeguard customers loyalty, fend off competitors, and gain competitive advantage in the market. By adopting this approach, manufacturers can pre-empt the threat posed by non-traditional or more agile competitors through a stronger and closer collaboration with

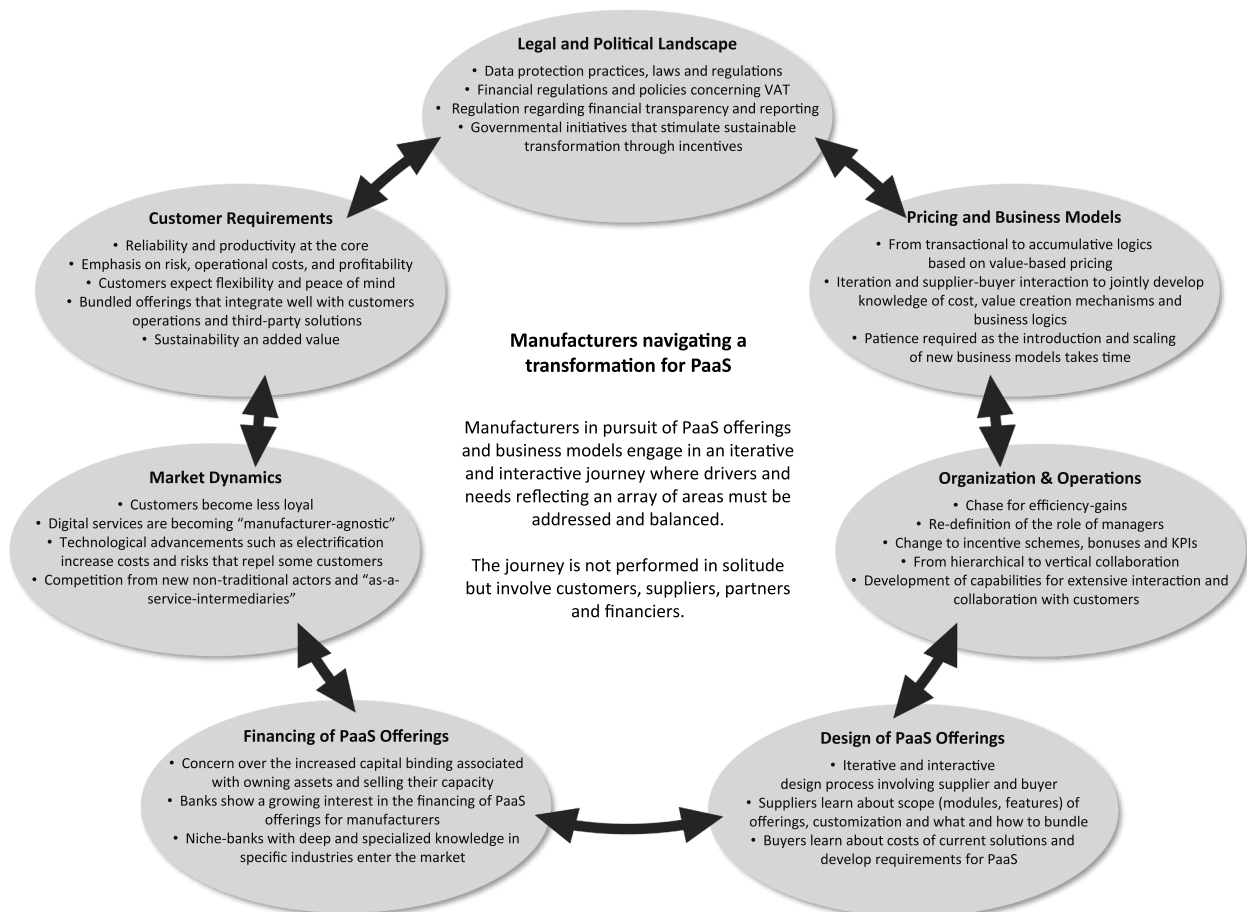


Fig. 2. Conceptual framework visualizing the dynamics of manufacturers navigating for PaaS business models.

customers and access to operational data that could be used to further improve and integrate the offering, measures that could ultimately lock out competitors. Furthermore, new PaaS models may also provide the benefit of handling challenges that arise due to new technological shifts. For instance, this may regard the ongoing electrification that otherwise contains the risk of diluting previously important profit generating activities such as after-market sales.

A shift to PaaS involves a range of critical decisions and changes, many of which depend on management commitment and endurance. Developing and implementing PaaS offerings involves interaction, iterative steps and mutual trust among manufacturers and customers. Moreover, as visualized in the framework of Fig. 2, changes made in different areas are interdependent and thus require coordination, alignment, and strategic governance from top management. One of the key challenges concerns changes in how manufacturer organize and operate. Developing and operating PaaS offerings relies on vertical collaboration throughout the manufacturer, close interaction, and transparency in terms of customer collaboration, and a shift to new incentive schemes. Such changes may cause friction in firms organized for optimal efficiency in developing and selling products and relying on steady revenue streams from the aftermarket.

Additionally, manufacturers must adopt new value-based pricing strategies, reflecting the full benefits of their services and ensuring mutual profitability. Regarding the development and design of offerings, the development of pricing models and business logics involves an iterative and interactive process based on supplier–buyer collaboration. To leverage such PaaS-based business models in an effective way, companies must invest in digital infrastructure and management, allowing them to offer enhanced services and gather valuable operational data. Moreover, in terms of the financial aspects enforced by PaaS models, companies must communicate changes in reporting to stakeholders in new and effective ways and secure the necessary financing as it involves greater capital investments. As mentioned, sales strategies must be redefined to emphasize the value and long-term benefits of PaaS offerings over traditional product sales. Risk management strategies must also be in place to anticipate and mitigate potential risks associated with the introduction of new technology and service models. These will most likely regard different types of legal contracts that regulate the temporality of the relationship between the customer and the supplier.

Even if our study does not identify sustainability and circular economies as the main drivers for PaaS adoption, the approach offers additional benefits. When properly designed and implemented, PaaS models support more environmentally friendly practices contributing to the broader corporate sustainability objectives. Offerings adopting “as-a-service” may prolong the useful life expectancy of products and enable more efficient utilization. With PaaS-based offerings, manufacturers can also secure access to their products and thereby also components to use for maintenance, remanufacturing, or repurposing. Additionally, by gaining access to the products of PaaS offerings, manufacturers can also secure the flow of material from scrapped products.

6.2. Research implications

Industrial manufacturers have been hesitant to embrace the logic of PaaS offerings (Grubic & Jennions, 2018) and, despite growing interest in PaaS business models, existing research provides limited empirical insights into how B2B manufacturing firms approach and explore such business models and navigate their intrinsic challenges (Benedettini, 2025; Kowalkowski & Ulaga, 2024). Drawing on the empirically based findings presented in Section 4, we observe three key implications for research and theory development related to PaaS as a business model.

First, the complex and multifaceted characteristics of PaaS offerings and the variety of strategies and decisions of firms adopting PaaS are situated at the crossroad of multiple theoretical streams. Hence, research focusing on this advanced form of service provisioning (e.g., Kramer et al., 2024) could benefit from drawing on the combined knowledge of

cross-discipline teams. In the conceptual background we have highlighted three of those streams (Servitization, Business Model Innovation, and Subscription Services), but the views and concerns of managers presented in Section 4 also point to the need for theory and concepts regarding accounting and sustainability, as examples.

Second, in extant research, it is often the role of the manufacturer comes to the fore. However, it appears that knowledge of how customers view and approach PaaS offerings is scarce. The offerings of manufacturers must satisfy the customers’ expectations of tightly bundled solutions that offer “peace of mind”, enable high productivity and efficiency, are vendor-agnostic, and integrate well with the customer’s processes. Hence, further studies should clarify how B2B customers establish and prioritize their demands on PaaS, and what aspects of such offerings influence how they value the offerings over time.

Third, as manufacturers will attempt to extend the useful life of the equipment of PaaS offerings, they strive to upgrade and replace the equipment at the core of their offerings. Moreover, manufacturers may also choose to embed previously used equipment in offerings for customers. To the best of our knowledge, research on how customers experience and evaluate such offerings remains sparse. Reflecting the growing interest in PaaS business models, combined with an increased focus on sustainability, it is essential to better understand how manufacturers may design and price PaaS offerings that meet the demands and expectations of customers that will purchase offerings based on previously used equipment.

6.3. Limitations and further research

While the methodological approach of this exploratory study was robust, it also involves limitations that pave the way for future research opportunities. First, although our qualitative approach garnered rich, detailed insights, the limitations with respect to the number of firms, interviewees, and markets means that the findings are not universally generalizable. Although the interviews were comprehensive, they were limited to a certain number of industry professionals and experts selected through purposive and selective sampling methods, which were effective for in-depth exploration, but may not fully capture the diversity of experiences and strategies across the broader spectrum of B2B manufacturing industries. Second, as our research focused on the manufacturers, we did not cover the views and strategies of PaaS customers. Nor did we apply a longitudinal perspective or include a wider range of firms of the manufacturer’s ecosystem, such as suppliers and partners.

While manufacturers and their customers increasingly turn to PaaS-based offerings and business models, knowledge about how firms navigate the exploration, introduction and operation of such new solutions and revenue models remains sparse. Hence, we encourage researchers to further expand and develop knowledge through qualitative and quantitative studies that cover a larger portion of the suppliers’ ecosystems of customers, partners and suppliers, and extend into other sectors and industries. In such studies, the role of banks and other financial institutions will be of particular interest. Also, given the dynamic process in which manufacturers and their customers jointly and interactively strive towards sustainable PaaS solutions providing gains for both suppliers and customers, we suggest that longitudinal studies could provide additional insights into the evolving nature of PaaS adoption and its long-term impact on firms’ performance, business, operations, and collaboration. In such studies, it will also be of value to further clarify which capabilities the collaborating firms rely on for successful outcomes.

CRedit authorship contribution statement

K. Hedvall: Writing – review & editing, Writing – original draft, Visualization, Validation, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **O. Benedettini:** Writing – review & editing, Writing – original draft,

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