12th International Conference on Business Servitization

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Book of Abstracts

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12th International Conference on

Business Servitization

(ICBS 2025)

Focal theme: Digital servitization as a key enabler for organizational scalability

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Foreword

Welcome to 12th International Conference on Business Servitization

At the outset, this volume presents the proceedings of the **12th International Conference on Business Servitization (ICBS 2025)**, hosted by Deusto Business School in Bilbao, Spain, on 6–7 November 2025, and preceded by a welcome reception on Wednesday 5 November in the Paraninfo Cloister at the University of Deusto. The main academic program convenes at Deusto Business School's "La Comercial" building, anchoring the discussions within Bilbao's broader innovation ecosystem. The 2025 focal theme—Digital servitization as a key enabler for organizational scalability—invites contributors to examine how firms design, govern, and diffuse scalable service solutions without compromising rigor, margins, or sustainability.

Building on this, the conference approaches digital servitization not as an accessory layer to product offerings but as the systematic integration of connectivity, data, and software-centric capabilities

into product–service systems. In this framing, scalability exceeds volumetric growth: it denotes the ability to replicate, adapt, and modularize solutions across sectors and geographies while preserving architectural coherence, robust data governance, and high-quality customer experience. Accordingly, the contributions assembled here engage with three macro-questions: (i) which architectural and organizational features underpin scalable advanced services; (ii) how analytics, AI, and platformization reconfigure the economics and governance of service portfolios; and (iii) which market-facing and capability-building practices sustain scaling over time.

This year conference, the program juxtaposes multi-country cases, longitudinal analyses, design-science proposals, and comparative assessments of maturity models. Read together, these studies move beyond pilot successes to specify the routines that anchor scale: service modularity and interface design; replication templates that codify local adaptation; boundary resources that make platform participation both feasible and valuable; and learning mechanisms that retain sensitivity to context while enabling disciplined growth. The cumulative insight is analytically exacting yet practice-engaged, clarifying where complementarities between product architectures, data assets, and service bundles actually hold—and where they fracture under growth pressures. Moreover, the architecture of the conference balances plenary anchors with thematic depth. The Opening Session (Thursday, Icaza Auditorium) situates the agenda through institutional remarks and an industry keynote by Eñaut Sarriegi (Service Director, ULMA Handling Systems) on *Automated Intralogistics Solutions Tailored to Customer Service—Evolving Automation through ULMA Handling Systems' Advanced Services*, foregrounding a pragmatic lens on lifecycle service architectures in capital-intensive environments. The Closing Session features an academic keynote by Professor Christian Kowalkowski (Linköping University) on *Sales*

Management for Servitization Success and Growth, connecting market development logics, capability orchestration, and performance metrics for scaling solution businesses.

Empirically, the parallel Scalability strands (I & II) assemble research on how firms move "from pilots to scale," including platform readiness and modular go-to-market approaches; the role of ecosystem alliances in empowering emerging scale-ups; and the capability stacks required for GenAI-enabled service digitalization. These sessions also interrogate why sustainable industrial offerings sometimes fail to scale and what institutionalization demands in complex organizations. In parallel, Service Innovation & Supply Chains explores revenue drivers in service start-ups, digital service innovation across manufacturing value chains, AI-empowered offerings in specific contexts (e.g., mobility services), and comparative maturity models for digital servitization trajectories in SMEs and large firms alike. The unifying concern is how supply-chain embeddedness shapes coordination and value capture as services scale.

Furthermore, Marketing, Sales & Customer Value addresses persistent tensions between standardization and customization; the role of legitimacy in adoption; and how service and experience design mediate customer value in digital servitization. Case material from manufacturing and security contexts surfaces how co-creation practices help overcome credibility barriers and foster uptake at scale.

Accordingly, Ecosystems & Collaboration examines multi-actor orchestration across OEMs, KIBS, and technology partners. Papers map transformative service research, analyze structural holes in digital service innovation networks, and develop cases on ecosystem governance for scalable solutions in smart buildings and autonomous systems. Together, they clarify the governance choices

and capability sets that lower coordination costs while preserving responsiveness.

Remarkably, AI, Generative AI & Service Digitalization interrogates both the promise and heterogeneity of AI's effects. Contributions consider environmental solution delivery in interorganizational ecosystems; revenue pathways and sales enablement; carbon-aware strategies; and organizational choices between corporate-wide and business-level deployment—asking when centralized approaches scale faster, and when local autonomy outperforms. Furthermore, Business Model Innovation, Evolution & Co-creation revisits theoretical perspectives on servitization and presents stepwise transformations in established firms, alongside lessons from the internationalization of KIBS. Complementing this, Industry-specific & Transformative Services offers sectoral depth—including livestock and space—illustrating how domain-tailored service logics travel, hybridize, and scale. In addition, Business Models & Platformization asks whether digital platform initiatives materially pay off for manufacturers, how product–service portfolios can be managed as complexity rises, and what iteration between experimentation and optimization implies for connected-product strategies; related work on Data, Applications & Platforms investigates pay-per-use dynamics, data-enabled service networks, and cyber-physical perspectives on B2B platforms.

Importantly, Sustainability, Circular Economy & Strategic Entry treats sustainability and circularity as design constraints and opportunity spaces for scale. Studies document eco-innovative services, collaboration for resource-efficient energy solutions, value capture in eco-industrial parks, and the strategic choices exporting firms face when transitioning into servitized models. Findings suggest that scale accelerates when platform rules, data standards, and incentive structures align with environmental objectives.

Beyond the sessions, ICBS 2025 sustains a tradition of community and place. A gala dinner at La Terraza de Yandiola (Azkuna Zentroa) punctuates the first day; the program closes with lunch at the University Library (CRAI) and a farewell visit to the Guggenheim Museum Bilbao—curated moments for cross-fertilization among scholars, practitioners, and policy makers.

Topics of 2025 Conference

Scalability in Digital Servitization

- Modular service architectures, platform readiness, and replication routines for moving from pilots to roll-outs.
- Ecosystem alliances and multi-level capability stacks for GenAI-enabled service digitalization.

Service Innovation & Supply Chains

- Revenue drivers in service start-ups, AI-empowered offerings along manufacturing value chains.
- SME trajectories, enabling/hindering dynamics, and comparative maturity models.

Marketing, Sales & Customer Value

- Legitimacy building, co-creation practices, and the balance between standardization and customization.
- Experience design as an enabler of digital servitization and market adoption.

Ecosystems & Collaboration

- Orchestration across OEMs, KIBS, and technology partners; managing structural holes and boundary resources.

- Ecosystem capabilities for autonomous solutions and smart-infrastructure services.

AI, Generative AI & Service Digitalization

- Environmental solution delivery, carbon-aware strategies, and AI-enabled revenue pathways.
- Organizational choices (corporate-wide vs business-level deployment) and assurance for human–AI collaboration.

Business Models & Platformization

- Experimentation–optimization cycles, portfolio management, and payoff profiles of platform initiatives.
- Connected-product strategies and product–service portfolio complexity.

Sustainability, Circular Economy & Strategic Entry

- Eco-innovative services, resource-efficient energy solutions, and value capture in eco-industrial parks.
- Entry modes and transition strategies for exporting firms.

Data, Applications & Platforms

- Pay-per-use dynamics and data-enabled services within service networks.
- Cyber-physical perspectives on B2B platforms and installed-base data economics.

AI, Governance & Strategic Pathways

- Heterogeneous effects of AI on scalability; governance for value co-creation in generative-AI ecosystems.

- Integrating sustainability value into services and pathways for disciplined growth.

In closing, the Bilbao edition consolidates evidence on how architectures (modularity and interfaces), analytics (data and AI), and arrangements (ecosystem governance and market development) co-produce scalable service outcomes. The contributions collected here are deliberately engaged: they offer conceptual clarity, empirically grounded guidance, and a forward-looking research agenda attentive to the contingencies that condition scale in data-rich, networked economies. By aligning technological design with organizational capability and market reality, ICBS 2025 charts disciplined pathways for expanding advanced service businesses—responsibly, resiliently, and with sustained value for stakeholders.

Ferran Vendrell-Herrero, Director Scientific Committee
Marco Opazo, Conference Chair
Jose Antonio "Tontxu" Campos, Conference Chair

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ABSTRACTS OF PAPERS

PRESENTED AT

12TH INTERNATIONAL BUSINESS SERVITIZATION CONFERENCE

Parallel Session 1

Scalability I

Co-Chairs: Ferran Vendrell, &Christian Kowalkowski & Heiko Gebauer

Scale down to scale up: how smart solutions challenge the traditional scaling imperative of physical assets

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University of South-Eastern Norway

Abstract

The idea of this paper is to use autonomous solutions as case in point to explore how digital scaling logics enabled by AI and sensor technologies materialize for physical assets. Traditionally, in traditional industries such as shipping and logistics, scale has been achieved by increasing vehicle size to offset operator costs. However, autonomous solutions allow for a shift toward scaling in numbers—deploying fleets of smaller, networked units that adjust dynamically to real-time demand. Drawing on multiple case studies and over 40 interviews with leading OEMs, the paper develops a framework for understanding how digital logics—such as flexibility, responsiveness, and modularity—materialize in physical operations. The findings contribute to the literature on scaling logics by showing how smart, autonomous technologies enable new forms of value creation beyond traditional size-based scale, blending economies of scale and scope in novel ways.

Keywords: Scaling, Digitalization, Autonomous solutions, Smart solutions, AI.

Introduction

Mature industries such as shipping and logistics follow a century-old economy scale thinking. This has led to an arms race to build ever larger vehicles sized to accommodate peak demand (e.g. rush hours).

Yet, the proliferation of sensory and AI technology enables smarter ways of organizing value creation activities that break with this imperative.

With the advent of smart solutions, the scaling logic of digital assets start materializing into physical assets (Kohtamäki, Rabetino, Parida, Sjödin & Henneberg, 2022). Therefore, leading OEMs such as Volvo, Scania and Kongsberg engage in business model piloting to develop scalable business models for autonomous solutions (Thomson, Kamalaldin, Sjödin & Parida, 2023). Yet a key challenge is that most stakeholders – customers, ecosystem partners, and even the OEMs themselves tend to evaluate autonomous solutions on the basis of today's man-driven solutions. However, such assessment limits their value potential to increased smartness and savings of drivers cost (Tsvetkova & Hellström, 2022). Overarchingly, several studies touch upon potential values such as increased safety, crew cost savings, spatial-temporal reach, lower co2 reduction (Frandsen, Raja & Neufang, 2022; Tsvetkova & Hellström, 2022; Turienzo, Cabanelas & Lampón, 2023), but have yet to explain how they scale.

While these are indeed part of the value scope, they adhere to single stand-alone solutions. Thus, they fail to take into consideration the full value scope and scaling potential of autonomous solutions. The literature has so far only understood the face value of autonomous solutions (e.g. saving driver costs) following the traditional scaling logics (Sandvik, Sjödin, Parida & Brekke, 2024).

Using autonomous solutions as case in point, the idea for this paper is to develop a new scaling framework that shows how smart solutions may scale differently as the digital scaling logics blends into the physical world.

Initial theoretical concepts

While autonomous solutions are many things, and can be described on a spectrum of increasing automation levels (e.g. operator assist, and semi-autonomous, fully autonomous) (Thomson, Kamalaldin, Sjödin & Parida, 2021), in this study the focus is on fully *autonomous solutions* defined as "self-driving vehicles that can sense their surroundings, location, and space, and that are operated without human control" (Leminen, Rajahonka, Wendelin, Westerlund & Nyström, 2022).

Economies of scale arise when the marginal cost of delivery and operation falls below the marginal value generated. Traditionally, this has been achieved by distributing labor costs across high-capacity vehicles and has created an industry imperative to scale by increased size.

Reviewing literature autonomous solutions and scaling

A literature matrix that summarizes knowledge on elements of scaling logic in the context of smart solutions and further highlights the gaps is under development but not posted here to keep close to the word limit.

Methods

The study will build on multiple cases of leading OEMs in traditional industries such as maritime, logistics and mining (Eisenhardt, 2021). A base of over 40 Semi-structured interviews is already conducted and will be supplemented with further interviews. Thematic analysis will be used to analyze the data (Braun & Clarke, 2006). The plan is to develop a scaling-framework for autonomous solutions revolving around the following idea present in current interviews.

Preliminary findings

To truly scale autonomous solutions, industries must break with the traditional economy of scale logic where the imperative has been to deliver large vehicles sized for peak demand to offset operator costs. However, because autonomous solutions drastically lower operator cost (unmanned), solutions can be reorganized so that solutions can scale in numbers rather than in size. For example, instead of operating one single large truck or ship sized for peak demand, fleets of autonomous units can work in collaborative network to perform value generating operations. This new, more granular scaling logic allows flexible scaling of operations (up and down) according to real time demand. For example, fleets of smaller autonomous ferries or smaller buses may actively operate during rush hours, yet as the rush drops, the fleet may adjust the amount of active vehicle accordingly. And, in contrast to single-large-vehicles, some percentages of the fleet may be rerouted to places where demand is higher. Such flexible scaling logic may maximize utilization rates and thus lower CO_2 emissions compared to traditional solutions. Moreover, Smaller vehicles may lower production cost per unit and further enhance scalability. Additionally, autonomous fleets may consist of diverse (heterogenous) vehicles that enable more complex operations – potentially fusing in economies of scope as the fleets value creation capabilities increases.

Potential contributions

This study contributes to the literature on scaling logics by rethinking the traditional economy of scale, showing how AI-driven smart solutions (autonomous solutions) enable digital scaling logics to materialize in physical assets (Porter & Heppelmann, 2014; Vendrell-Herrero, Bustinza & Vaillant, 2021).

Moreover, it will contribute to knowledge on how to scale autonomous solutions from single solutions to fleet of homogenous, heterogenous or multimodal autonomous solutions (Frandsen, et al., 2022; Fritschy & Spinler, 2019; Leminen et al., 2022; Pérez-Moure, Lampón, Velando-Rodriguez & Rodríguez-Comesaña, 2023; Sandvik et al., 2024).

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Ensuring Platform Readiness and Scalability of Digital Platforms: The Case of Dassault Systèmes and Cadland

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Keywords: Digital platforms, Digital service innovation, Platform ecosystems, Scalability, Platform readiness

Digital Service Innovation

Consultants such as Bain & Company and BCG alike urge companies to build a strong digital strategy, reframe their business model, build customer-centric offerings, and create a sense of urgency for scaling digital solutions using transformation 'enablers' (Lancry, Anderson, Caimi, Colombani, Cummings & Morrissey, 2019; Close, Franke, Grebe Hrishikesh & Rogers, 2022). Studies emphasize the role of digital technologies as drivers of service innovation in manufacturing industries (Kohtamäki, Rabetino, Parida, Sjödin & Henneberg, 2022; Kowalkowski, Wirtz & Ehret, 2024, Vendrell-Herrero, Bustinza, Opazo-Basaez & Gomes, 2023).

Digital service innovation (DSI) is defined by Opazo-Basáez, Vendrell-Herrero, Bustinza and Raddats (2024: 131) as "the strategic use of digital technologies to (re)model service design, delivery, and individualization, leading to innovative offerings, improved operations, and enhanced service value creation". DSI can be considered an extension of digital servitization, whereby manufacturing firms switch from a product to a service-dominant business model (see Shen Lei et al., 2023 for an overview). DSI represents a new source of technological innovation, in which digital interconnectivity and user data enable the development of new, dynamic and tailored services in multiple business contexts (Opazo-Basáez et al. (2024:129). In DSI, both the service offering and the technological infrastructure that support it can be adapted. Digital servitization and DSI imply a complex transformation process impacting the business model and managerial decision-making, necessitating learning, internal alignment and complexity management (Dmitrijeva, Schroeder, Ziaee Bigdeli & Baines, 2022; Coreynen, Matthyssens, Struyf & Banhaverbeke, 2024; Momeni, Rapaccini, Martinsuo, 2024; Friedl, Matthyssens & Van Bockhaven, 2025).

Kowalkowski et al. (2024:281) agree on the disruptive character of B2B digital services and stress that service markets have been revolutionized by three key complementary signature technologies: (1) the Internet-of-Things, (2) intelligent automation, and (3) digital platforms. The latter are providing "the technical and organizational architecture for integrating resources and stakeholders into service ecosystems for value co-creation" (Kowalkowski et al., 2024: 285). Recent literature emphasizes the *ecosystemic nature* of DSI. Kowalkowski et al. (2024: 291) put forward that an "ecosystem reconfiguration is often necessary for the successful implementation of new services", whereby actors interact, integrate resources, and interpret ideas from their heterogeneous perspectives during DSI

generation and transformation. Vargo et al. (2024) suggest an enriched S-D Logic for (digital) service innovation, based on emergence, distributed governance ensuring high degrees of interoperability, and symbiotic design, requiring a collective effort, resource integration, and adequate training and support for participating stakeholders.

Developing and Scaling Digital Platform Ecosystems

Narvaiza, Campos, Martín-Peña and Díaz-Garrido (2024) argue that in order to realize the full potential of digital transformation, industrial firms need to adopt digital platforms. DSI in digital platforms encompasses multiple parties along a complex design and development process, with multiple multilateral interactions and iterations (Vendrell-Herrero, Vaillant & Bustinza, 2025; Jovanovic, Sjödin & Parida, 2022). Along a similar line, and (2025) focus on how digital platforms execute DSI by orchestrating diverse ecosystem actors' activities and resources, thereby enabling interoperability for innovation.

Scalability is critical for digital business models but industrial firms keep on struggling to achieve comparable scalability, as reaching a critical mass of service sales has proven to be key for financial performance (Vendrell-Herrero et al., 2025). However, experts agree that "[d]espite digital opportunities, especially those facilitated by IA and platforms, scalability is still a major challenge for service processes and many digital service offerings are developed very individually as firms struggle to mobilize the wider ecosystem (Kowalkowski et al., 2024: 294). Scaling might be difficult as it implies the co-evolution of services, infrastructure and governance (Jovanovic et al., 2022). Hendricks, Matthyssens and Kowalkowski (2025) demonstrate it also presupposes the co-evolution of collective engagement and value co-creation on digital platforms,

and identify different pathways for scaling platforms depending on the business model (freemium versus premium). Hein, Weking, Schreieck Wiesche, Böhm and Krcmar (2019: 509) propose three value co-creating practices in platforms: (1) Integration of complementary assets (demand-side), (2) Ensuring platform readiness (supply-side), and (3) Servitization through application enablement (core practice).

A variety of practices and capabilities have been suggested as being critical to services and start-up scaling and scalability (e.g., Nagy, Bläse, Filser, Appenzeller & Puumalainen, 2025; Lange, Tomini, Brinkmann, Kanbach & Kraus, 2023). The latter distinction has been clarified by Coviello, Autio, Nambisan, Patzelt and Thomas (2024). They argue that *scaling* refers to "a type of growth characterized by returns to scale…whereby managers transform the internal organization and leverage digital resources to rapidly expand a firm's outputs without a corresponding ex-ante increase in inputs" (p. 14). They define *scalability* as an "ordinary organizational capability developed by managing and achieving coherence among a firm's technological architecture, organizational architecture, and business model" (p.16).

More concrete models on platform scaling and platform-based companies have been offered by Schreieck, Wiesche and Krcmar (2021) and Vendrell-Herrero et al. (2025). With a case study DSI on SAP's platform, Schreieck et al. (2021) illustrate how technology-related capabilities (cloud-based platformization and open IT landscape management) and relationship-driven capabilities (ecosystem orchestration, platform evangelism, and platform co-selling) help the platform owner to enable and balance value co-creation and value capture, and thereby the scaling. Vendrell-Herrero, Vaillant et al. (2025) explore how Nvidia over time fostered scalability. They propose a process model revealing how incumbent

firms can establish scalability conditions in three stages: value recognition, organizational adaptability, and strategic renewal.

Outlining the Research Gap and Research Method

So far, we highlighted the importance and complexity of DSI. We zoom in on DSI on digital platforms and learned that scaling is a strategic priority for such digital platforms. An overview of core frameworks for guiding researchers and managers on platform development and scaling has been given. However, in line with calls from several scholars, this study digs deeper into the scalability of platform offerings by mature players. We wonder *how a B2B multiplatform owner and its key partners can stimulate platform readiness and generate scalability over time.* In fact, Vendrell-Herrero, Kowalkowski, Wirtz and Gebauer (2025) argue that there has been limited exploration of how digitalization integrates with servitization to drive scalability. Also, a focus on less deliberate factors and emergence is welcomed (Vendrell-Herrero, Vaillant et al., 2025). Schreieck et al. (2021) stress the need for studying this phenomenon in more mature contexts.

During this discovery, we zoom in on platform readiness and applications growth as scaling will be impossible to reach without customer and stakeholder readiness for using the applications, share data and engage in intensified value co-creation. We extend the concept of *customer service readiness* (Vaittinen & Martinsuo, 2019; Vaittinen, Martinsuo & Ortt, 2018; Galvani & Bocconcelli, 2022) and Narvaiza et al.'s (2025) Digital Service Readiness Model, to study the *service platform readiness* through a wider "actor engagement perspective" in order to uncover how scaling is realized thorugh "synchronized readiness for co-developing and co-delivering services" (Narvaiza et al., 2025: 3, citing Opazo-Basaez et al., 2024)

and dynamic exchange capabilities for value co-creation (Siaw & Sarpong, 2021) among diverse actors.

We present a *longitudinal case study* of the development and growth of Dassault's the 3DEXPERIENCE® platform, a digital environment representing a series of innovative software solutions for 3D modeling, simulation, virtual twin, information intelligence, and collaboration, offered to and co-developed with industrial companies (application users) and third-party developers/system integrators. We zoom in on the creation of customer readiness by coordinated activities of the platform owner *Dassault Systèmes* (FR) and the third-party value solutions partner *Cadland* (IT). We follow different customer-readiness enhancing initiatives (the Academy, User advocacy communities, joint customer-centric software development projects, etc.) and engagement enhancing interactions with customers aimed at increasing their digital capabilities, performing joint innovation, resource sharing and value co-creation related to the cloud platform. We also observe feedback loops (Hendricks et al., 2025) from these interactions to the third-party developer and to the platform owner and between these partners, resulting in adaptive and explorative learning (Coreynen et al., 2024; Friedl et al., 2025) and upgrades and customization of the solutions offered. As such, we illustrate how a symbiotic business collaboration (Dalenogare, Le Dain, Ayala, Pezzotta & Frank, 2023) through a combination of original platform ecosystem capabilities (Schreieck, Wiesche & Krcmar, 2023) and marketing/sales initiatives can stimulate customer readiness and result in platform growth.

As contribution, we extend the model of Narvaiza (2025) on Customer Readiness to platform readiness as an important element of scaling. We link Schreieck et al.'s (2021) value co-creation and capture model to scaling of digital platforms. We fulfil the call for studies on DSI in multiplatform ecosystems (Ahmed & Kowalkowski, 2025), and extend the model of Vendrell-Herrero

(2025) through our focus on emergence and less visible scalability factors.

PS: The case is work in progress. A first round of interviews with Cadland managers and a major customer has been realized during 2023-2024. With a second wave of interviews during the Summer and Fall 2025, the case will be finalized.

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A Fuzzy-Set QCA on successfull product and market configurations of Product-as-a-Service (PaaS) in Industrial Manufacturing

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Abstract

This study examines success configurations in Product-as-a-Service (PaaS) models using fuzzy-set Qualitative Comparative Analysis (fsQCA) across 50 industrial cases. Drawing on performance data from running contracts and sales initiatives of a leading finance platform for PaaS-offerings in Germany, Austria and Switzerland, we identify attribute-level combinations that predict PaaS success. Findings suggest higher success rates for complex, high-TCO assets that are peripheral to customers' core processes. Organizational maturity in procurement, particularly in purchasing departments, significantly influences adoption and performance. Additionally, PaaS offerings by dealers outperform those by OEM, with value chain positioning emerging as a critical factor. These insights contribute to servitization theory by highlighting the configurational nature of PaaS success and offer practical guidance for scaling advanced service models.

Introduction

The shift from selling industrial equipment to offering it as a service —commonly referred to as Product-as-a-Service (PaaS)—is a defining trend in the servitization of manufacturing. PaaS models, which bundle equipment with performance-based services, not only promise recurring revenue and deeper customer relationships for manufacturing firm.

Also regulatory bodies like the EU Commission are working on inventives for PaaS. It leverages sustainability principles, as „producers keep the ownership of the product or the

responsibility for its performance throughout its lifecycle. However, despite their strategic appeal, these advanced service implementations often fail to scale or deliver profitability. Recent reserach is postulating that less than 5 % of manufacturers achieve sustainable service transformation (Sun & Oliva, 2025).

This study investigates the configurations of product, market, and organizational attributes that might predict success in PaaS. We argue that success is not driven by isolated factors but by interdependent combinations of conditions. Using fuzzy-set Qualitative Comparative Analysis (fsQCA), we analyze a sample of more than 50 PaaS cases. These cases were all derived from a platform enabling pay-per-use and data-driven asset financing. The study is practitioner-involved and action research oriented, with contributions from researchers and industry experts as co-authors.

Related Work

Servitization research has evolved from descriptive case studies to theory-driven inquiries. Foundational work by Oliva and Kallenberg (Oliva & Kallenberg, 2003) outlined the shift from product to service logic, while more recent studies emphasize successfull servitization (Fliess & Lexutt, 2019; Kowalkowski, Kramer, Eravci,

Salonen & Ugala, 2025), and also the configurational nature of servitization success (Heirati, Leischnig & Henneberg, 2023; Lexutt, 2020). However, the literature lacks empirical studies that identify attribute-level configurations specific to PaaS as one specifc offering in servitation.

Lexutt (2020) highlights decentralization, managerial commitment, and service-oriented culture as necessary conditions for servitization success but does not isolate configurations for product-as-a-service models. Heirati et al. (2023) extend this by showing that internal service units are more effective for complex offerings, yet their focus remains on organizational architecture.

Jovanovic, Engwall and Jerbrant (2016) demonstrate that product characteristics and operational environments significantly influence the success of outcome-based service models. Their comparative case study reveals that products with high total cost of ownership (TCO), stable operating environments, and direct customer access are more amenable to advanced service contracts. However, their work stops short of identifying specific configurations of attributes that might predict success.

This study addresses this gap by focusing on attribute-level configurations—such as product complexity, lifecycle costs, position within the value chain, market regulation and customer structure—using fsQCA to capture causal complexity and equifinality.

Method

We apply fuzzy-set Qualitative Comparative Analysis (fsQCA) to identify configurations of conditions that lead to successful EaaS outcomes. FsQCA is particularly suited for capturing causal complexity, equifinality, and asymmetry—key characteristics of organizational transformations in servitization (Pappas & Woodside, 2021).

Data Collection

Our dataset includes more than 50 PaaS cases drawn from a finance platform that tracks running PaaS contracts. Additionally, we used documentet sales initiatives and customer touchpoints of the same platform provider. Data sources include performance metrics, internal reports, CRM records, and sales campaign data as well as aditional strucutred interviews with sales representatives, as well as purchasing departments and managers from PaaS-customers. Each case includes information on product design, sales process, market information, customer engagement, and organizational structure.

Construct Development and Calibration

Following Lexutt (Lexutt, 2020), we developed constructs for product, market, and organizational attributes. Multi-item constructs were validated. We then transformed these constructs into fuzzy sets using direct calibration, with breakpoints at 0.95 (full membership), 0.50 (crossover), and 0.05 (non-membership), based on theoretical reasoning and empirical distribution (Pappas & Woodside, 2021).

Findings

Preliminary analysis suggests that success in PaaS is contingent on the alignment of product, market, and organizational factors. We expect to identify several successful configurations.

First, EaaS models tend to perform better when applied to complex assets with high total cost of ownership (TCO) that are not part of the customer's core process. These assets are often seen as non-strategic but operationally critical, making them ideal candidates for outsourcing via service contracts. Customers are more willing to

adopt EaaS for such equipment, as it reduces capital expenditure and operational risk without compromising core capabilities.

Second, customer maturity in the purchasing department plays a significant role. Organizations with advanced procurement practices and experience in managing service contracts are more likely to adopt and benefit from EaaS models. These customers understand the value of performance-based agreements and are equipped to evaluate total lifecycle costs.

Third, the position in the value chain influences success. EaaS offerings from dealers or intermediaries tend to outperform those offered by original equipment manufacturers (OEMs).

Discussion

Implications for Theory

This study contributes to servitization theory by adopting a configurational perspective.

Traditional variance-based models often overlook the interplay of multiple conditions. FsQCA allows us to identify multiple pathways to success and distinguish between core and peripheral conditions.

Our findings extend the organizational architecture framework proposed by Heirati et al. (2023), showing that internal service units are particularly effective for complex EaaS offerings. We also build on Lexutt (2020), demonstrating that successful EaaS configurations often involve advanced digital capabilities and cross-functional integration.

By focusing on attribute-level configurations, this study advances the theoretical understanding of how product, market, and organizational factors interact to enable EaaS success.

Implications for Practice

For practitioners, the study offers actionable insights into how to structure PaaS initiatives. Our findings help to evaluate PaaS maturity and attribute fit for PaaS-business models. Further firms can benchmark against successfull configurations and plan strategic shifts. Hereby we support firms in navigating the servitization trajectory, from basic services to advanced PaaS models.

Limitations

This study has several limitations. First, the sample size is focused on German, Austrian and Swiss manufacturers, which may limit the generalizability of the findings. Also, fsQCA is well-suited for small to medium-N studies, we just have a limited number of cases. Due to the focus on one financier platform as our data source the transferability of the results might be limited. Third, while we tested for predictive validity, longitudinal data would strengthen causal inferences.

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Why Sustainable Industrial Offerings Fail to Scale – And what to do About It

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Abstract

Many industrial equipment manufacturers have the strategy to create sustainable industrial offerings (SIOs), i.e. integrated, site-specific solutions that combine product, service, and software elements to reduce environmental impact while generating business value. It is relatively easy to create a first SIO, but much harder to make SIOs scale on the market. This paper presents a framework for market scaling of SIOs, which allows companies to self-assess their organizational readiness. The framework has two broad phases – market scaling prerequisites and market scaling execution – with specific core dimensions and practices subsumed under each. This framework will help companies pursue the scaling of SIOs and increase their chances of successful servitization in practice.

Keywords: Industrial sustainability offerings, Market scaling, Servitization, Practical framework.

Introduction and background

Industrial equipment manufacturers (IEMs) increasingly find themselves at a crossroads, facing a "perfect storm" of challenges: their advanced engineering products are being commoditized by low-cost global competitors, while simultaneously being pressured by increasingly stringent environmental regulations and customer expectations for sustainability. These pressures not only shrink

profit margins but also call into question the long-term viability of traditional product sales-focused strategies. In response, many IEMs are developing Sustainable Industrial Offerings (SIOs)—integrated, site-specific solutions that combine product, service, and software elements to reduce environmental impact while generating business value.

While it is relatively easy to co-develop the first SIO in close collaboration with a key customer—often motivated by branding or technical experimentation—market scaling remains a formidable hurdle (Frishammar & Parida, 2019; 2021; Frishammar et al., 2025). Previous research on servitization, digital servitization, outcome-based business models, and product service system by us and by others (e.g. Sjödin, Parida, Kohtamäki & Wincent, 2020; Kohtamäki, Rabetino, Einola, Parida & Patel, 2021; Cenamor, Sjödin & Parida, 2017; Reim, Parida & Sjödin, 2022) has laid essential theoretical groundwork, yet industrial actors continue to struggle with transitioning from pilot offerings at small scale to commercially scalable solutions. This study addresses that persistent challenge by presenting a structured decision-making framework and a diagnostic tool that allows IEMs to evaluate and improve their readiness for market scaling of SIOs.

Methods and empirical setting

This framework –to be presented at the conference– is grounded in more than 150 interviews and over 20 workshops conducted with senior and middle managers, R&D engineers, and commercial leaders across 10 industries. Our research over the past 15 years or so spans firms like Sandvik, ABB, Metso Outotec, Epiroc, and Volvo CE, as well as ecosystem actors such as Skanska, LKAB, Ragn-Sells, and Mobilaris. By examining both successful and struggling cases, triangulated with internal strategy documents and

other types of secondary data, we expose recurring scaling bottlenecks related to organizational readiness, ecosystem alignment, and commercial viability. Insights from studies on business model innovation (Sjödin, Parida, Jovanovic & Visnjic, 2020; Parida & Jovanovic, 2022), product service systems (Reim et al., 2022), and ecosystem orchestration (Sjödin, Parida & Visjnic, 2022; Parida, Burström, Visnjic & Wincent, 2019) guided the formulation of our practical framework. A key insight from this research is that SIO scaling requires companies to move beyond technical feasibility and corporate communication exercises toward building commercially sound, repeatable offerings with a viable revenue logic and scalable delivery capacity.

Results and contribution

The proposed framework distinguishes two major phases in the SIO scaling journey. The first phase, Market Scaling Prerequisites, comprises three core dimensions. (1) SIO Strategy focuses on strategic visioning, roadmapping, and resource commitment—for example, evaluating whether top management has articulated a compelling vision and allocated sufficient cross-functional resources to SIO development. (2) Dual Value Proposition requires IEMs to balance business value (profit, growth, efficiency) and environmental value (emissions reduction, material circularity)—an essential combination also emphasized in recent work on circular transformation (Frishammar & Parida, 2019; Averina, Frishammar & Parida, 2022). (3) Modularity and Customization addresses the development of reusable product, service, and digital modules, allowing site-specific SIO configuration. Here, digital modules often become the architectural core—enabling solution scalability and interoperability—consistent with findings on digital servitization (Kohtamäki et al., 2021; Kolagar, Parida & Sjödin, 2022).

The second phase, Market Scaling Execution, highlights the external and operational dimensions of scale-up. (4) Partner Contributions refers to identifying and orchestrating complementary capabilities across hardware, software, and circular services, recognizing that no single firm possesses all required competencies (Kamalaldin, Sjödin, Hullova & Parida, 2021; Parida et al., 2019). (5) Financial Viability emphasizes the importance of revenue model alignment, cost control, and risk management—critical to counteracting the "service paradox" where service-heavy offerings incur disproportionate costs (Reim, Parida & Sjödin, 2016; Linde, Frishammar & Parida, 2021). (6) Market Scale and Scope captures how firms broaden their customer base and institutionalize delivery mechanisms, ensuring that offerings are not only sellable but operable at scale. Aligning internal structures and external channels for international expansion is especially vital in capital equipment industries, where global service networks must deliver consistent outcomes (Parida & Jovanovic, 2022).

Each dimension contains a set of specific practices (19 in total), which are translated into a self-assessment tool featuring Likert-scale questions. The tool enables firms to benchmark their scaling readiness by reflecting on actual—not aspirational—capabilities. For instance, under SIO Strategy, managers are asked whether "The roadmap outlines specific milestones for scaling SIOs" and "Dedicated cross-functional teams are in place to execute SIO development." Under Dual Value Proposition, questions include "Does the offering have validated metrics for both business and environmental impact?" and "Are customer insights systematically gathered to refine the offering's value logic?" In the Modularity domain, firms assess whether "Digital components are reusable across solution contracts and scalable across customer sites." These questions serve as diagnostic mirrors that help firms identify whether a single weak practice might undermine the entire scaling

effort—a logic consistent with systemic scaling frameworks (Sjödin et al., 2022; Hullova et al., 2019).

In summary, our article contributes a theoretically grounded framework that helps industrial firms scale their sustainability-oriented offerings more systematically. The dual-phase structure captures both internal readiness and external execution, bridging well-documented gaps in ecosystem alignment (Sjödin et al., 2022), value capture (Sjödin et al., 2020), and revenue modeling (Linde et al., 2021). Used as a reflective tool and planning instrument, the framework supports strategic decision-making for leaders seeking to scale SIOs that are not only technically feasible and environmentally beneficial, but also commercially sound. By doing so, it advances both the theory and practice of scaling sustainable industrial transformation.

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Institutionalizing Service Innovation Processes in Industrial Firms: A Comparative Case Study of Volvo and ZEISS

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Abstract

This study explores the institutionalization of service innovation processes in industrial firms through a comparative case study of Volvo and ZEISS. Despite strategic intent and resource investment, both firms faced challenges in embedding service development routines across organizational layers. Drawing on performance data and qualitative insights, the study identifies recurring barriers—such as organizational misalignment, cultural inertia, and reliance on external actors—that hinder scalability. Temporal tensions between short-term performance demands and long-term innovation goals further complicate institutionalization. However, the cases also reveal enabling factors, including leadership commitment, cross-functional integration, and iterative learning mechanisms. By analyzing failed or stalled institutionalization efforts, the study contributes to a process theory of servitization and offers practical guidance for scaling service innovation. It highlights that scalability depends not only on strategic design but also on the routinization and internal legitimacy of service innovation practices within product-centric organizations.

Introduction

Servitization—the transformation from product-centric to service-centric business models—has become a strategic imperative for industrial firms seeking sustainable competitive advantage (Baines, Lightfoot, Benedettini & Kay, 2009; Rabetino, Kohtamäki, Foss, Rahman & Huikkola, 2025). Central to this transformation is the institutionalization of service innovation processes, defined as the embedding of structured routines, roles, and resources that enable the continuous development and scaling of service offerings (Sjödin, Parida, Kohtamäki, 2020; Iriarte, Hoveskog, Justel, Val & Halila, 2023). While many firms initiate service innovation programs, such as global service development processes or innovation labs, few succeed in institutionalizing these efforts across organizational layers.

This study investigates the institutionalization challenges of service innovation processes through a comparative case study of two leading industrial firms: Volvo, which implemented a Global Service Development Process and Innovation Labs, and ZEISS, which pursued a strategic service design initiative facilitated by external consultants. Despite their strategic intent and resource commitment, both firms encountered significant barriers to embedding these processes into their organizational routines. The study aims to uncover the organizational, cultural, and structural factors that hinder institutionalization and to contribute to theory-building on service innovation in servitized contexts.

Related Work

The literature on servitization has evolved from exploring business model innovation (Rabetino et al., 2025) to examining the microfoundations of service development (Huikkola, Kohtamäki & Ylimäki, 2022). Service design has emerged as a critical enabler of

digital servitization, facilitating stakeholder alignment and co-creation (Iriarte et al., 2023). Agile approaches to service innovation, such as sprint-based development and iterative prototyping, have been shown to mitigate the digitalization paradox—where digital investments fail to yield value (Sjödin et al., 2020).

However, institutionalization remains underexplored. Sun (2025) identifies failure modes in servitization, including low commitment, slow capability development, and poor scalability, which often stem from misaligned organizational structures and temporal tensions. Martín-Peña, Sánchez-López, Kamp and Giménez-Fernández (2023) highlight the role of innovation antecedents, such as open innovation and technological capabilities, in enabling servitization performance. Yet, the mechanisms through which service innovation processes become institutionalized—i.e., routinized, legitimized, and sustained—are not well understood.

This study builds on these insights by conceptualizing institutionalization as a dynamic capability (Teece, 2007) that requires deliberate orchestration of organizational routines, cultural norms, and strategic intent.

Method

We adopt a multiple case study design (Eisenhardt, 1989; Yin, 2018), focusing on Volvo and ZEISS as theoretically relevant cases. Both firms represent advanced industrial manufacturers with explicit service innovation ambitions and documented attempts to institutionalize service development processes.

Data collection will include

Semi-structured interviews with managers, service designers, and consultants involved in the initiatives Internal documents, process maps, and strategic plans.

Observations of service development activities (where feasible)

The analysis will follow an abductive logic, iterating between empirical data and theoretical constructs from institutional theory, dynamic capabilities, and service design. We will use cross-case comparison to identify common patterns and contextual contingencies that shape institutionalization outcomes.

Findings

We expect to identify several recurring challenges in institutionalizing service innovation processes:

- Organizational misalignment between service innovation units and core business functions.
- Temporal dissonance between short-term performance pressures and long-term innovation goals.
- Cultural inertia in product-centric organizations resisting service-oriented logic.

Reliance on external actors (e.g., consultants) without internal capability building Conversely, enabling factors may include:

- Leadership commitment and strategic sponsorship.
- Cross-functional integration and boundary-spanning roles.
- Iterative learning mechanisms and feedback loops.

These findings will contribute to a process theory of institutionalization in servitization, highlighting the interplay between structure, agency, and temporality.

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Parallel Session 2

Service Innovation & Supply Chains

Co-Chairs: Esteban Lafuente & Marin Jovanovic

Exploring Digital Service Innovation (DSI) in manufacturing and supply chains through a scoping literature review

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Extended Abstract

Digital servitization, the transformation of traditional manufacturing and supply chain operations through the integration of digital technologies and service-oriented business models, is a contemporary topic for researchers and business practitioners. Our study employs systematic literature review (SLR) methodology, leaning on a scoping approach of literature categorization outlined by Paré, Trudel, Jaana and Kitsiou (2015), to analyze the current state of Digital Service Innovation (DSI) (Marić, Pejić Bach & Gupta, 2024; Opazo-Basaez, Vendrell-Herrero & Bustinza, 2022, Opazo-Basaez, Vendrell-Herrero, Bustinza & Raddats, 2022; Rabetino, Kohtamäki & Huikkola, 2024) in a particular context of supply chains. The objective is to identify empirical case studies that demonstrate how manufacturers and companies in supply chains and logistics have innovated with dedicated digital servitization approaches.

The research covers an extensive search across academic databases, yielding an initial body of 196 relevant peer-reviewed articles. These articles were systematically screened and analyzed to extract insights into the practical applications of digital servitization in supply

chains. The review focuses on identifying case studies that highlight the implementation of digital technologies –predominantly IoT, AI, or data analytics– within manufacturing and supply chain contexts, as well as the resulting transformation of business models toward service-oriented strategies.

Preliminary findings of this body of literature reveal that while digital servitization is widely discussed in theoretical terms, there is a relative scarcity of empirical case studies that focus on innovation, as defined by the DSI norms, in business application. The existing case studies emphasize the role of digital technologies in enabling predictive maintenance, enhancing customer experience, and optimizing supply chain operations. This study also highlights the fragmented nature of the literature related to DSI (Marić et al., 2024; Rabetino, Kohtamäki & Huikkola, 2023), with varying definitions and frameworks for digital servitization across disciplines. The lack of a coherent, systematic approach to studying and implementing innovation driven by digital servitization underscores the need for further empirical research and cross-disciplinary collaboration.

Keywords: Digital servitization, service digitalization, innovation, case study analysis.

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Understanding Revenue Drivers in Supply Chain Service Startups: An Interpretive Machine Learning Approach

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Abstract

This study investigates the factors influencing revenue in supply chain service startups using a Random Forest model, supported by Feature Importance metrics, SHAP (SHapley Additive exPlanations) values, and Partial Dependence Plots (PDPs). The sample consists of startups offering outsourced supply chain services. The findings indicate that firms providing outsourcing for *Production* and *Wholesale/Retail* activities are the strongest positive drivers of revenue, consistently increasing average revenues. *Service* outsourcing also contributes positively. Importantly, while *Logistics*, *Financial Services*, and *DSI*-related outsourced services exhibit predictive importance, their presence in a startup's portfolio is, on average, associated with reduced revenues. This reveals that a feature's predictive relevance does not necessarily imply a positive effect on the outcome. The study recommends that startups prioritize outsourcing services related to *Production* and *Wholesale/Retail* to drive revenue growth, while critically assessing the strategic alignment and cost-effectiveness of *Logistics* and *Financial Services* offerings. These insights provide actionable guidance for optimizing business models in the dynamic supply chain startup ecosystem.

Keywords: Startups, value chain, machine learning, revenue.

Introduction

The landscape of knowledge-intensive business services (KIBS) firms providing supply chain services is increasingly complex, driven by the integration of advanced technologies such as Artificial Intelligence (AI) and Machine Learning (ML). A significant gap in the literature concerns the identification of specific supply chain activities within KIBS that most require enhanced support (Bustinza, Opazo-Basaez & Tarba, 2022; Lafuente González, Vaillant & Vendrell-Herrero, 2015; Liu, Lattermann, Xing & Dorawa, 2019). This study draws on recent contributions to clarify this gap.

AI and ML have been framed as essential tools for digital transformation in manufacturing. According to Rana and Daultani (2023), these technologies facilitate the development of intelligent supply chains, enabling firms to increase profit margins, reduce costs, and improve customer service. This highlights a need for KIBS firms to assist manufacturers not only with technology adoption but also with workforce training and process redesign, revealing a service gap around digital transformation support. Nevertheless, many KIBS firms lack structured mechanisms to assist clients in transitioning toward digitally transformed supply chains. Thus, understanding which outsourced services drive higher revenue becomes critical. Bustinza, Vendrell-Herrero, Davies and Parry (2022), Bustinza, Vendrell-Herrero and Jabbour (2024) amplify this observation by indicating that firms should be supported in tailoring their service offerings aligned with the complexities of customer demands and advancements in technology.

In the context of sustainable supply chain operations, the integration of product-service innovations with sustainability goals (Bustinza, Vendrell-Herrero, & Jabbour, 2024) further underscores the necessity of frameworks that help companies adopt eco-friendly

practices while staying competitive. Existing literature has yet to adequately address this. Moreover, digital service innovation (DSI) is a key driver for ongoing technological advancement (Opazo Basáez, Vendrell-Herrero, Bustinza & Raddats, 2024; Opazo-Basáez, Vendrell-Herrero & Bustinza, 2022). KIBS firms must therefore support not only traditional innovation but also the integration of DSI into supply chain operations. These considerations point to an urgent need for strategies tailored to managing digital and sustainable innovation in supply chain contexts.

Methods

Using a sample of over 400 startups specializing in supply chain services across diverse sectors, this study applies a Random Forest regression model, augmented by Feature Importance analysis, SHAP values, and Partial Dependence Plots (PDPs), to identify key revenue drivers. The model's features represent distinct supply chain services that may be outsourced, encoded as binary variables (presence = 1, absence = 0).

Results

The model's outputs reveal a complex array of factors influencing startup revenue, extending beyond simple additive effects. The Random Forest analysis (Table 1) shows that the mere accumulation of outsourced service offerings does not guarantee increased revenue, suggesting potential interaction effects between features. Notably, the combination of *Production = 1* and *Wholesale/Retail = 1* is particularly associated with higher revenues, especially when other features are absent. This implies diminishing returns or even negative impacts when too many services are offered without strategic coherence.

Production	Logistics	Marketing and sales	WholeRetail	Service	FinServ	DSI in-house	DSI sourced	**Revenues**
1	0	0	1	0	0	0	0	11,02997
1	0	0	1	0	1	0	0	10,94816
1	1	1	1	0	0	1	0	10,11609
1	1	1	1	1	0	0	1	10,02334
1	0	1	1	0	0	0	0	9,966708
1	1	1	1	0	1	1	0	9,89752
1	0	1	1	0	1	0	0	9,777868
1	1	0	1	0	1	0	0	9,476334
1	1	1	1	1	1	0	1	9,46162
1	1	0	1	0	0	0	0	9,372137

Table 1. Random forest revenue expected analysis for the different combinations

SHAP analysis identifies the most influential features for predicting revenue (Figure 1).

Production, *Wholesale/Retail*, and *Service* outsourcing consistently emerge as strong positive contributors. However, despite their predictive importance, *Logistics*, *Financial Services*, and *DSI Sourced* are, on average, associated with lower revenues. PDPs further illustrate these relationships (Figure 2). Given the binary nature of features, these plots compare average predicted revenues for the presence (1) versus absence (0) of each feature. *Production* services increase average log-revenues from ~10.68 to ~10.95, and *Wholesale/Retail* from ~10.65 to ~10.88. *Service* offerings also show modest positive

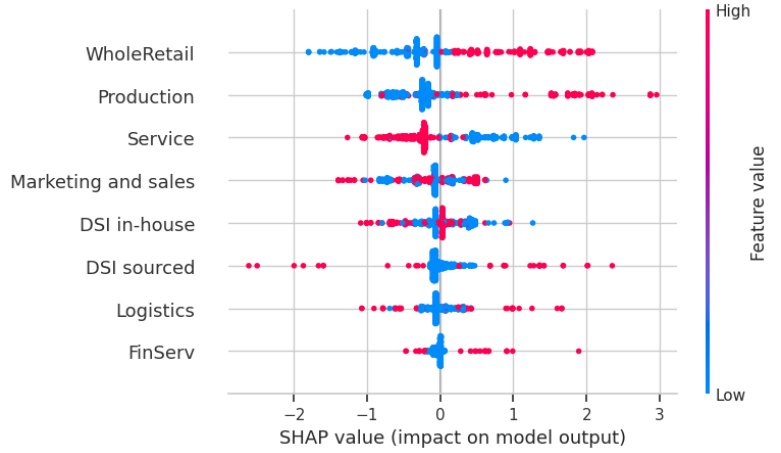

Figure. 1. Importance of features in predicting revenue

effects. In contrast, *Logistics* outsourcing corresponds to a decrease from ~10.95 to ~10.60, and *Financial Services* from ~11.00 to ~10.60.

These counterintuitive findings emphasize that predictive importance in a model indicates strong association, not necessarily a positive impact. The model relies on these negatively associated features to identify lower revenue cases. Several explanations are plausible:

- These services may entail high operational costs not matched by revenue gains.
- Startups offering these services may serve lower-revenue market segments or business models.
- Implementation inefficiencies may limit their profitability.
- Complex feature interactions not visible in univariate PDPs may exist, where positive effects emerge only in specific configurations.

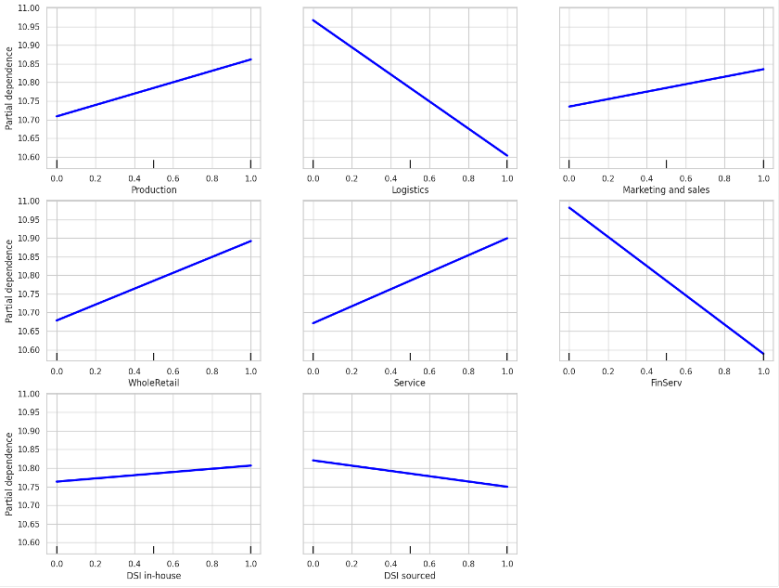

Figure. 2. Predicted averaged revenue for the features based on a PDP analysis

- SHAP value spreads also indicate heterogeneous individual impacts, while PDPs highlight average trends.

Conclusions

This study provides strategic insights for startups in the supply chain service sector. Startups should prioritize offerings in *Production* and *Wholesale/Retail* services, which are consistently associated with higher revenues. *Service* outsourcing also shows growth potential. Conversely, the negative associations of *Logistics*, *Financial Services*, and *DSI Sourced* services with average revenues warrant strategic reevaluation (Bustinza et al., 2022; Opazo-Basáez et al., 2022). Startups offering these should critically assess their cost structures,

business models, and market positioning. This might involve optimizing operations, revising pricing strategies, or even reconsidering the viability of offering these services altogether.

These findings highlight the importance of coherent business model design, where services must be strategically integrated to generate returns. Simply expanding service portfolios without synergy may reduce profitability. Future research incorporating multi-feature interaction analyses could further unravel these complex dependencies and support more refined strategic decision-making.

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Opportunities for servitization through AI-empowered services of the bike rental business in Taiwan

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Extended Abstract

Purpose – This study investigates the application of artificial intelligence (AI) in enhancing the servitization of the YouBike rental service, particularly addressing the challenges of service delivery risks and fostering service innovation. The research is centered around using AI to manage and predict bike rental shortages effectively and to innovate service delivery by adapting to customer needs and environmental conditions. This aims to transform the YouBike service from a product-centric to a service-centric approach, leveraging digital servitization.

Design/Methodology/Approach – The methodology involves analyzing the proximity of rental stations to significant locations, historical demand, environmental factors, and regional dynamics to

inform the development of AI models. Various machine learning (ML) models were evaluated to identify an optimized model capable of predicting bike rental shortages at different time intervals and pinpointing key factors influencing these shortages. The study uses comparative analysis to determine the most effective AI strategies for operational and service innovation challenges.

Findings – The research demonstrates that the optimized ML model can effectively predict bike rental shortages and identify critical variables that influence these events, thereby mitigating service risks and optimizing resource allocation. This enables digital service innovation through both basic and add-on servitization in a way that addresses both operational and environmental risks. Our findings suggest that AI significantly enhances resource management and supports digital service innovation (DSI) through strategies like service bundling and geographic customization.

Originality/Value – The originality of this research lies in its exploration of AI's role in both mitigating risks and fostering service innovation to enable the two categories of servitization for the service industry. Additionally, mitigation of operational and environmental risks has received only beginning attention, with most works being theoretical and descriptive. The servitization literature has called for further empirical evidence in this area. Our work not only fills this gap but also extends the discourse on digital servitization by integrating AI with operational strategies, providing a new perspective on enhancing service delivery and creating innovative service solutions in the bike rental industry.

Keywords: Digital servitization, Digital service innovation, Machine learning, Predictive analytics, Public bike rentals.

Dynamics enabling or hindering the scalability of digital servitization in manufacturing SMEs: An empirical approach

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Abstract

Digital servitization (DS) has been established as a strategic avenue for manufacturing companies to integrate digital capabilities into their value propositions, transforming both existing products and developing new service-based models. However, the sustainable growth of these initiatives requires a deep understanding of the factors that drive and limit their scalability. This study develops a qualitative analysis, based on multiple case studies of manufacturing SMEs, that allows identifying and analysing the barriers companies face when attempting to scale their DS strategies. The results reveal five critical areas: (1) technological limitations and interoperability; (2) organizational resilience; (3) challenges in service monetization; (4) concerns around trust and cybersecurity; and (5) restrictions in access to resources. In addition, the study also highlights enabling elements such as modular architectures, digital talent, and ethical governance. This article contributes to the debate on the relationship between digitalization, servitization, and growth, exploring when and how SD can facilitate sustainable scaling trajectories, especially for SMEs. The findings offer practical implications for designing scalable strategies that combine personalization and efficiency through digital technologies.

Keywords: Digital servitization, scalability, barriers, digital capabilities.

Introduction

The rapid evolution of digital technologies is reshaping the competitive landscape across industries. Manufacturing firms are no the exception. In this context, Digital Servitization (DS) has emerged as a transformative concept that integrates digital capabilities into service offerings, enabling firms not only to enhance existing products but also to develop entirely new service-based value propositions (Opazo-Basáez, Vendrell-Herrero & Bustinza, 2022; Zhang, Zhao & Zhou, 2024). DS can improve business outcomes in at least three dimensions. First, digital tools such as the use of analytics or embedded knowledge repositories can significantly enhance the performance of traditional offerings (Rakic, Visnjic, Gaiardelli, Romero & Marjanovic, 2021). Second, technologies like remote diagnostics or predictive maintenance support higher operational efficiency and sustainability (Beducci, Acerbi, De Carolis & Taisch, 2025). Thrid, DS allows for the development of entirely new service-based models powered by artificial intelligence (Burton, Story, Zolkiewski & Nisha, 2024). Furthermore, manufacturing firms adopt varied behavioral patterns when implementing DS, which can be broadly categorised as digital experimentalists, strategic pioneers, or servitization novices (Arioli, Pezzotta, Romero, Adrodegari, Sala, Rapaccini et al., 2025).

In line with recent conceptualizations (Opazo-Basáez, Vendrell-Herrero, Bustinza & Raddats, 2024), we adopt a broad understanding of DS that encompasses both "digital servitization" (adding digital layers to existing services) and "service digitalization" (designing services natively digital). This duality represents two strategic pathways: one pursuing standardization and scale, and another emphasizing customization and value co-creation (Rabetino, Kohtamäki, Brax & Sihvonen, 2021).

Within this framework, scalability emerges as a critical concept for enabling controlled and efficient growth without compromising

service quality or functionality. While digital technologies, especially those rooted in software and platform-based architectures, offer significant scaling potential, their diffusion and impact depend heavily on firms' access to digital capabilities and infrastructures (Minaya, Avella & Trespalacios, 2024; Vendrell-Herrero, Bustinza & Vaillant, 2021). For instance, software-based services may scale rapidly and globally at low marginal cost, whereas hardware-dependent solutions—such as sensor-based systems—often require larger capital investments and face greater replication barriers (Kowalkowski, Vindahl, Kindström & Gebauer, 2015).

Servitization is a promising but inherently complex transformation process. It demands deep organizational changes and faces several implementation challenges, particularly for small and medium-sized enterprises (SMEs) (Baines, Ziaee-Bigdeli, Bustinza, Shi, Baldwin & Ridgway, 2017; Le-Dain, Benhayoun, Matthews & Liard, 2023). However, despite its growing interest, empirical studies exploring the conditions that enable DS scalability, especially in SMEs, remain scarce. The aim of this study is to explore the barriers that SMEs encounter when attempting to scale DS strategies. Drawing from existing literature and empirical evidence, we categorise these barriers into five key domains: (1) technological barriers, such as lack of interoperability or inadequate digital infrastructure (Weerabahu, Samaranayake, Nakandala, Lau & Malaarachchi, 2024); (2) organizational resistance, including cultural inertia and misaligned capabilities (Lenka, Parida, Sjödin & Wincent, 2018); (3) service monetization challenges, where firms generate value but struggle to capture it (Ritala, Keränen, Fishburn & Ruokonen, 2024); (4) trust and cybersecurity concerns, which limit customer acceptance and data-driven interaction (Marcon, Marcon, Le Dain, Ayala, Frank & Matthieu, 2019) and; (5) resource access constraints, including financial limitations and limited internal capabilities to sustain growth (Le-Dain, Allal-Chérif & Poissonnier, 2024). This

classification aligns with recent efforts to structure the DS landscape using integrative frameworks, which emphasize the importance of understanding context, mechanism and outcomes in DS adoption (Zhang, Balaji & Jiang, 2025).

By shedding light on these factors, this research aims to contribute to a better understanding of the dynamics that enable or hinder the scalability of DS in manufacturing SMEs.

Methods / Results / Findings

To analyse a complex and context-dependent phenomenon such as the scalability of DS, a qualitative multiple-case study design was adopted, following Yin's (2018) guidelines. This methodological approach allows for a holistic and in-depth exploration of the interplay between digital capabilities, organizational dynamics, and market conditions in real-world settings.

The study focuses on a group of manufacturing SMEs engaged in DS initiatives, selected for their diverse service maturity and digital integration. Data was collected through semi-structured interviews with key stakeholders—specifically, CEOs, operations managers, and digital transformation leaders—who provided firsthand insights into the barriers encountered when attempting to scale DS strategies. The interviews were complemented by public available documentation and field observations where possible.

The analysis reveals a multifaceted set of challenges limiting scalability. Among the most recurrent are: (1) limited digital infrastructure and interoperability issues, especially in companies with legacy systems; (2) cultural inertia and resistance to organizational transformation; (3) uncertainty regarding the monetization of service value, especially in outcome-based models; (4) low levels of trust in data sharing and cybersecurity frameworks;

and (5) difficulties accessing the financial and human resources needed to support DS scaling efforts.

Despite these barriers, the study also identified several facilitators. Companies with modular service architectures, proactive investment in digital talent, and integrated ethical governance frameworks demonstrated greater potential for scalable and resilient DS models. Furthermore, strategic clarity regarding service value propositions and alignment with customer readiness proved crucial in overcoming adoption inertia.

By uncovering these dynamics, this research contributes to the emerging literature on the scalability of DS in SMEs and provides practical insights for firms seeking to successfully navigate digital-service transformation. The findings support recent calls for a better understanding of the boundary conditions under which digital servitization drives sustainable business growth.

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Comparative Application of Maturity Models for Digital Servitization

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Abstract

Due to the advancement of digitalization and changing customer expectations, industrial companies increasingly rely on service-oriented business models, such as pay-per-use or equipment-as-a-service. This digital servitization requires profound transformations in the areas of IT, processes, and customer interfaces. Various maturity models have been developed to assess the corresponding transformation capabilities; however, their comparability and practical applicability remain unclear. This study contributes to closing this gap by applying five existing maturity models related to digital servitization to the same case organization, Henkelhausen GmbH & Co. KG, a medium-sized provider of energy and industrial drive solutions that is currently developing an engine-as-a-service model. The results indicate a general agreement on the company's key areas for improvement. At the same time, structural differences in the models' foci and evaluation logics lead to divergent assessments in specific areas. The application shows that maturity models can complement each other meaningfully and provide a more differentiated picture together than any individual model could provide on its own. The study contributes to the discussion on the validity, transferability, and context-appropriate selection of maturity models for driving digital servitization.

Keywords: Digital servitization, maturity models, pay-per-X, case study.

Introduction

In the context of ongoing digitalization and growing customer expectations, service and solution business models increasingly emerge in the industrial machinery and equipment sector. With these business models, traditional products are supplemented, or completely replaced, by data-driven service offerings. So-called pay-per-X models, such as pay-per-use, pay-per-availability, or equipment-as-a-service approaches, become increasingly relevant for companies because they enable new revenue models and focus more on actual customer benefits (Schroderus, Lasrado, Menon & Kärkkäinen, 2021). These models typically require extensive changes in areas such as service delivery, IT infrastructure, operations, and customer interfaces, which motivates companies to verify that they possess the organizational, technical, and process capabilities necessary for digital servitization (Adrodegari & Saccani, 2020; Schroderus, Mittal, Menon, Lasrado & Kärkkäinen,, 2023; Senna, Barros, Bonnin Roca & Azevedo, 2023).

The literature offers various maturity models that assess the multidimensional criteria of organizational and transformational capability concerning digital service and solution business models. These models typically differentiate between dimensions such as strategy, technology, culture, processes, or data integration, assigning different maturity levels to them and their sub-dimensions (Kirmizi & Kocaoglu, 2022). Nevertheless, it remains unclear whether these models accurately reflect a uniform understanding of what makes a company ready to offer digital services and solutions, whether they will yield comparable conclusions when applied to a specific company, and how practical their recommendations are.

The present study addresses this research gap by a cross-model comparison in which several maturity models pertinent to digital servitization were applied to the same organization. We conducted a case study with Henkelhausen GmbH & Co. KG, a medium-sized provider of energy and industrial drive solutions, which is currently planning the introduction of an Engine-as-a-Service model in collaboration with a technology partner or engine supplier. This is a usage-based business model in which customers receive guaranteed engine availability or performance via defined interfaces without gaining ownership of the engines. In addition to the development of digital monitoring functions, the model also includes remote support, preventive and predictive maintenance, risk management, and transparent billing based on defined KPIs.

The objective of the study is not to make a final judgment about the maturity level of the company mentioned above, but to analyze the comparability, complementarity, and significance of different maturity models under identical application conditions. The central question is whether the model applications yield consistent findings, for example, regarding maturity deficits, structural needs for action, or areas of design that should be prioritized, or whether the models imply different understandings of maturity that lead to divergent assessments. For our study, we applied five maturity models from the area of digital servitization (e.g., Adrodegari & Saccani, 2020) and related fields, including smart product service systems (e.g., Heinz, Benz, Silbernagel, Molins, Saltzger & Lanza, 2022) and pay-per-X (e.g., Schroderus, et al., 2023), to the case organization. The models were applied simultaneously, and the correct application of the maturity models was partially verified with the support of the original authors.

Our analysis reveals that the models used are surprisingly convergent in their central statements, despite differing conceptual origins. They diagnose similar weaknesses in areas such as data

integration, process coherence, and governance issues. A consistent maturity profile is also evident in the assessment of technological fundamentals and the strategic orientation regarding digital business models. These similarities indicate that a robust maturity assessment, despite different evaluation logics, can be validated by the triangular use of several models.

At the same time, the models reveal specific differences in structure, weighting, and evaluation logic. While some models focus strongly on digital infrastructure and system integration, others emphasize cultural and organizational aspects, as well as the ability to manage business models based on clear key performance indicators. Thus, not only do the scale formats and categorizations vary, but also the conceptual starting points. These differences occasionally lead to divergent assessments, for example, regarding service process maturity or data-driven decision-making ability but offer a valuable supplementary perspective.

A central finding of the study is therefore the observation that multiple maturity models can be understood as complementary assessment instruments, which, when applied in a coordinated manner, lead to a more differentiated diagnosis and derivation of developmental needs than each individual model on its own. This methodological strategy is often recommended in research, but rarely actually implemented in the practical context of industrial transformations. By applying several maturity models to the same empirical case, both the robustness and the significance of the individual models are tested. Their combined application enables the identification and compensation for the blind spots of specific models. At the same time, such triangulation requires that one consciously deal with the differences in model logic, scale definition, and evaluation perspective.

The study thus contributes to the discussion about the suitability, further development, and potential integration of existing maturity

models in digital servitization. It shows that their significance depends not only on the quality of the model itself, but also on the idiosyncratic application and interpretation of the model. They indicate which models offer concrete recommendations for action and which remain more theoretical. This provides users with a solid foundation for selecting or adapting maturity models according to context, an aspect that has often been overlooked in previous research. In addition, the study addresses a central challenge of the maturity level discussion: the question of how far maturity should be understood as a linear maturity process of successive stages (Adrodegari & Saccani, 2020; Hajoary, Amrita & Garza-Reyes, 2024), as a modular development path (Santos & Martinho, 2020; Senna et al., 2023), or as a domain-specific competence cluster (Schroderus et al., 2023).

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Parallel Session 3

Scalability II

Co-Chairs: Christian Kowalkowski & Heiko Gebauer

Scaling Solution Offerings Globally through Modularizing Go-To-Market Approaches

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Abstract

Manufacturing firms are increasingly shifting from product-based strategies to solution-based business models, yet the architecture of value delivery often constrains their ability to scale such businesses globally. While business model innovation research has examined modularity in solution design, far less attention has been devoted to modularity in go-to-market (GTM) structures – the allocation of commercial, delivery, and support responsibilities across headquarters, subsidiaries, partners, and customers. This is striking, since scalable growth depends not only on modular offerings but equally on modular delivery systems capable of spanning heterogeneous international environments. We conceptualise GTM architectures as modular responsibility systems, in which core activities (customer engagement, sales execution, solution delivery, and lifecycle support) and non-core activities (financing, training, and portfolio governance) can be configured across various actors. This perspective addresses the dilemma of balancing scalability with local responsiveness, providing a design logic for overcoming the structural inertia of legacy networks while enabling entrepreneurial reconfiguration. Based on a comparative study of 8–10 European manufacturers, we identify recurring GTM configurations and derive a Modular GTM Toolkit. Our findings extend modularity in BMI to value delivery, illuminate the organisational and governance

foundations of scalability, and provide firms with actionable guidance for configuring scalable GTM architectures.

Keywords: Go-To-Market; Solution Business; Solution Sales; Internationalization; Modularity.

Introduction and Background

As manufacturing firms transition from product-based strategies to solution business models, their ability to scale service-based growth across international markets is often constrained by the architecture of value delivery. While much of the servitization and business model innovation (BMI) literature has focused on designing scalable value propositions, far less attention has been devoted to the scalability of go-to-market (GTM) structures. Nevertheless, empirical evidence shows that solution businesses often fail not because the offering is unviable, but because operational capabilities, such as GTM structures –i.e. responsibility allocations across headquarters, subsidiaries, partners, and customers– prove unsuitable for replication and adaptation in heterogeneous global contexts (Sun & Oliva, 2025).

International business research has long highlighted the dilemma between global integration and local responsiveness (Prahalad & Doz, 1987; Bartlett & Ghoshal, 1989), and solution business models amplify this tension. Delivering advanced solutions requires longer and more complex customer relationships, new contractual forms, and deeper involvement of local partners in customer engagement, delivery, and lifecycle support (Davies, Brady & Hobday, 2006; Storbacka, 2011). Despite this, a systematic lens for designing globally scalable GTM architectures remains underdeveloped.

Theory and Purpose

Modularity has been recognised as a key mechanism in BMI, enabling efficiency and flexibility in complex environments (Bask, Lipponen, Rajahonka & Tinnilä, 2011; Rajala, Brax, Virtanen & Salonen, 2019). However, research has broadly applied modularity to the "What?" dimension of BMI, explicitly focusing on the value proposition, including solution design and product-service architectures (Ulaga & Reinartz, 2011; Davies, 2004). In contrast, little is known about modularity in the "How?" dimension – namely, the design of GTM architectures through which solutions are sold, delivered, and supported across markets. This is surprising, given that scalable solution growth depends not only on modular offerings but equally on modular delivery systems, i.e. GTM architectures, capable of spanning heterogeneous international environments.

We argue that GTM structures can be conceptualised as modular responsibility systems, where core activities, such as customer engagement, solution framing, sales execution, implementation and delivery, lifecycle support, and non-core activities, such as financing, training, and portfolio governance, can be configured and reconfigured across different actors. A modular GTM perspective enables firms to replicate proven elements while adapting others to local conditions, thereby striking a balance between scalability and responsiveness. In this way, modular GTM architectures provide a design logic for overcoming the structural inertia (Tushman & O'Reilly, 1996) of legacy global networks while enabling entrepreneurial reconfiguration at the ecosystem level.

The purpose of this study is to investigate how modular GTM architectures can enable the scalable expansion of solution businesses across global markets. We specifically focus on the post-design phase of the solution lifecycle, analysing not what firms offer but how they deliver and capture value internationally. By comparing

how responsibilities are distributed among various international manufacturers and their downstream ecosystems, we aim to identify common GTM configurations, evaluate their trade-offs, and develop modular GTM patterns that support more flexible, context-sensitive GTM design. We ask:

What GTM responsibility configurations do international solution providers employ across their global operations?

Which modular GTM patterns can be identified, and under what circumstances do they enable scalable growth?

Methodology

Our empirical study is based on a comparative analysis of 8–10 European manufacturers in the machinery and equipment sectors. These firms have entered the solution market but face challenges in scaling solution businesses globally. Data is collected through interviews with senior executives in strategy, sales, and service, complemented by archival documents and internal process descriptions. We systematically map GTM responsibilities across five key activity areas and examine how these responsibilities are allocated between headquarters, subsidiaries, partners, and customers. This comparative approach enables us to identify recurring GTM configurations and theorise the conditions under which each pattern either enables or constrains scalability.

Expected Contributions

Our study makes three contributions. First, building on the ideas from renowned modularity research such as Campagnolo and Camuffo (2010), we extend the application of modularity in BMI from solution design to GTM architecture, thereby providing a new conceptual perspective on scalable value delivery.

Second, we examine the organisational and governance foundations of scalability in servitisation by analysing how responsibilities are allocated among OEMs and their downstream ecosystems. In doing so, we respond to calls for research on the role of downstream partners in solution value delivery and contribute to the emerging body of literature on this (Capanni, Rapaccini, Momeni, Knapp & Poeppelbuss, 2025; Momeni, Rapaccini & Martinsuo, 2024; Raddats, Momeni, Rathi & Bigdeli, 2024; Hullova, Laczko & Frishammar, 2019).

Third, we develop a Modular GTM Toolkit, offering firms a design-oriented framework for configuring scalable GTM architectures based on contextual contingencies.

This study enhances understanding of how industrial and governance differences affect scalability. By viewing GTM as a modular responsibility system, it shows how internal processes, partner governance, and local factors influence the scalability of solution businesses. While previous research focuses on the modularity of offerings or digital technologies as drivers of scalability, this work highlights the less explored organisational and governance aspects of GTM architecture.

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From intention to adoption: factors enhancing e-government digital service adoption in the UAE

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Extended Abstract

This study examines the emergence and the use of e-government services in the United Arab Emirates (UAE), with a particular focus on understanding the environmental determinants impacting service innovation, and factors influencing adoption by customers/users. Leaning on the logic of service digitalization, that is, servitization and service innovation emerging before integrating digital capabilities (Vendrell-Herrero, Para-González, Mascaraque-Ramírez, & Freixanet, 2024), we discuss the context of governmental services as a non-industrial setting (opposite to typical scholar approach to digital servitization or service digitalization in industrial contexts), which, as a consequence, opens completely new tracks of contributions and discussions in servitization scholar communities.

It has been discussed that advanced technologies, through interconnectivity, data, and learning, enable companies to create new

digital service offerings (innovation) across industries. These also allow businesses to align their business models with customer needs (Vaillant & Lafuente, 2024; Rabetino, Kohtamaki & Huikkola, 2024) and services become sources of digital innovation (Opazo-Basáez, Vendrell-Herrero, Bustinza & Raddats, 2024). We argue that governmental services follow the same pathways of service dominant logic (Vargo & Lusch, 2004, 2008) where the value is co-created and determined by how well offerings address customer/ user needs.

In order to prove this conceptual approach, by building on the Unified Theory of Acceptance and Use of Technology (UTAUT) extended with additional constructs –system quality, perceived security, and satisfaction– we tailored a study for the context of UAE. UAE is an extremely dynamic environment with various governmental-funded services going along with the recently established digital strategy of the country. Data was collected through a survey of 616 users of e-government portals and applications. Linear regression analysis was applied to test the framework.

The results indicate that all UTAUT dimensions significantly affect behavioral intention towards governmental services, except for social influence. Among the additional constructs, satisfaction emerged as the strongest driver, while perceived security and system quality were also playing an important role. However, user satisfaction did not moderate the relationship between perceived security of services and behavioral intention.

As such, study findings contribute to both theory and practice. In the first hand, insights contribute to the never ending question of how digital technologies enhance governmental services through interactions with customers/users (Opazo-Basáez,Monroy-Osorio & Marić, 2024; Vendrell-Herrero, Bustinza, Opazo-Basaez & Gomes, 2023), whilst advancing the understanding of services scalability through digital capabilities in a non-industrial setting (Fang, Palmatier & Steenkamp, 2008; Suarez, Cusumano & Kahl, 2013; Kowalkowski,Wirtz & Ehret, 2024; Vendrell-Herrero, Vaillant & Bustinza, 2025). This, on the other hand, also leads to managerial insights oriented towards a classical and straightforward set of insights relevant to improving e-government services. The empirical

data coming from UAE adds an additional scholar flavor with a relatively dynamic and unique geographical context ignored in the North-South research tendencies among the scholars of servization community (Marić, Pejić Bach & Gupta, 2024).

Keywords: Digital servitization, service innovation, e-government, customer/user interaction, scalability, quantitative research design.

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From Pilots to Scale: A Multi-level Capability Stack for GenAI-Enabled Service Digitalization in Industrial Firms

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Abstract

Industrial and service-intensive firms have accelerated experimentation with generative AI in customer service, yet many initiatives stall at the proof-of-concept stage and fail to travel across units, channels, or geographies. This study explains how firms move from pilots to enterprise deployments that deliver repeatable value at declining marginal cost while maintaining quality and control. We adopt an inductive case design centred on a large European telecommunications provider and analyse 21 semi-structured interviews across strategy, engineering, product, and operations, complemented by internal artefacts. The analysis yields a three-layer capability stack. The readiness layer integrates strategic alignment and governance, shared technical substrates for model access, retrieval, and evaluation, and human readiness through literacy, role redesign, and protected experimentation. The scaling mechanisms layer converts readiness into replication by orchestrating partner portfolios, clarifying ownership and translator roles, engaging stakeholders early and continuously, aligning expectations with GenAI-specific evaluation, reconfiguring service and process logic, and institutionalising learning so improvements propagate across use cases. The outcome layer signals when the economics of service delivery change due to declining integration costs, growing reuse of technical and organizational components, and system-level

personalization. A cross-cutting finding concerns sequencing: initiatives that layer GenAI into established service routines scale faster because ownership, interfaces, and evaluation logic already exist, while technology-first efforts progress once shared substrates, translation roles, and explicit go-live criteria are in place. The study advances understanding of scalable GenAI in customer operations by specifying the organisational and technical conditions under which use cases replicate, and it offers managers a deployable capability stack and evaluation logic to shift from experimentation to controlled, repeatable value creation.

Keywords: Generative AI; customer service operations; scalability; service digitalization; industrial firms; AI governance.

Introduction

Generative AI lowers the cost of trialing customer-facing tools for knowledge retrieval, text generation, and conversational triage, which explains the recent proliferation of pilots. However, scaling in industrial and service-intensive settings remains difficult because legacy data and IT architectures raise integration costs, model behavior requires new assurance and evaluation practices, and coordination across business, engineering, operations, and compliance adds decision frictions. We define scaling as the capability to reproduce performance under variety with stable risk and falling marginal cost, consistent with contemporary treatments of organizational scaling and scale-up in digital contexts (Coviello, Autio, Nambisan, Patzelt & Thomas, 2024; Giustiziero, Kretschmer, Somaya & Wu, 2023). Research on digitalization and service-led growth reveals why services become the primary vehicle for value creation in industrial and service-intensive firms, and why governance and alignment are crucial for capturing value (Kohtamäki, Parida Patel & Gebauer, 2020; Shen, Sun & Parida, 2023). Related work highlights that sequencing between digital and service moves can shape scalability trajectories (Vendrell-Herrero,

Para-González, Mascaraque-Ramírez & Freixanet, 2024). Building on these insights and ecosystem-oriented accounts of assembling internal assets with external complements (Kolagar, 2024), we explore how industrial and service-intensive firms can scale GenAI-enabled customer service from early proofs to enterprise deployments that deliver repeatable value at declining marginal costs while maintaining quality and control.

Methodology

We employ a qualitative, inductive case design suited to tracing socio-technical change in context. The focal site is a large European telecommunications provider with approximately 4,000 customer service agents and live GenAI use cases in summarization, agent assistance, and conversational routing. The dataset comprises 21 semi-structured interviews with AI strategy leads, product and process owners, software and data engineers, operations managers, and external partners. Interviews were recorded and transcribed, and were complemented with internal documents and project artefacts. Analysis followed the Gioia methodology, moving from first-order informant terms to second-order themes and aggregate dimensions through iterative comparison and constant triangulation; informal member checks supported credibility and analytical generalization rather than statistical inference (Gioia, Corley & Hamilton, 2013; Yin, 2018).

Preliminary Findings

The analysis yields a three-layer capability stack that explains movement from experimentation to scale. At the *readiness layer*, strategic alignment and governance define intent, decision rights, and evidence requirements for go-live and continued operation.

Technology readiness takes the form of shared substrates that lower integration cost across use cases, including a secure model gateway that abstracts vendor change and enforces guardrails, reusable middle-layer services for retrieval, redaction, and prompt management, and a common evaluation substrate with curated datasets, task-appropriate metrics, and runtime monitoring. Human readiness centers on GenAI literacy for leaders and frontline staff, role redesign toward exception handling and problem solving, and protected time with sandbox environments that make experimentation feasible within operational constraints.

The *scaling mechanism layer* converts readiness into replication. Firms orchestrate partner portfolios to balance speed from hyperscalers and niche vendors with control over proprietary assets such as evaluation corpora, taxonomies, and retrieval logic. Ownership and translator roles are clarified early so that handoffs among business, engineering, data, and compliance do not stall as complexity increases. Stakeholders are engaged early and continuously to reframe job-loss concerns, surface practical design constraints, and build trust in regulated or unionized environments. Expectations are aligned with GenAI-specific evaluation that augments or replaces legacy indicators when task complexity changes. Service and process logic are reconfigured, for example, by compressing support tiers and reusing foundation components across channels. Learning is institutionalized through repositories, playbooks, and evaluation assets, so improvements propagate, and subsequent deployments become faster and cheaper without compromising quality.

The *outcome layer* signals when the economics of service delivery change. When readiness and mechanisms cohere, we observe declining marginal integration costs, expanding reuse of technical and organizational components, and system-level personalization through improved capture and use of interaction histories. A cross-cutting pattern concerns sequencing: initiatives that layer GenAI

into established service routines scale faster because ownership, interfaces, and evaluation logic already exist; technology-first initiatives progress once shared substrates, translation roles, and explicit go-live criteria are in place.

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Scaling Without Selling Out: How Ecosystem Alliances Empower Emerging Scaling up Firms

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Introduction and Research Question

Scalability has attracted increasing attention in recent years. Research on scalability has primarily been entrepreneurship- and individual-focused, examining how start-up firms build internal capabilities, such as organizational structures, technological architectures, and business model designs to enable exponential growth through internal mechanisms (Coviello, Autio, Nambisan, Patzel & Thomas, 2024; Vendrell-Herrero, Vaillant & Bustinza, 2025). However, external factors such as innovation systems, entrepreneurial ecosystems, and their supporting organizations are also relevant and can potentially influence a firm's scalability (e.g., Autio, 2022; Thomas & Autio, 2020; Tippmann, Ambos, Del Giudice, Monaghan & Ringov, 2023). Yet, their role compared to internal factors, remains less well understood. The aim of this paper, therefore, is to examine how the external context complements a firm's internal capabilities in achieving scalability, particularly through the delivery of integrated services and solutions enabled by digital technologies and data, which foster new business models and enhanced connectivity.

We argue that strategic alliances can act as a bridge between a firm's scalable capabilities and the broader external resources needed for growth, and we term such an extended scalability as alliance-based scalability. In this way, alliances foster a firm's scalability architecture through linking internal and external elements. Prior studies suggest that involving partners in the value delivery process can significantly enhance scalability. Specifically, alliances may reduce internal burdens by outsourcing capital investments to partners or by creating platform-based ecosystems where multiple complementary players collaborate as partners or customers (Nielsen & Lund, 2017; Gulati, 1998).

Alliance-based scalability typically takes two forms: bilateral alliances, which involve one-to-one relationships, and multilateral or ecosystem alliances, which bring together networks. For scalable companies striving to scale, bilateral alliances with an incumbent firm can provide valuable access to resources and markets. However, these alliances often concentrate bargaining power in the hands of the incumbent, increase hold-up risks, and may ultimately expose the start-up to acquisition as the incumbent internalizes complementarities. A well-known example is Google's acquisition of Waze, which began as a data-sharing alliance but ultimately resulted in Waze being absorbed into Google. While such outcomes may suit start-ups seeking a profitable exit, they pose a challenge for those that wish to grow independently and achieve scalability on their own terms.

Alternatively, we argue that a stronger option for scalable start-ups to develop scalability is to partner with multiple players in ecosystem alliances. These multilateral networks distribute dependence, preserve strategic autonomy, and sustain outside options. By aligning around shared standards, platforms, and channels, start-ups can achieve scale without becoming acquisition "captives." Such alliances embed young firms in webs of trust and resources,

allowing them to benefit from relational ties characterized by reciprocity as well as structural positions that facilitate information flow and resource access (Uzzi, 1996). The network thus functions as a collective "growth platform," enabling start-ups to scale not only through their own capabilities but also by mobilizing the broader social and economic embeddedness of the ecosystem. As the capacity of the entire network expands, positive spillovers are generated for all participants. In this sense, scalability becomes an emergent property arising from the integration of multiple organizations' architectures and resources (Adner, 2017). Start-ups' products and services effectively become part of a larger, scale-free platform, reframing scalability from a firm-centric outcome to a collective one: as the ecosystem's ability to deliver value at scale grows, each participating firm can leverage that expansion.

Digital servitization is particularly relevant for scalable firms because growth today relies less on expanding production capacity and more on embedding products within digitally enabled service systems. By creating value-in-use and addressing customers' contextual needs through digital infrastructures such as data platforms, analytics, and interfaces, firms can deliver services efficiently and at scale. Consequently, scaling is less about replicating products and more about extending digital service architectures across users and markets. Digital servitization thus enables firms to integrate digital capabilities with service-oriented business models and to create new forms of value in both consumer and industrial markets (Gebauer, Paiola, Soccani & Rapaccini, 2021). From this perspective, ecosystem-based alliances become critical, as they allow firms to co-create digital and service capabilities through interfirm collaboration, fostering scalability without immediate acquisition dependency. In line with Sklyar, Kowalkowski, Tronvoll and Sörhammar (2019), such collaborative ecosystems help start-ups leverage shared digital infrastructures and relational embeddedness

to grow independently and build scalable foundations for future scale-up. Similarly, Ahmed and Kowalkowski (2025) show that in multi-platform ecosystems, scalability depends on governance mechanisms, complementor integration, and boundary resources that enable heterogeneous actors to interoperate—highlighting that for digital start-ups, ecosystem alliances rooted in digital servitization provide the essential foundation for sustainable growth.

In summary, this paper aims to examine how ecosystem alliances enable digital and servitized scalable start-ups to scale while reducing the risk of acquisition by incumbents. By linking their internal architectures with partners' assets, start-ups can leverage complementarities without losing strategic autonomy. Scalability thus emerges as a collective property of the ecosystem rather than the achievement of a single firm.

Methodology

The study employs a case-based exploratory qualitative approach, focusing on the space sector. The space industry has unique attributes and challenges because it introduces a new environment for organizations, where institutions are often underdeveloped or non-existent, geographical boundaries are undefined, and extreme physical conditions prevail (Raswant, Nielsen & Buckley, 2025). In this context, an institutional vacuum exists, characterized by weak coordination between public and private stakeholders and insufficient governance to manage the growing interdependence between Earth and space activities. These conditions pose significant challenges for all stakeholders (Raswant et al., 2025). Consequently, the space industry, with its distinctive characteristics and constraints, provides an appropriate context to better

understand how ecosystems support the generation, development, and scaling of firms.

The central case is the *EU Copernicus Program*, the European Earth Observation (EO) flagship infrastructure of satellites (called "Sentinels") operated by the European Space Agency (ESA) for the European Commission (EC). Copernicus, through its Sentinels, provides free and open data about Earth diverse user bases. Since 2009, the Copernicus Program has been enriched by Contributing Missions, which are satellites provided by multiple companies entering the program with complementary data to address new data needs. In addition to established data suppliers (e.g., Airbus, Planet Labs, E-Geos, ICEYE), recent Contributing Missions have come from what is referred by the European Commission as *emerging scale-ups* (e.g., Constellr, Kuva Space, Orora Technologies). These new players aim to strengthen the Copernicus ecosystem and its data offerings, while leveraging its global reach and established user base to increase their visibility and growth. As emerging scale-ups, they represent an ideal natural experiment for examining the potential to achieve true scalability. This case presents a significant opportunity, as major incumbents in the space sector conventionally prefer acquisitions over strategic alliances.

This study seeks therefore to explore strategic alliances within Copernicus, with a particular focus on understanding collective scalability within ecosystem partnerships and the benefits to both scale-ups and established data suppliers. Data sources to build the case include primary and secondary data, such as semi-structured interviews, documents, and industry reports. The analysis is informed by alliance and ecosystem literature, which provides the theoretical foundation for understanding the dynamics of alliances within the Copernicus ecosystem.

Keywords: Scalability, Ecosystem alliances, Servitization, Digitalization, Start-ups.

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Scaling Digital Services in Servitization: Service Modularity as Sociomaterial Practice

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Keywords: Generative AI; customer service operations; scalability; service digitalization; industrial firms; AI governance.

Introduction and Context

In digital servitization trajectories, manufacturing firms rely on integrated product-service- software components to fulfill the varying and evolving needs of customers (Hsuan, Jovanovic, & Clemente, 2021; Kohtamäki, Parida, Oghazi, Gebauer & Baines, 2019). Growing digitalization, combined with sophisticated customer demands for more data-driven service offerings, requires firms to develop more advanced, digitally enabled services (Kowalkowski, Wirtz & Ehret, 2024). In this context, through scaling, manufacturing firms can achieve the expected results from investments, supporting the development and deployment of digital services. Following Coviello, Autio Nambisan, Patzelt and Thomas 's (2024, p. 14), scaling can be defined as an "organizational process whereby managers transform the internal organization and leverage digital resources to rapidly expand a firm's outputs without a corresponding ex-ante increase in inputs."

Previous research has highlighted industrialization (Kowalkowski, Windahl, Kindström & Gebauer, 2015) and service productization (Wirtz & Kowalkowski, 2023) as strategies that could lead to more

scalable solutions and services in the B2B context (Kohtamäki, Rabetino, Parida, Sjödin & Henneberg, 2022; Wirtz & Kowalkowski, 2023). Recently, digital technologies have become progressively more sophisticated and increasingly accessible at an affordable cost, creating multiple ways through which manufacturing firms can scale their businesses (Palmié, Parida, Mader & Wincent, 2023; Vendrell-Herrero, ., Vaillant & Bustinza, 2025). As promising as it looks, developing and scaling product-service solutions that embed complex digital services is challenging, especially in light of artificial intelligence-enabled developments, due to increasing levels of service customization and the complexity of service businesses (Sjödin, Parida, Palmié & Wincent, 2021). Manufacturing firms often face the challenge of scaling their digital service businesses (Kohtamäki, Brekke, Naeem, Sjödin & Parida, 2025; Kowalkowski et al., 2015), as it requires different skills and capabilities than those that enable scaling their product businesses. Particularly, scaling digital services is challenging for firms, as it must enable both volume – the provision of a large volume of services to a large number of customers – and variety – the provision of services adapted to increasingly heterogeneous customer needs.

This study argues that an ascending scaling trajectory exists, which moves from low- volume, low-variety service offerings to higher levels, where the number of stages along this trajectory varies across firms. In adapting Hayes and Wheelwright's (1979) product-process matrix to digital services, we consider that scaling lies at the intersection between standardization and customization to ensure both volume and variety. The underlying mechanism that underpins this scaling trajectory through multiple stages is service modularity, which refers to the extent to which service components can be separated and recombined into new service packages (Hsuan et al., 2021; Schilling, 2000). Modularity increases volume in services through enabled economies of scale while also increasing variety

through enabled economies of scope (Ponsignon, Davies, Smart & Maull, 2021).

In this context, modularity serves well when heterogeneous inputs can be recombined into different configurations to fulfill heterogeneous customer demands (Schilling & Steensma, 2001). For services, replicability enabled by modularity is a critical factor in this discussion, as it allows service components to be replicated across offerings, increasing volume and variety without necessarily growing inputs proportionally (Voss & Hsuan, 2009). The same set of service components can be extensively recombined and replicated across different offering configurations, thereby achieving the volume and variety (Salvador, Forza & Rungtusanatham, 2002) necessary for scaling digital services. Replication through service modularity helps manage the tension between standardization and customization (Voss & Hsuan, 2009), one of the hurdles in scaling digital services in manufacturing firms.

Digital technologies have a dual role in scaling digital service through modularity. On one hand, digital technologies drive the development of novel, digitally-enabled services that can be later recombined into service packages (Rabetino, Kohtamäki & Huikkola, 2024). On the other hand, these technologies provide analytical capabilities (particularly through AI) that allow manufacturing firms to manage and scale a complex portfolio of digital services (Sjödin et al., 2021). In turn, digital technologies expand replicability, recombinability, and scalability of the digital service portfolio, in which service modularity is the mechanism through which it is structured and managed (Hsuan et al., 2021).

Suppose service modularity is approached from a design or architectural perspective only –as it has been dominant in the literature (Brax, Bask, Hsuan & Voss, 2017). In that case, there is a risk of overlooking how scaling is enabled through everyday practices, how managers and customers engage to scale services

(Kohtamäki et al., 2025), and the materiality of enabling digital technologies (Orlikowski & Scott, 2008).

Against this backdrop, our research aims to understand the role of service modularity as a sociomaterial practice that underpins and enables the scaling of digital services in servitized manufacturers. In doing so, this paper addresses the following research questions: (i) How does service modularity as sociomaterial practice enable scaling trajectory in servitized firms? And (ii) What are the main stages in the scaling process in servitized manufacturing firms, and how do they unfold over time?

Our reseach adopts a practice theory perspective and leverages service modularity as a sociomaterial practice. Service modularity as sociomaterial practice underpinning scaling as an organizational process contributes to the emerging calls for a more micro-level, practice- oriented approach to modularity (Brunswicker & Mukherjee, 2023; Sanchez, Galvin & Bach, 2023). Service modularity as sociomaterial practices shifts the focus away from the content of what is being scaled, shedding light on how this micro-level perspective connects to scaling as macro- level organizational process (Kohtamäki, Rabetino, Einola, Parida & Patel, 2021). Such an approach not only addresses recent calls for micro-level approaches to scaling (Coviello et al., 2024; Palmié et al., 2023) but also contributes to the novel view of services-as-practices (Skålén, 2024).

The study adopts a process research approach to investigate how service modularity as sociomaterial practices enables the scaling of digital services in manufacturing firms. In leveraging a strong process ontology (Langley, Smallman, Tsoukas & Van De Ven, 2013), we consider scaling an ongoing process of becoming (Cloutier & Langley, 2020). This means that while scale-up, for example, may be a phase –like others may exist– or an important moment in a firm's growth, scaling persists, neither ceasing to exist

nor ending after the scale-up phase. With this view, scaling is a process that is continually adapted and altered through the enactment of service modularity as a sociomaterial practice by managers, customers, and other stakeholders involved in the process.

Research Methods

This research employs a longitudinal, over thirty-year, abductive single-case study design. Longitudinal research is suitable for process research, allowing the investigation of how scaling unfolds and changes over time (Langley et al., 2013), and is underpinned by service modularity as a sociomaterial practice. Therefore, processes are important from the perspective of practitioners (Gehman, Glaser, Eisenhardt, Gioia, Langley & Corley, 2018). Our case company is a Finnish solution provider leading in its sector, with a strong record of developing, scaling, and commercializing worldwide digitally enabled services to its large installed base of technological products. Our research draws on data collection from multiple sources to ensure robustness, such as (i) semi-structured interviews, (ii) corporate reports, (iii) press releases, and (iv) other materials (audiovisual and others) for investors and other stakeholders. Through robust data collection and analysis, we aim to develop a strong process theory for scaling digital services in servitized firms, investigating how scaling is enacted through service modularity as a sociomaterial practice.

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Parallel Session 4

Marketing, Sales & Customer Value

Co-Chairs: Marco Opazo-Basáez & Tontxu Campos

Exploring the Strategic Role of Marketing and Communication in the Servitization Process in Manufacturing Firms

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Extended Abstract

Servitization — the shift from a traditional product-centric business model to an integrated service-centric approach — has emerged as a critical strategy for manufacturing firms seeking long-term competitive advantage. Yet, despite its promise, the implementation of servitization often encounters significant hurdles, including internal resistance, fragmented internal communication, and relational capability gaps. Against these constraints, this research aims to reconceptualize servitization not merely as an outcome, but as a dynamic capability comprised of three interlinked dimensions: sensing, seizing, and reconfiguring (Teece, 2007). In doing so, it explores the role of marketing and communication (M&C) strategies — both internal and external, digital and traditional — as relational enablers that foster cross-functional alignment, deepen customer relationships, and enable effective service co-creation. Grounded in Dynamic Capabilities theory (Teece, 2007), Relationship Marketing theory (Grönroos, 1994), and Digital Organizational Communication theory (Men & Bowen, 2016), this paper proposes a comprehensive conceptual framework for understanding how M&C strategies drive servitization capabilities and influence performance outcomes across financial, market, and customer dimensions. Through a sequential mixedmethods approach, integrating expert interviews and a survey of industrial firms, this study will illuminate the mediating role of capabilities and the moderating effects of contextual variables such as technological intensity, servitization maturity, and firm size. The findings will offer

both theoretical advances and actionable insights for firms seeking to successfully navigate the servitization journey.

Keywords: Servitization, marketing, internal communication, digitalization, dynamic capabilities, relational marketing.

Introduction

Servitization has evolved from a tactical extension of traditional manufacturing offerings to a strategic shift towards service-centric value creation (Vandermerwe & Rada, 1988; Baines,., Lightfoot, Benedettini & Kay, 2009). Yet, despite its growing relevance, firms continue to struggle with its implementation. These challenges often arise from misaligned internal structures, cultural resistance, or a lack of relational capabilities required for service-centric thinking (Kowalkowski, Gebauer, Kamp & Parry, 2017). As a result, many firms experience "deservitization", a partial or complete reversal of service offerings (Valtakoski, 2017). To overcome these hurdles, recent studies have advocated for a dynamic capabilities approach (Teece, 2007), positioning servitization as an ongoing process that involves sensing latent market opportunities, seizing them through service innovation, and reconfiguring internal resources and routines. Against this backdrop, this paper explores the role of marketing and communication (M&C) strategies as relational enablers for servitization, highlighting their pivotal role in aligning internal stakeholders, deepening customer relationships, and facilitating service co-creation.

Conceptual Framework

Servitization as a Dynamic Capability

Servitization is increasingly understood as a dynamic capability —an organizational competence allowing firms to adapt to and shape

service-oriented environments (Teece, 2007). This perspective captures three core sub-capabilities:

- **Sensing**: Identifying latent customer needs, technological advances, and market trends.
- **Seizing**: Mobilizing internal and external resources to design and launch service offerings.
- **Reconfiguring**: Aligning internal structures, capabilities, and culture to enable service-centric strategies.

Each sub-capability is activated and sustained through marketing and communication.

The Relational Role of Marketing and Communication

Relationship Marketing theory (Grönroos, 1994) and Digital Organizational Communication theory (Men & Bowen, 2016) shed light on how M&C strategies enable servitization. Kohtamäki, Rabetino and Einola (2020) emphasize cross-functional collaboration to achieve optimal outcomes and internal communication for service-oriented mindsets and facilitate knowledge sharing. Meanwhile, external relational marketing allows firms to foster long-term connections with customers, gathering feedback and nurturing collaborative service design. Together, these efforts build trust, foster co-creation, and enable firms to adapt offerings in line with customer and market demands.

Proposed Conceptual Framework

This paper proposes an integrative framework in which internal and external M&C strategies operate as relational enablers across the three servitization dynamic capabilities. The interplay of these capabilities influences servitization outcomes across three performance dimensions: financial, market, and customer.

Contextual factors (technological intensity, servitization maturity, and firm size) further moderate these effects.

Research Propositions

P1. Relational marketing and internal communication strategies positively influence the development of servitization capabilities (sensing, seizing, reconfiguring).

P2. Servitization dynamic capabilities positively affect performance across customer, market, and financial dimensions.

P3. Servitization capabilities mediate the relationship between relational M&C practices and performance outcomes.

P4. The effectiveness of M&C practices depends upon external contextual factors (technological intensity, servitization maturity, and firm size).

Methodology

This study adopts a sequential mixed-methods design (Creswell & Plano Clark, 2018), grounded in a pragmatic epistemology (Morgan, 2007). The qualitative phase utilizes semi-structured interviews with senior managers to capture perceptions of servitization and the role of M&C. Thematic coding (Braun & Clarke, 2006) will identify key patterns and relational dynamics. The quantitative phase will use survey data from manufacturing firms, employing Structural Equation Modeling (Hair, Hult, Ringle & Sarstedt, 2017) to test proposed relationships, mediation effects, and moderation effects. This approach allows for methodological triangulation and robust testing of the theoretical model.

Contribution

This research aims to contribute to both theory and practice. Theoretically, it advances servitization literature by reframing the phenomenon as a dynamic capability rooted in integrating relational marketing and internal communication within the dynamic capabilities' lens, addressing critical gaps in the literature (Adams, 2018; Benedettini, Neely & Swink, 2015). In doing so, it bridges an important gap by aligning servitization theory (Teece, 2007) with Relationship Marketing (Grönroos, 1994) and Digital Organizational Communication theory (Men & Bowen, 2016). Practically, it provides actionable insights for manufacturing firms. The findings will aid managers and researchers in crafting effective servitization strategies across diverse technological and market contexts.

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Enabling Servitization and University-Industry Ecosystems for SME Internationalization – A Case Study of Commercialization Strategies in an Industrial Ecosystem

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Abstract

University–industry collaboration has become a key driver of innovation, bringing together universities, industries, and governments into collaborative ecosystems. These ecosystems have increasingly started to facilitate new value creation through servitization, with value being captured using various revenue-sharing models with the ecosystem orchestrator. Small and medium-sized enterprises (SMEs) have an important role as ecosystem complementors. To succeed in this role, SMEs must develop new capabilities — not only do they need to understand the ecosystem's business logic and co-create joint offerings with other ecosystem partners, but they also need to implement strategies that empower their salesforce for ecosystem offering sales. This work-in-progress research argues that SMEs would benefit from building strategic, servitization-specific sales enablement initiatives that integrate diverse organizational resources to enhance the ecosystem-based offering commercialization strategies and improve sales productivity in the ecosystem. The study is conducted as a qualitative multi-case study within an innovation ecosystem that is developing industrial metaverse solutions for manufacturing companies. The goal of this

research is to develop a strategic sales enablement framework that supports the commercialization strategies of ecosystem-based servitization offerings. This research is intended to be extended to testing the developed framework empirically in real-life business settings.

Keywords: Servitization, ecosystem, SME, commercialization, sales enablement, university–industry collaboration.

Theoretical Background

The modern economy is driven by new innovations that are created in collaboration between universities, industries, and governments (Etzkowitz, Webster, Gebhardt & Terra, 2000; Etzkowitz, Dzisah, Albats, Cai & Outamha, 2023; Etzkowitz & Dzisah, 2008) in ecosystems that support the innovation creation process (Autio, Kenney, Mustar, Siegel & Wright, 2014). Modern ecosystems have evolved into dynamic, technology-driven partnerships that are set to promote continuous innovation and co-creation among ecosystem stakeholders (Vandermerwe & Erixon, 2023) who collaboratively share resources to co-create value (Vargo & Lusch, 2016).

Today, many of new the innovations are brought to the market using different servitization business models (Paiola, Grandinetti, Kowalkowski & Rapaccini, 2024; Visnjic Kastalli & Van Looy, 2013). Servitization, however, adds another layer of complexity to the commercialization strategy by fundamentally transforming value creation strategies, stakeholder relationship management, and the development of a value proposition that drives sustainable profitability (Fang, Palmatier & Steenkamp, 2008; Kohtamäki, Partanen, Parida & Wincent, 2013; Rabetino, Kohtamäki & Gebauer, 2017). Especially nowadays, when manufacturing companies have become more and more technology-driven businesses, servitization requires a technology-focused mindset and a service-oriented approach to create new value propositions (Baines, Lightfoot,

Peppard, Johnson, Tiwari, Shehab et al., 2009) using business model innovation strategies (Paiola, Agostini, Grandinetti & Nosella, 2022) within the ecosystem.

SMEs have developed a unique role in these ecosystems as complementors (Cozzolino & Geiger, 2024; Miehé, Palmié & Oghazi, 2023), and they bring their unique knowledge to the ecosystem to create collaborative value delivery systems (Kohtamäki, Parida, Oghazi, Gebauer & Baines, 2019; Saadatmand, Lindgren & Schultze, 2019). Strategic alliances are viewed as a strategy for SMEs to foster innovation and enhance capabilities for value creation (Pombo & Franco, 2023; Gao & Yu, 2023). These strategic alliances, such as joint training programs and call centers, contribute to building intellectual capital and positively impact servitization initiatives in the ecosystem (Rapaccini, Cinquini, Mauro & Tenucci, 2024). Technology suppliers can also help to identify and capture digital service opportunities in the ecosystem and thus evolve the strategic partnerships that transform the manufacturer's business model into digital servitization (Momeni, Martinsuo, & Härkälä, 2024).

Servitization and ecosystem-based commercialization requires, however, organizational capability development as well as co-creative value development for new service offerings (Garcia Martin, Schroeder & Ziaee Bigdeli, 2019; Trabert, Doerr & Lehmann, 2023). Current research neither explicitly explains what the strategic implications of ecosystem-oriented sales processes are for SMEs pursuing servitization (Galvani & Bocconcelli, 2022; Gomes, Farago, Facin, Flechas & Silva, 2023; Smania, Osiro, Ayala, Coreynen & Mendes, 2024) nor how sales enablement initiatives impact the ability of sales teams to foster ecosystem partnerships and to accelerate commercialization of servitization-based ecosystem offerings (Friend, Mangus, Pullins, Davis & Gilstrap, 2024; Kowalkowski, Kramer, Eravci, Salonen & Ulaga, 2025;

Peterson, Malshe, Friend & Dover, 2021; Rangarajan, Dugan, Rouziou & Kunkle, 2020). This work-in-progress research aims to fill these research gaps by conducting empirical research in real-life business settings. The goal of this research is to contribute both academically and managerially by developing a strategic sales enablement framework that supports the commercialization of ecosystem servitization offerings.

Methodology

This research employs a qualitative multi-case study approach to explore ecosystem-based servitization and the role of SMEs as complementors within an innovation ecosystem (cf. Braun & Clarke, 2006; Flyvbjerg, 2006; Yin, 2013). The ecosystem in question is developing industrial metaverse solutions for manufacturing companies and consists of a publicly listed company acting as the orchestrator, several university R&D collaborations, and over 70 SMEs serving as the complementors. The ecosystem is jointly financed by national and European Union funding, along with co-financing from the participating companies. The ecosystem orchestrator and the SMEs were selected by using purposive sampling to identify an ecosystem that is undergoing the servitization business model implementation process together with the SMEs as the complementors in the ecosystem (cf. Eisenhardt, 2021).

Early Findings

The ecosystem orchestrator elaborated in two separate interviews that the company began formulating the ecosystem in late 2020 through early R&D programs. The current ecosystem program, which was launched in late 2024, has secured funding of 70 million

euros. The primary goals of the ecosystem at this stage are to prepare the commercialization of innovations and create various revenue sharing models. These goals also pose the main hurdles that the ecosystem orchestrator has attempted to solve and overcome in collaboration with the other complementary stakeholders. The problem at hand has to do with the fact that the ecosystem partners must develop a unified knowledge and capabilities in relation to the commercialization of the ecosystem offerings. As a core component of the commercialization strategy of the ecosystem offerings has been mentioned data-driven business models (cf. Ritala, Keränen, Fishburn & Ruokonen, 2024). The commercialization is done either by the ecosystem orchestrator or a complementor SME.

As part of the upcoming ecosystem offering, one of the key SME partners vividly illustrated during the interview how the company has developed an IoT solution (cf. Paiola et al., 2022) that is currently sold through a single-payment model. While the company is interested in developing servitization offerings (cf. Kohtamäki et al., 2019), the company struggles to demonstrate value to customers and to equip its salesforce for value-driven selling (cf. Friend et al., 2024; Peterson et al., 2021; Terho, Eggert, Ulaga, Haas & Böhm, 2017). Another interviewee noted that their organization sells products through retailers and has faced challenges in training and developing their retailers' competencies related to value-based selling (cf. Liu, Zhao & Wang, 2023). A third interviewee highlighted that many companies tend to be highly risk-averse, which creates opportunities for startups to introduce disruptive market innovations (cf. Sandvik, Sjödin, Parida & Brekke, 2024). A fourth one emphasized the importance of jointly developing general strategies and maintaining an ongoing, open dialogue within the ecosystem (cf. Parida, Burström, Visnjic & Wincent, 2019); without this, there is a risk that the organizations or researchers may build solutions that lack practical relevance.

Discussion and next steps

The next steps in this research include conducting 20 to 30 interviews with SMEs in the ecosystem and developing a sales enablement framework (cf. Rangarajan et al., 2020) that will support the commercialization of value-driven ecosystem servitization offerings. This framework will help companies to build capabilities for digital servitization at the ecosystem level (cf. Kohtamäki et al., 2019; Peterson et al., 2021) and enable ecosystem-driven sales (cf. Friend et al., 2024). By addressing these existing research gaps, the study is expected to have significant academic and managerial implications.

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Embracing Persistent Tensions between Standardization and Customization

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Abstract

This article explores the tension between standardization and customization, particularly in relation to pricing strategies that can effectively address the tensions. Through an in-depth single case study involving experienced practitioners from different organizational levels and their customers, a new framework is revealed based on a critical realist perspective. This framework provides a comprehensive explanation of how to engage in both standardization and customization simultaneously. In this conference article, we focus on pricing actions and insights at the actor level, aiming to balance innovation and personalization objectives while maintaining standardization and scalability.

Keywords: Paradox, Critical Realism, Pricing Procedures.

Persistent Tensions between Standardization and Customization

Digital technologies have facilitated the development of advanced services, a phenomenon referred to as "digital servitization" (Gebauer, Paiola, Saccani, & Rapaccini, 2020; Kohtamäki, Parida, Patel & Gebauer, 2020; Gebauer, Fleisch, Lamprecht & Wortmann, 2020). Providers offer complex solutions that include the core

product bundled with software and a range of services, leveraging operational data from products or entire fleets (Lenka, Parida & Wincent, 2017; Sklyar, Kowalkowski, Tronvoll & Sörhammar, 2019). These solutions provide new value-generating opportunities through personalization and innovation. However, when providers invite customers to co-create, an over-reliance on the customers' needs to the detriment of standardization possibilities can negatively affect the provider's scalability.

From a paradox lens, this article focuses on the co-existing tension between standardization and customization. The term paradox can be defined as 'contradictory yet interrelated elements that exist simultaneously and persist over time' (Smith & Lewis, 2011, p. 382). Individuals and organizations hold two competing, yet inconsistent, states, employing 'both-and' thinking to leverage the interconnections between them (Smith & Lewis, 2011).

This study adopts paradox theory as a theoretical framework and employs a pricing lens to explore new ways to address the tension. The role of pricing practices and routines deserves further research. Despite their demonstrated importance, existing literature has largely overlooked the analysis of (value-based) pricing within the context of servitization. Therefore, our aim is to bring attention to these findings on a more practical level, concentrating on pricing actions and actors.

Methodology

For studies at the actor level, Rabetino, Kohtamäki, Foss, Rahman and Huikkola (2025) recently suggested adopting a critical realist lens, as microfoundational explanations rely on a layered ontology (Foss, 2021). Drawing on the critical realist lens, the study acknowledges that different individuals hold varying views on the same reality. An in-depth case study was conducted to explore and

unpack the nuances of the different ontological layers from multiple perspectives, illustrating paradoxical tensions (as speculative underlying mechanisms) with a concrete, real-life example (Nicolaj, 2007). The Case Company offers complex solutions (including hardware, software, services, and digital) to business customers worldwide. The study focuses on advanced offerings that include remote monitoring, predictive, prescriptive, and/or preventive activities, sold in a consultative selling mode. In line with the critical realism stance, multiple perspectives within the provider company, including those of customers, were valuable to attain (Yin, 2017). Initially, data were collected as part of a doctoral research study, resulting in 366 pages of transcripts. As the conceptualization of this model progressed, we focused on a thorough analysis of pricing actions and actors.

Results

The framework organizes findings within a layered ontology, offering insights on how pricing activities can navigate paradoxical tensions. Unlike the positivists' flat ontology of laws, critical realism does not assert a direct correspondence between various levels, positing instead that mechanisms persist independent of participants' experiences. The framework extends our knowledge by zooming into the micro level, indicating that 'individual traits or individual activities influence organizational activities in the domain of pricing or organizational performance' (Hinterhuber & Liozu, 2017, p. 159). While the pricing process suggests 'what' actions need to be done, it shapes the understanding of 'how' actors conduct these actions. It reveals human emotions and thought processes, inspiring firms to reconsider the rules of engagement between actors regarding data sharing, accepting uncertainties, and adopting a both-and mindset to find optimal solutions and price points for

both parties. While, for many years, management theory and servitization-related research have been constrained by either-or thinking (Kohtamäki, Einola, & Rabetino, 2020), this framework inspires individuals to accept conflicting information simultaneously. Then, they are more likely to create new frames that are genuinely distinct from their initial viewpoints (Lewis & Smith, 2022). For managers, the results provide actionable recommendations that help them attain sustainable high performance in their provider firms by addressing the tensions fruitfully (Lewis & Smith, 2014).

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Overcoming legitimacy challenges for the development of Condition Monitoring Services in Digital Servitization through Service Design co-creation practices

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Abstract

This paper explores how Service Design co-creation practices can help overcome legitimacy challenges in the deployment of Condition Monitoring Services within the broader context of digital servitization. While CMS hold promise for delivering predictive maintenance and operational efficiency, industrial firms often struggle with several barriers that hinder their adoption. Through a single case study of a Spanish industrial company that developed a CMS offering we show how co-creation workshops and visual storytelling facilitated the alignment of stakeholder expectations and organizational readiness. Our findings reveal that Service Design enhanced the perceived value of the service offering internally and served as a legitimacy-building mechanism by visualizing outcomes and engaging frontline key employees in early service development.

Keywords: Digital servitization, condition monitoring services, service design, co-creation

Introduction

The convergence of digitalization and servitization is reshaping the competitive landscape for industrial firms. Digital Servitization (DS)

offers manufacturers the opportunity to evolve from product-centric business models to outcome-based service systems (Kohtamäki, Parida, Patel & Gebauer, 2021). In this scenario, Condition Monitoring Services (CMS), which leverage IoT-enabled diagnostics and predictive analytics to improve asset uptime and maintenance efficiency are key components of this transition (Jardine, Lin & Banjevic, 2006; Iriarte, Nguyen Ngoc & Lasa, 2025).

However, despite their technical maturity, CMS often face significant challenges in being perceived as legitimate internally and externally. These legitimacy challenges—encompassing cognitive (understanding the value), normative (cultural acceptance), and regulative (procedural compatibility) dimensions—represent a major barrier for manufacturing organizations attempting to scale service-based business models (Valtakoski, 2017). This paradox is especially critical in contexts where industrial employees and customers are habituated to transactional based relationships and where organizational inertia hinders the uptake of digitally-enabled services (Lee, 2020).

Service Design (SD) is progressively recognized as a strategic enabler for digital servitization, also in industrial B2B environments where services are complex, intangible, and require stakeholder alignment (Sjödin, Parida & Kohtamäki, 2020). SD incorporates human-centered methods in iterative co-creation processes that bring together diverse stakeholders to collectively shape service value propositions (Iriarte, Hoveskog, Nguyen Ngoc, Legarda, Uranga, Nazabal, 2023). By involving stakeholders in the early stages of service conceptualization, organizations can surface hidden concerns, visualize benefits, and build shared understanding (Nguyen, Lasa, Iriarte, Atxa, Unamuno & Galfarsoro, 2022). Thus, we belive that co-creation can play a pivotal role in legitimizing CMS development both internally (aligning service operations and roles) and externally (framing the value proposition to customers).

This paper explores how Service Design co-creation practices can help overcome legitimacy challenges and enable the successful development of CMS as part of broader DS strategies in manufacturing firms. We draw on insights from a service intervention in an industrial company specialized in designing, manufacturing and maintaining integrated electrical infrastructure and automation solutions.

Methodology

This research is based on a participatory single case study. The case focused on the design and development of a new CMS offering built around a IoT monitoring tool. Data was collected through: (i) participatory observation of co-creation workshops with internal stakeholders in the company, (ii) analysis of the visual artifacts created in the workshops (Blueprinting and other tools), and (iii) semi-structured interviews with participants in the workshops. This embedded participatory approach allowed us for deep insight into how legitimacy on the CMS offering is constructed (and contested) in the case company.

Findings

Based on the collected data we identified three key mechanisms through which Service Design co-creation practices addressed legitimacy barriers during the development of the CMS in the firm.

First, expectation alignment and storytelling proved essential. The co-creation workshops created a space where key frontline employees (service technicians) could openly surface and negotiate their expectations regarding the CMS. These sessions revealed how different actors—such as service technicians seeking actionable data —conceived of "value" differently (Solem, Kohtamäki, Parida &

Brekke, 2022). Through this collaborative process, a unified service narrative was constructed. This narrative outlined a modular CMS offering, comprising installation, real-time monitoring, and scheduled improvement milestones with customers. As a result, the different employees' roles, scope, and pricing structure were clarified and standardized, reducing ambiguity and enhancing both internal coherence and internal understanding.

Second, the mechanism of value visualization played a crucial role. Utilizing tools such as service blueprints, the project facilitators were able to illustrate abstract service benefits in visual representations. These visual artifacts facilitated communication across departments inside company, offering a shared language to discuss and refine the CMS offering. By illustrating concrete use cases where the CMS helped avoid unplanned downtime or enabled proactive interventions, thus these tools strengthened the perceived usefulness of the CMS offering.

Finally, cultural integration and ownership emerged as a foundational mechanism for internal legitimacy. By involving frontline employees in the design of service operations—particularly through collaborative blueprinting exercises—the organization fostered stronger internal engagement and accountability. This participation also led to the formalization of a new role within the organization.

Conclusions and Future Work

This study contributes to the DS literature by demonstrating that SD co-creation practices play a critical role in building legitimacy of CMS. By engaging frontline employees in participatory design processes, firms can better position to align internal capabilities with client expectations, ultimately fostering trust, clarity, and acceptance of CMS internally.

For industrial firms aiming to scale CMS offerings, one actionable recommendation emerges from this research: embedding co-creation early in the service development lifecycle helps ensure that the resulting solution is not only technologically sound but also aligned with internal and external users' needs and use contexts. Future research could explore the longitudinal effects of co-created CMS on business model transformation. Applying this framework across different industrial sectors may also uncover additional insights into how co-creation contributes to the legitimacy of digitally enabled services.

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Service and Experience Design as an enabler of Digital Servitization: Insights from University-Industry Collaboration with a Security company

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Abstract

Servitization, the transition from product-centric models to integrated product–service systems, is increasingly evolving into digital servitization through technologies such as IoT, AI, and digital twins. Yet, in sensitive domains like security, the adoption of digital services requires more than technological deployment: it depends on designing user experiences that foster trust, usability, and scalability. This paper presents insights from a university–industry collaboration between the University of Deusto and Prosegur's Innovation Department, in which design students addressed real challenges in areas such as robotics, AI-supported monitoring, digital twins, and security in the metaverse.

The projects followed a participatory action research approach over ten weeks, progressing through framing, exploration, conceptualization, and materialization. Findings show that Service and Experience Design methodologies help reframe technological opportunities into understandable services by emphasizing deeper motivational dimensions of user experience. They also highlight how principles such as clarity and transparency can reinforce trust in sensitive services, while design tools like service blueprints and journey maps provide scalable models deployable across multiple contexts.

The collaboration functioned as a living lab, enabling rapid prototyping and low-risk experimentation while simultaneously

fostering talent attraction for the company. The case demonstrates that Service and Experience Design act as strategic enablers of digital servitization, ensuring that technological solutions remain human-centered, trustworthy, and scalable. Future research should examine the long-term organizational and cultural impacts of design-led approaches to digital servitization.

Keywords: Digital servitization, Service design, Experience design, Security services.

Introduction

Servitization, defined as the transformation of product-centric firms into providers of integrated product–service solutions, has become a key strategy to sustain competitive advantage in traditional industries (Vandermerwe & Rada, 1988; Baines, Lightfoot, Benedettini & Kay, 2009). In the security sector, this trend is evolving into digital servitization, enabled by technologies such as the Internet of Things (IoT), AI-based monitoring, and digital twins.

Yet this transformation cannot be understood as a purely technological shift. In a sensitive field like security, the successful adoption of digital services depends on the design of service interactions and user experiences that ensure scalability, usability, and customer trust. Service Design and Experience Design methodologies provide structured approaches to tackle these challenges, but empirical studies on their role in supporting digital servitization in such contexts remain scarce.

This paper presents insights from a collaboration between the University of Deusto and the Innovation Department of Prosegur, where design students developed projects addressing real innovation challenges. The aim was to design and prototype service-based solutions that could foster adoption, trust, and scalability through user-centered approaches.

Background

Research on servitization has identified a continuum of service integration that firms may adopt as they move from product-centric to service-oriented business models. At the most fundamental level, organizations offer basic services, typically focused on product-related support functions such as corrective maintenance, spare parts provision, or technical assistance. These services are essential for ensuring product functionality but do not substantially alter the underlying value proposition.

A second level involves the provision of intermediate services, which extend beyond reactive support to include proactive activities such as predictive maintenance, systems integration, and customer training. At this stage, firms begin to develop closer and more sustained relationships with clients, offering services that require deeper knowledge of both product performance and customer operations.

The highest level of service integration is represented by advanced outcome-based solutions, in which firms commit to delivering specific performance outcomes or business results rather than simply providing access to products or ancillary services. This model requires not only technological capabilities but also new contractual and relational arrangements, as providers assume responsibility for measurable results valued by the customer (Baines et al., 2009; Visnjic Kastalli & Van Looy, 2013).

Building on this framework, the concept of digital servitization has emerged to describe how firms employ digital technologies such as real-time data analytics, AI-driven monitoring, and platform-based infrastructures to enhance service delivery. By enabling continuous monitoring of product performance, optimizing operational processes, and creating scalable service models, digital servitization represents a significant extension of the traditional servitization

paradigm (Coreynen, Matthyssens & Van Bockhaven, 2017). In parallel, Service and Experience Design methodologies have proven effective in aligning complex technological solutions with user needs (Stickdorn, Lawrence, Hormess & Schneider, 2018). Tools such as service blueprints, customer journey maps, co-design workshops, and rapid prototyping enable organizations to translate technological capabilities into clear and usable service experiences (Mager, 2009). Applying these methodologies in digital servitization initiatives has the potential to accelerate adoption and facilitate organizational scalability.

Methodology

The study was based on a participatory action research approach, where student teams worked as co-creators alongside Prosegur's innovation managers. The projects were defined around real organizational challenges, such as robots for security in B2B and large-scale events, applications of digital twins. new uses for 360° cameras with AI, security in the metaverse, enhancing the protection of artworks in museums or exploring AI-based services and the role of ChatGPT in supporting security operators.

The overarching question framing all these challenges was:

> *How can we create better experiences around security services for the immediate future?*

This challenge was approached considering the dual nature of security: on the one hand, extrinsic, referring to external agents and threats; and on the other, intrinsic, referring to the subjective perception of safety. The main goal of the collaboration was to increase clients' perceived security through innovative service concepts based on emerging technologies and novel applications. The projects, based on the Inclusive Experience Design

methodology (Retegi, 2015), unfolded over a 10-week period, structured into four phases:

- Framing – understanding and contextualizing the challenge.
- Exploration – searching for insights.
- Conceptualization – defining experiences.
- Materialization – determining the necessary means (products, services, applications, etc.)

In addition to the academic guidance provided by Deusto faculty, students benefited from continuous support offered by internal company mentors. This dual framework ensured that the exploratory dimension of the projects remained grounded in organizational realities. The sustained interaction with the client proved to be particularly significant, as developing an accurate understanding of the organizational context often represents one of the most challenging aspects of projects of this nature.

Results

The collaboration revealed several ways in which Service and Experience Design can meaningfully contribute to digital servitization in the security sector. A first finding was the ability of these methodologies to reframe complex technological challenges from a user-centered perspective. Rather than approaching innovation solely from the potential of technologies such as AI, robotics, or digital twins, students translated these capabilities into service concepts grounded in people's daily realities. In this sense, working with the "Why" level of experience (Hassenzahl, 2010) helped uncover deeper emotional and motivational dimensions that go beyond pragmatic variables such as purchase intention or preferences.

The projects also highlighted the role of experience design in building trust and supporting adoption. In a domain where issues of safety and privacy are paramount, clarity, transparency, and accessibility proved essential to strengthen user confidence. This resonates with previous research on the importance of trust in outcome-based servitization models (Visnjic Kastalli & Van Looy, 2013). The student concepts showed that a human-centered approach not only makes new technologies easier to understand, but also increases the likelihood that clients will perceive them as reliable and valuable.

Another contribution was related to scalability. The use of service design artifacts, such as blueprints and journey maps, provided replicable structures that can be deployed across different client contexts without requiring proportional increases in human resources. This capacity to combine user alignment with organizational efficiency underlines the strategic potential of service design for scaling digital servitization initiatives.

Finally, the collaboration itself functioned as a living lab of academic–industry co-creation. Involving students created a safe space for experimentation, where ideas could be prototyped and iterated before being tested in real-life contexts. For Prosegur, this represented not only an opportunity to explore new directions for service innovation, but also a way to connect with and attract young talent into its innovation team. From the students' perspective, the projects provided a unique learning environment to engage with complex socio-technical challenges and to apply design methodologies in a highly sensitive sector.

Discussion

The case illustrates that service and experience design are strategic enablers of digital servitization. While technology offers capabilities,

the design of service interactions ensures that digital offerings are understandable, trustworthy, and scalable. The findings also reinforce the importance of academic–industry collaboration. Organizations benefit from access to fresh ideas and low-risk experimentation, while students gain practical skills in addressing innovation challenges at the intersection of technology, design, and organizational strategy.

In sensitive sectors such as security, integrating design from the early stages of digital servitization initiatives appears particularly beneficial. Adoption depends not only on functional performance but also on trust, usability, and perceived safety, all of which can be systematically addressed through design methodologies. The collaboration with Prosegur further demonstrated how such initiatives can serve the dual purpose of fostering innovation and attracting future professionals with the necessary hybrid competencies.

Digital servitization is reshaping traditional product-centric industries, but its success relies on more than technology adoption. Service and Experience Design provide practical methods to ensure that digital services remain user-centered, trustworthy, and scalable.

The University of Deusto–Prosegur collaboration illustrates how design-led projects can serve as living laboratories, bridging academic knowledge and industry needs. Future research should investigate the long-term impact of design-driven servitization initiatives on organizational performance, customer satisfaction, and innovation culture.

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Parallel Session 5

Ecosystems & Collaboration

Co-Chairs: Rodrigo Rabetino & Inmaculada Freije

Mapping Transformative Service Research: A Bibliometric Study of Its Evolution, conceptual structure, and Collaboration Networks

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Abstract

The literature on transformative services is a growing field that explores how services enhance individual and collective well-being. Although there are several systematic reviews in this area, a comprehensive overview of the research has not been provided. This study addresses this gap by analyzing data from the Web of Science database and employing advanced bibliometric tools from the Bibliometrix R package. The analysis includes identifying publication trends, pinpointing the most influential authors, institutions, and countries, and mapping co-citation networks, keyword co-occurrence, and academic collaborations, so that the evolution and conceptual structure of this emerging field of research can be discussed and analyzed. The findings highlight key authors and contributors, major research topics, and emerging themes such as digital transformation, sustainability, and artificial intelligence in services. This study offers unique value by visually mapping the intellectual, thematic, and social structures of transformative services research, thereby providing a strategic perspective for researchers, practitioners, and policymakers aiming to improve transformative services with social impact.

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Keywords: Transformative services, TSR, bibliometric analysis, service ecosystems.

Purpose

Transformative service research (TSR) is an emerging interdisciplinary field that integrates consumer and service research to promote well-being (Anderson, Ostrom, Corus, Fisk, Gallan, Giraldo et al., 2013). Rooted in sustainable development goals (SDGs), it has become increasingly important in latest studies on consumption, innovation, and sustainability, aiming to improve quality of life, include vulnerable populations, reduce inequalities, and generate shared value (Alkire, Mooney, Gur, Kabadayi, Renko & Vink, 2020; Anderson & Ostrom, 2015). TS is an ethical and transdisciplinary approach to service analysis, recognizing services as catalysts for social progress (Anderson & Xue, 2022; Castro, Martín-Peña, Martínez, & Salgado, 2025). However, the field faces challenges in establishing a coherent body of knowledge due to its variety of theoretical approaches, application areas, and disciplinary languages. To address this gap, this study conducts a bibliometric analysis of TSR, focusing on its historical development, key academic collaboration networks, and emerging issues. The goal is to develop robust conceptual frameworks and transdisciplinary methodologies, addressing critical challenges such as equitable health access, consumer empowerment, community-based service innovation and social impact technologies. The specific objectives are:

- Analyze scientific production in TSR, identifying publication trends, leading authors, key institutions, and dominant countries.
- Map the networks of co-citation and co-occurrence of keywords to reveal the conceptual structure and the core thematic clusters of the field.

- Identify the most relevant international collaborations and active research clusters.
- Detect major knowledge gaps and future research opportunities.

The study uses data from the Web of Science and advanced bibliometric tools to analyze publication trends, identify influential authors, institutions, and countries, and map co-citation networks. It highlights key research topics and emerging areas like digital transformation, sustainability, and artificial intelligence. The analysis provides a strategic perspective for researchers, practitioners, and policymakers to enhance the social impact of technology.

Methodology

This study uses a bibliometric approach based on co-word analysis to examine the thematic structure and conceptual evolution of the field of TS. The papers were collected from the Web of Science database, focusing on authors's keywords, which were standardized by unifying synonyms, abbreviations, and plurals and removing irrelevant words (Bermejo-Olivas, Soriano-Pinar & Pinillos, 2024). The selection process followed the PRISMA protocol (Moher, Liberati, Tetzlaff & Altman, 2009), limiting results to articles, reviews, and works in early access. The study used Bibliometrix software through Biblioshiny to generate co-occurrence networks and visualizations to analyze the conceptual structure and temporal evolution of the field.

Findings: research in progress

The analysis is expected to reveal a complex and evolving thematic structure, highlighting key concerns in TSR. So, a) subjective well-being and consumer empowerment, highlighting inclusive design

and participatory service logic, b) digital innovation for social transformation, including the role of artificial intelligence (AI), assistive robotics, blockchain, and digital platforms in creating social value, and c) social justice, citizen engagement, and the care economy, with increasing visibility of terms such as equity, sustainability, collaborative economy, digital rights, and socio-economic resilience.

A shift is also anticipated from traditional consumer-centric models toward critical and community-based approaches, with growing emphasis on ethics, environmental responsibility, and the collective production of services. This shift is evident in academic language, with terms like "rights", "equity", "citizen participation", "collaborative economy", and "care" emerging. This research helps understand these connections and responds to social and technological changes.

Implications

This research provides a comprehensive analysis of TSR clarifying its foundations, emphasizing its transdisciplinary, and action-oriented nature. It offers a solid and practical underpinning for researchers, practitioners, and policymakers interested in designing, implementing, and evaluating services that create lasting positive impacts on individual and collective well-being.

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Managing structural holes in digital service innovation networks

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Abstract

This study examines how industrial firms organize their relationships with technology suppliers and customers in digital service innovations (DSIs). Using the concepts of structural holes and brokerage, it explores how industrial firms identify and leverage structural holes to strategically position themselves within DSI supply networks. The study employs a qualitative case approach, grounded in interviews with industrial firms and their technology suppliers across four DSIs. It finds that structural holes in DSIs are multi-faceted, extending beyond relational gaps to include knowledge, cognitive, technical, and temporal gaps. Industrial firms actively manage their relationships through brokerage practices, such as streamlining workflows, balancing priorities, controlling information flow, and mediating customer knowledge across firm boundaries. This study contributes to research by demonstrating how industrial firms strategically bridge gaps, even when relying on external digital expertise, and emphasizes the importance of actor perceptions within DSI supply networks for the sustainability of brokerage.

Keywords: Digital service innovation, supply network, structural hole, brokerage.

Introduction

Industrial firms use digital technologies to develop innovative new service offerings and improve existing ones, known as DSIs (Rabetino, Kohtamäki & Huikkola, 2024). DSIs enable industrial firms to transform their service offerings by leveraging digital technologies to track, monitor, and optimize product lifecycles (Opazo-Basáez, Vendrell-Herrero & Bustinza, 2022). DSIs represent a complex interplay of technological advancements, often combining product, process, and digital services elements (Vendrell-Herrero, Bustinza, Opazo-Basaez & Gomes, 2023). While these innovations are promising, they challenge the supply network structures by reshaping roles and introducing new interdependencies among actors. Implementing DSIs involves a network of actors, including industrial firms, customers, and a range of technology suppliers (e.g., developers, platform providers, and IT consulting firms) who possess the resources and capabilities industrial firms require (Dalenogare, Le Dain, Ayala, Pezzotta & Frank, 2023).

Prior research has highlighted the increasing need for collaboration between industrial firms, technology suppliers, and customers (Narvaiza, Campos, Martín-Peña & Díaz-Garrido, 2024). Studies have demonstrated that successful DSIs often depend on shared knowledge, coordinated development efforts, and mutual adaptation among these actors (Huikkola, Kohtamäki, Rabetino, Makkonen & Holtkamp, 2022). The literature underscores the relational and interactive nature, as well as the challenges and tensions between actors involved in DSIs (Smania, Osiro, Ayala, Coreynen, & Mendes, 2024). However, there is still a limited understanding of how industrial firms structure these relationships in DSIs networks. Specifically, existing research tends to emphasize coordination and joint development but pays less attention to how industrial firms position themselves, shape inter-firm connections, and manage access to knowledge and capabilities within the triad. The present

study poses the following research question: *How do industrial firms structure their relationships with technology suppliers and customers in digital service innovations?*

To address this question, the study draws on the concepts of structural holes and brokerage (Burt, 1992). Instead of seeing networks as entirely interconnected, structural hole emphasizes the strategic opportunities that emerge from the gaps between actors (Ahuja, 2000). To better understand the practices industrial firms undergo across their organizational boundaries to utilize these gaps, the study also draws on the concept of boundary-spanning practices (Levina & Vaast, 2005), which emphasizes the translation and alignment work performed across organizational and knowledge boundaries.

Research Method

Data was collected through 21 semi-structured expert interviews with key informants from industrial firms and technology suppliers in four DSIs. The third actor's perspective, i.e., customers, is included indirectly through how they are discussed and interpreted by these actors. The data analysis followed an inductive approach. The unit of analysis is the industrial firm's management of relationships with technology suppliers and customers in DSIs.

Findings

Our analysis reveals that industrial firms utilize structural holes in DSIs, and brokerage practices serve as the means to navigate disconnections, selectively connecting, coordinating, and mediating across organizational boundaries. The study identified six types of structural holes that appeared in various forms, including relational, knowledge, cognitive, technical, and temporal gaps. The analysis also

identified four key brokerage practices: streamlining workflows, balancing priorities, controlling the flow of information and access, and mediating customer knowledge across firm boundaries.

Conclusions

First, while foundational work on structural holes (e.g., Burt, 1992) primarily conceptualized them as relational disconnections, our findings show that structural holes in DSIs span multiple dimensions. The multiple distinct dimensions of structural holes emerge because DSIs involve actors from different domains operating with different mindsets, organizational structures, technical systems, and development timelines. Second, our findings show that while industrial firms may not fully orchestrate the development process (Kamalaldin, Sjödin, Hullova & Parida, 2021) due to gaps in digital expertise, they may still strategically broker across structural holes to shape the innovation network to their advantage. The strategic aims of industrial firms may include reducing the threat of competition, developing in-house knowledge and capabilities, mitigating data sharing and intellectual property risks, and aligning development priorities with their business strategies. Third, it highlights that sustaining brokerage depends on how partners perceive the firm's coordination and technical competencies, underscoring the role of perception management alongside structural positioning in DSI networks (Vedel, 2016).

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Orchestrating the ecosystem for scalable digital servitization: a case of an automotive OEM

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Abstract

This study explores the innovative strategies that established manufacturers can adopt to orchestrate their ecosystems for a successful transition from traditional business models to scalable digital servitization. To achieve this, we conduct an in-depth case study of a leading automotive original equipment manufacturer (OEM) that has implemented a comprehensive digitalization strategy, spanning research and development, manufacturing, marketing, and operations. Our findings offer both theoretical insights and practical implications for managing digital servitization through ecosystem orchestration in complex industrial contexts. The insights generated serve not only as a theoretical contribution to the intersection of digital servitization and ecosystem orchestration literature but also as a practical framework for managers seeking to evaluate and refine their ecosystem strategies. Finally, the study proposes a research agenda to guide future inquiries into the convergence of digital servitization and ecosystem orchestration.

Keywords: Digital servitization, ecosystem orchestration, business model innovation, digital transformation, automotive industry.

Introduction

Amid accelerating digitalization, manufacturing firms are increasingly pursuing digital servitization as a pathway to sustained growth and competitive advantage (Kolagar, Parida & Sjödin, 2022). This transformation entails a strategic shift from the provision of standalone physical products to the delivery of integrated solutions that combine products, services, and digital technologies (Ruffoni & Reichert, 2024). Within this shift, ecosystems are emerging as foundational enablers, offering the structural and relational conditions necessary for digital servitization (Kolagar, 2024). Manufacturing ecosystems typically include a diverse set of partners —such as technology vendors, platform providers, integrators, and service companies—who jointly contribute to innovation diffusion and the creation of bundled offerings (Shi & Shen, 2025).

These ecosystems facilitate not only the integration of product-service systems but also the emergence of new application scenarios and digitally enabled business models. However, advancing digital servitization across an ecosystem is a highly complex and dynamic undertaking, requiring strategic management among actors with divergent goals and capabilities. In this context, the orchestration capabilities of focal firms are critical. Orchestration involves the deliberate design and management of ecosystem strategies, the alignment of partner incentives, the setting of technological standards, the integration of resources, and the incentivization of innovation (Shen, Shi, Parida & Jovanovic, 2024).

For traditional automotive manufacturers, the rapid emergence of new energy vehicles (NEVs) and intelligent connected vehicles presents a significant disruption to established, product-centric business models. To remain competitive and enhance perceived customer value, adopting digital servitization is strategic necessary. Key digital features such as over-the-air (OTA) updates, data-driven telematics services, and personalized in-car experiences are

becoming essential differentiators. Moreover, digital-native entrants are intensifying competition with platform-based mobility solutions, further underscoring the urgency of transformation. Studying how a leading OEM navigates this transformation through effective ecosystem orchestration provides valuable insights into the strategic and operational mechanisms required to achieve scalable digital servitization.

Theoretical positioning

The literature on leveraging ecosystems to develop digital services and solutions has grown substantially in recent years (Kolagar, 2024), with increasing attention paid to the concept of digital servitization ecosystems. Several recent studies have begun to unpack the unique characteristics and challenges of such ecosystems. For instance, Smania, Osiro, Ayala, Coreynen and Mendes. (2024) identify a series of paradoxical tensions among firms operating within such ecosystems. Smania, Ayala, Coreynen and Mendes (2024) further explore data-related tensions and the coping strategies adopted in inter-firm collaborations. Dalenogare, Le Dain, Ayala, Pezzotta and Frank (2023) categorize the collaborative configurations of ecosystem actors in digital servitization based on their value creation, value capture mechanisms, and social bases of collaboration.

Despite these important advances, there remains a significant gap in the literature concerning the role of focal firms in orchestrating ecosystem-wide digital servitization. Specifically, limited research has examined the strategic and operational mechanisms through which these firms align diverse ecosystem actors and resources toward a shared transformation agenda. This gap is critical, as digital servitization is not the result of isolated innovation efforts but

rather a systemic transformation that requires orchestration actions across organizational boundaries.

Orchestrating an ecosystem involves managing complex, multi-stakeholder interactions to make digital services scalable, integrated, and customer-centric (Kolagar et al., 2022). Yet, the actual practices, routines, and governance mechanisms employed by focal firms to achieve such orchestration remain underexplored. Most existing studies stress the importance of orchestration, without providing a granular understanding of how orchestration is enacted in practice. As Kolagar (2024) argues, there is an urgent need for a more comprehensive and empirically grounded conceptualization of ecosystem orchestration in the context of digital servitization.

Against this backdrop, the present study aims to addresses the following research question: *How can focal firms within manufacturing ecosystems orchestrate their ecosystems to achieve digital servitization?* More specifically, what are the primary innovative strategies that established manufacturers can adopt to transition from traditional models to scalable digital servitization models?

Contribution

By focusing on the orchestration role of focal firms within industrial ecosystems, this study contributes to a deeper understanding of how digital servitization can be systematically enabled at scale. Theoretically, it advances the intersection of digital servitization and ecosystem orchestration by identifying the mechanisms through which incumbent manufacturers mobilize, coordinate, and govern heterogeneous actors and resources to drive transformation. It provides empirical insights into how orchestration practices unfold across ecosystem layer, contributing to a more nuanced understanding of ecosystem dynamics in digitally transforming industries.

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Operationalizing Service-Dominant Logic through Ecosystem Collaboration: The Case of Smart Building Solutions

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Abstract

This study explores how Service-Dominant Logic (S-D Logic) and ecosystem collaboration can drive digital service innovation (DSI) in the context of smart product transformation. As smart products evolve into dynamic service platforms, firms shift from selling physical goods to offering adaptive services, exemplified by models such a "Keys as a Service". Adopting a qualitative approach, this research conducts a case study of a European smart access control company to examine how it redesigns its offering, integrates user feedback, and collaborates with ecosystem partners. The research contributes empirically to the literature on DSI (Kowalkowski et al., 2024; Vargo et al., 2024) by illustrating how manufacturing firms transform through human-centered design and platform-based strategies.

Keywords: Digital Service Innovation, Ecosystem Collaboration, Service-Dominant Logic, Smart products.

Theoretical background

The proliferation of smart products and connected devices is transforming traditional manufacturing firms into providers of adaptive digital services. This evolution aligns with the Service-

Dominant Logic (S-D Logic) perspective, which reframes value creation around co-creation processes and resource integration (Vargo, Fehrer, Wieland & Nariswari, 2024). In this view, smart products function not merely as physical objects but as platforms that enable dynamic service delivery (Kandampully, Bilgihan & Li, 2022).

At the core of this shift is Digital Service Innovation (DSI), which involves leveraging digital technologies to redesign service systems, create new value propositions, and support ongoing adaptation to evolving customer needs (Opazo Basáez, Vendrell-Herrero, Bustinza & Raddats, 2024; Kowalkowski, Wirtz & Ehret, 2024). Scholars emphasize that DSI requires integrating technological affordances with human-centered design and organizational change (Kandampully et al., 2022; Rabetino, Kohtamäki & Huikkola, 2024).

Beyond the product level, successful DSI depends on ecosystem collaboration (Bustinza, Gomes, Vendrell-Herrero & Baines, 2017). Firms must orchestrate value co-creation with partners, platforms, and users across interconnected services (Adner, 2017; Narvaiza, Campos, Martín-Peña & Díaz-Garrido, 2024). In the smart home sector, for example, digital locks offered as "Keys as a Service" illustrate this logic: instead of selling hardware, companies deliver flexible, continuously updated services integrated with third-party platforms such as home-sharing apps and building management systems.

Although prior literature has conceptualized these dynamics (Kowalkowski et al., 2024; Vargo et al., 2024), there remains limited empirical work exploring how firms operationalize S-D Logic and ecosystem collaboration to achieve DSI (Bustinza, Gomes, Vendrell-Herrero & Baines, 2019). To address this gap, the present study investigates how these concepts are enacted in practice through a case study situated in the smart building solutions sector. Specifically, it examines how a firm transforms a smart product into

a digital service platform by integrating ecosystem partnerships. Accordingly, our research question is: *How do firms operationalize Service-Dominant Logic and ecosystem collaboration to achieve digital service innovation through smart products?*

Research methods

A qualitative case study is conducted on a European smart access control company operating in the smart building solutions sector. The study adopts the Gioia Method (Gioia, Corley & Hamilton, 2013) to analyze how the firm applies Service-Dominant Logic and engages in ecosystem collaboration to transform smart products into a scalable digital service platform. Data collection includes semi-structured interviews with managers, as well as internal documents and customer feedback reports. The analysis followed Gioia's inductive process, generating first-order concepts from informant terms, grouping them into second-order themes, and synthesizing aggregate dimensions. This method supports theorizing how organizational practices align with S-D Logic and ecosystem strategies.

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Understanding Capabilities of Ecosystem Management: The case of autonomous solutions

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Abstract

This study examines the ecosystem management capabilities crucial for scaling autonomous vehicle solutions (AVS) within the shipping and transportation industries. It emphasizes the need for collaboration among diverse actors, including OEMs, IoT providers, and AI developers, to create and adapt ecosystems for distributive value creation. The research utilizes a dynamic capabilities lens to explore how multiple organizations collectively manage an innovation ecosystem. Through thematic analysis of 42 semi-structured interviews across three ecosystems, the study identifies routines that aid in aligning interests, adapting value exchange, and ensuring effective learning. The study reveals that firms require three dynamic capabilities for effective ecosystem management: ecosystem anticipation capabilities, ecosystem activation capabilities, and ecosystem redeployment capabilities. The findings contribute valuable insights into innovation management and practical recommendations for stakeholders in the AVS industry, highlighting the importance of active ecosystem management in responding to macroenvironmental changes and enhancing value creation processes.

Keywords: Ecosystem management capabilities; autonomous vehicles; scaling.

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Autonomous vehicle solutions (AVS) have transformative potential to shape the future of the shipping and transportation industries worldwide (Sandvik, Sjödin, Parida & Brekke, 2024; Tsvetkova, Hellström & Ringbom, 2021). Although AVS has high potential, developing and deploying AVS in these industries necessitates collaboration among multiple industrial domains, including but not limited to OEMs, IoT providers, safety providers, and AI developers (Repetto, Striccoli, Piro, Carrega, Boggia & Bolla, 2021; Sandvik et al., 2024). Such collaboration is regarded as an ecosystem in the existing literature (Adner, 2017). The value process, where multiple actors are involved in creating and delivering value, is considered distributive value creation (Gomes, Facin, Leal, Zancul, Salerno & Borini, 2022). By definition, AVS can be seen as an example of distributive value creation. Hence, to scale AVS in the market, it is not only sufficient to create an ecosystem; there is also a need to make the ecosystem adaptive to changes in the macroenvironment. However, creating and enhancing an ecosystem is highly complex due to several practicalities, including socio-technological changes, diverse interests among the actors, and uncertainties arising from the markets (Adner, 2017; Leminen, Rajahonka, Wendelin, Westerlund & Nyström, 2022; Sandvik, Sjödin, Brekke & Parida, 2022; Thomson, Kamalaldin, Sjödin & Parida, 2022). Thus, providers of AS need to engage in active ecosystem management, which can be referred to as "all the activities required to design and manage the ecosystem as a structure" (Gomes et al., 2022). The concept of ecosystem management is relatively novel, and there is limited insight into how organizations oversee their ecosystems,

particularly concerning the scaling of innovation (Linde, Sjödin, Parida & Wincent, 2021; Sjödin, Liljeborg & Mutter, 2024).

This study argues that the dynamic capabilities lens can enhance our understanding of the ecosystem management process. More recently, several studies on ecosystems have highlighted the importance of understanding ecosystem management capabilities (See, e.g., Linde et al., 2021; Sjödin et al., 2024). While these studies offered valuable insights into the firm-specific capabilities needed to manage the ecosystem, they did not provide insights into the activities and routines necessary for managing an ecosystem when firms are involved in distributive value creation, such as AVS. Hence, to complement the existing knowledge on ecosystem management, there is a need to understand the ecosystem management capabilities for successfully managing a distributive value creation process (Gomes, Chaparro, Facin & Borini, 2021; Jacobides, Cennamo & Gawer, 2018). Accordingly, this study aims to explore the dynamic capabilities of ecosystem management jointly developed by multiple actors to commercialize a distributive value-creation process. To achieve this objective, this study examines three ecosystems of AVS, comprising fourteen companies, to analyze the activities and routines employed to manage collaboration among these actors. A total of 42 semi-structured interviews served as the primary source of data for the study. To analyze the data, this article used a thematic analysis approach suggested by Braun and Clarke (2006).

This study shows that AS providers collaboratively develop ecosystem anticipation capabilities, helping them identify suitable partners for forming ecosystems and gaining a deeper understanding of potential macroenvironmental risks. In building these capabilities, providers establish routines for exploring ecosystem conditions, enacting ecosystem logic, and scanning macroenvironmental changes. Additionally, they develop ecosystem

activation capabilities, enabling them to become skilled at configuring ecosystems using their acquired knowledge. When developing ecosystem anticipation capabilities, providers create routines for aligning the interests of cross-functional actors, adapting value exchange processes, and distributing value creation among ecosystem participants. As the macroenvironment constantly changes, it is crucial to have ecosystem redeployment capabilities to reconfigure the ecosystem and optimize the performance of value-creating processes for AVS. To build these capabilities, providers need routines for implementing continuous solution integration, cultivating mutual commitment, and ensuring effective ecosystem learning. These findings are summarized in a framework showing how these three ecosystem management capabilities lead to more efficient value creation, delivery, and capture processes for AVS.

This study has broad implications for innovation management, operations, and entrepreneurship research on capabilities (see, e.g., Teece, 2007), for innovation ecosystems (Adner, 2017), for autonomous vehicles solutions (Leminen et al., 2022; Sandvik et al., 2024), and for related literature streams, such as digital servitization (Kolagar et al., 2022; Sjödin et al., 2024). In addition to its theoretical contributions, the article offers significant practical insights for practitioners and policymakers in the autonomous vehicles solutions industry.

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Parallel Session 6

AI, Generative AI & Service Digitalization

Co-Chairs: Johan Frishammar & Vinit Parida

Transforming integration of AI and LLMS in servitization: methodologies, applications, and future directions for innovation

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Abstract

This paper examines the transformative role of Artificial Intelligence (AI)—especially Large Language Models (LLMs)—in advancing servitization within the context of science, technology, and innovation (STI) policy. It highlights how AI-driven tools foster predictive maintenance, resource optimization, and the development of sustainable, customer-centric service models. The study explores methodologies for leveraging LLMs in policy design, implementation, and evaluation, addressing persistent barriers such as regulatory gaps, integration challenges, and limited institutional experience. Emphasis is placed on applications such as automated monitoring agents, legal advisors, business model benchmarking, and Retrieval-Augmented Generation (RAG) architectures. The paper also analyzes key risks, including hallucination and bias, and proposes robust validation and ethical oversight frameworks. Ultimately, it offers practical guidance and future directions to enhance institutional agility, support responsible deployment, and promote inclusive, effective innovation ecosystems enabled by AI-assisted servitization.

Keywords: Servitized AI, AI-driven servitized solutions, Ethical AI Governance in servitization, Business Models (BM) benchmarking.

The link between AI and Servitization

Artificial Intelligence (AI) serves as a transformative enabler of servitization, by leveraging AI capabilities like predictive analytics and machine learning. In this regard, companies can deliver advanced services such as predictive maintenance, personalized solutions, and resource optimization with the help of AI assisted solutions. For instance, AI-driven platforms that analyze real-time equipment data to anticipate failures, transforming product sales into service guarantees. This transition fosters deeper customer relationships and new revenue streams tied to performance outcomes rather than physical assets.

Furthermore, AI accelerates circular economy practices within servitization. Manufacturers in the motor field use AI to optimize remanufacturing processes, extending product lifecycles, and reducing waste through data-driven resource management. AI also enables innovative business models, including risk-reward sharing agreements where pricing aligns with actual results, enhancing efficiency and sustainability. Research confirms AI's critical role in "Servitization 5.0" where intelligent systems enhance organizational agility and customer-centric solutions.

Thus, AI's predictive, perceptive, and prescriptive capacities may help to overcome traditional servitization barriers, creating competitive advantages through operational excellence and sustainable value creation.

The rapid evolution of Large Language Models (LLMs) has the potential to reshape the landscape of science and innovation, offering unprecedented opportunities to enhance the design, implementation, and evaluation of policy instruments to promote servitization. This transformation addresses persistent challenges such as regulatory gaps, limited institutional experience, difficulties in monitoring and evaluating policy impacts, the need for greater

agility in responding to emerging technological trends and enhancing data-driven decision making.

Methodological proposals for the responsible integration of LLMs into STI workflows

The rapid evolution of Large Language Models (LLMs) has the potential to reshape the landscape of science and innovation, offering unprecedented opportunities to enhance the design, implementation, and evaluation of policy instruments to promote servitization. This transformation addresses persistent challenges such as regulatory gaps, limited institutional experience, difficulties in monitoring and evaluating policy impacts, the need for greater agility in responding to emerging technological trends and enhancing data-driven decision making.

This paper explores a diverse range of LLM-based solutions built on recent academic and applied literature. It provides methodological clarity, practical use cases and guidance while critically addressing the potential and limitations of LLMs in these domains. LLMs can be leveraged to prototype and design instruments for servitization, synthesizing real-time evidence and best practices. A key advantage of LLMs lies in their ability to democratize access to expert knowledge, reducing barriers for institutions with limited experience in innovation policy. By streamlining information retrieval and synthesis, LLMs support the design of experimental policy implementation, the creation of project and capability maps, the pooling of technologies and business models databases for cross-sectoral collaboration and resource optimization. This research also highlights the potential of LLMs to identify servitizable innovation tasks, facilitating the development of new business models and enhancing the impact of public support measures; as well as opportunities for demand-side

instruments such as public procurement of innovation or sandboxes, in the context of servitization.

A distinctive contribution of this paper lies in its methodological proposals for the responsible integration of LLMs into STI workflows. These include implementation guidance for tools such as automated monitoring agents that track implementation in real time, virtual legal advisors to interpret complex regulations and identify legal gaps, valuation tools to assess the maturity and relevance of emerging technologies to anticipate and address areas of unmet need and business model benchmarking and optimization by analyzing patterns, outcomes, and competitive positioning across various industries and sectors. Special attention is given to the strategic use of high-quality institutional datasets—such as administrative registries, open data portals, or evaluation databases—for fine-tuning domain-specific applications via Retrieval-Augmented Generation (RAG). These hybrid architectures can enhance the accuracy, relevance, and transparency of AI-generated outputs. Where applicable, this work includes executable code and practical examples, for replication and adaptation.

The authors address key concerns such as hallucinations, bias, and overconfidence, and emphasizes the need for robust validation, human oversight, and new ethical frameworks. It also highlights the importance of developing fact-checking mechanisms and evaluation metrics to safeguard the reliability, transparency, and reproducibility of LLM-assisted solutions for servitization.

The structure of this paper begins with an overview of STI policy frameworks, focusing on supply-side, demand-side, and mixed instruments and identifying current implementation bottlenecks and challenges from a national and regional point of view. The discussion then offers a structured overview of LLM-enabled tools, illustrated with applied use cases, while also reflecting on the need

for human oversight and fact-checking mechanisms to ensure the reliability and accountability of their outputs.

Finally, it outlines promising research directions, including self-improving architectures, integration of LLMs into workflows, and the development of governance mechanisms tailored to AI-driven solutions. The goal is to guide servitization practitioners to harness the transformative potential of LLMs in building more responsive, inclusive, and effective innovative solutions.

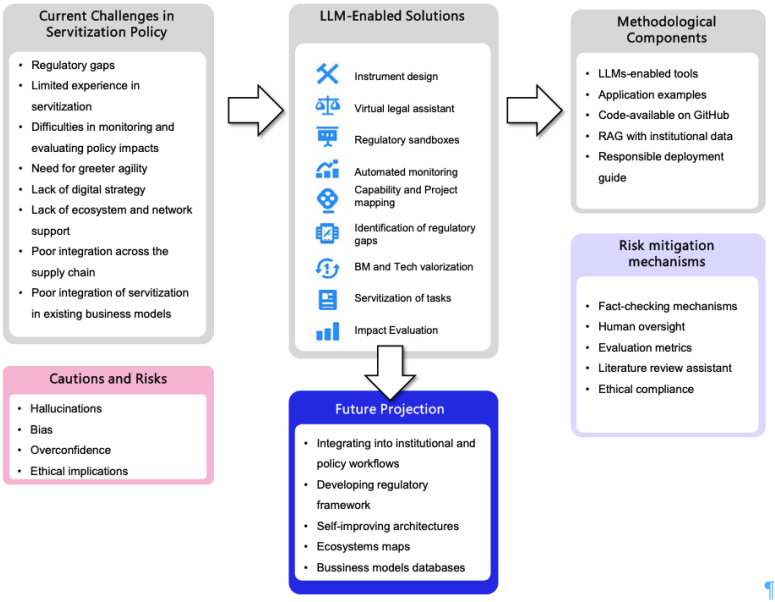

Figure 1. Summary of content

The impact of AI on environmental solution delivery through inter-organisational ecosystems

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Abstract

This study explores the differentiated impact of artificial intelligence (AI) on firms' capacity to deliver environmental solutions through smart, solution-oriented business models. As AI technologies enable greater customization, responsiveness, and collaboration, firms are increasingly shifting from standardized production toward personalized, problem-solving strategies that address complex customer needs. In the context of the environmental transition, this shift is particularly significant, as customers—driven by regulation and sustainability values—demand more environmentally responsible offerings. The study draws on the Natural Resource-Based View and ecosystem theory to argue that effective environmental solution delivery relies not only on internal capabilities but also on interorganizational collaboration. AI serves as a key enabler, enhancing two critical solution delivery levers: bilateral customer embeddedness and multilateral interorganizational networkedness. Using a novel dataset of 526 Spanish firms, the study tests two hypotheses through regression analysis. Findings

show that AI positively influences environmental solution delivery and that this effect is mediated primarily through enhanced interorganizational collaboration. These results underscore AI's strategic role in building collaborative ecosystems for environmental value creation, offering important theoretical and managerial implications for digital strategy, sustainability, and innovation in a rapidly transforming industrial landscape.

The rise of solution-oriented business models is allowing firms to better align production with the growing and increasingly complex demands of both consumer and industrial markets (Brady, Davies & Gann, 2005; Vaillant, Lafuente & Vendrell-Herrero, 2025). These models go beyond delivering standardized products by offering tailored, problem-solving solutions that address specific client needs (Sjödin, Parida, Jovanovic & Visnjic, 2020; Storbacka, Windahl, Nenonen & Salonen, 2013). In doing so, they enhance customer value while also enabling greater flexibility in production and service delivery. The capacity of firms to deliver enhanced value by providing personalized solutions tailored to the unique challenges faced by individual customers represents a key advancement enabled by digitalization in contemporary production strategies (Kulkov, 2023; Lafuente & Sallan, 2024). Unlike traditional standardized production models, which prioritize uniformity and economies of scale, digital technologies—particularly Artificial Intelligence (AI)—have introduced new levels of flexibility, responsiveness, and adaptability into manufacturing and service processes (Leppänen, George & Alexy, 2023; Vendrell-Herrero, Vaillant, Bustinza & Lafuente, 2022). These technologies facilitate the collection and analysis of vast amounts of customer and operational data, enabling firms to identify specific needs and configure offerings accordingly. As a result, companies can now scale customized solutions more

efficiently and cost-effectively, bridging the gap between mass production and individualized service (Vaillant, Lafuente et al., 2025).

Importantly, AI-enhanced smart solution delivery also helps firms to anticipate and adapt their offerings in response to emerging challenges and frictions that shape market dynamics and client expectations (Lafuente & Sallan, 2024; Vaillant, Vendrell-Herrero, Bustinza & Xing, 2025). This anticipatory capacity becomes a key source of competitive advantage in fast-changing environments that enhances customer satisfaction and loyalty but also creates new avenues for differentiation in increasingly dynamic and demand-driven markets (Bustinza, Lafuente, Rabetino, Vaillant & Vendrell-Herrero, 2019; Vendrell-Herrero et al., 2022).

One significant and pervasive challenge affecting both private and organizational clients is environmental transition (Chowdhury, Budhwar & Wood, 2024). This transition is progressively reshaping all sectors of the economy, influencing both upstream and downstream segments of value chains, including final consumers. As environmental concerns become more central to business and policy agendas, customers are placing increased importance on sustainability (Geels, 2011). These new demands stem from a combination of regulatory compliance—such as emissions standards and circular economy directives—and shifting values rooted in environmental awareness and social responsibility (Dey, Malesios, De, Chowdhury & Abdelaziz, 2020). As a result, firms in the market are under growing pressure to transform towards the adoption of more environmentally oriented purchases, processes, and offers. This includes designing environmentally responsible products and services, improving resource efficiency, and contributing to clients' own environmental goals. The ability to provide personalised solutions that help clients navigate the complex and firm-specific challenges of this transformation is a valuable strategic asset (Tucker, 2015). Solution-oriented business

models, and smart solution delivery in particular, thus provide a favourable framework for addressing these evolving expectations, positioning firms to create both economic and societal value in the context of global environmental transformation (Boons & Lüdeke-Freund, 2013; Porter & Kramer, 2011; Tucker, 2015).

Compared to standard product-centric models, AI technologies can introduce superior generative capacities to productive systems, enabling firms to develop solution-based strategies. These strategies are anchored in collaborative schemes of value-chain interoperability, allowing firms to co-create value and generate highly personalised environmental solutions for their clients (Leppänen et al., 2023; Sjödin et al., 2020). As such, the development of solution delivery models aimed at facilitating the environmental orientation of customers is likely to require the adoption of AI technology and platforms (Turunen, Eloranta & Hakanen, 2018; Vaillant, Lafuente, 2025). This is achieved through the potential impact of AI on a firm's main solution delivery levers: a bilateral customer embeddedness lever and a multilateral inter-organisational networkedness lever (Lafuente & Sallan, 2024; Storbacka et al., 2013; Vendrell-Herrero et al., 2022).

AI can facilitate the solution provider's embeddedness within their customer's business to help it fully understand the unique concerns that need to be addressed (Lafuente & Sallan, 2024; Storbacka et al., 2013). The bilateral integration of such AI-enabled customer embeddedness can lead to better tailored value propositions that more effectively solve the client's unique environmental challenges. Likewise, AI-based software and platforms can also be used to establish and coordinate solution delivery ecosystems, thus fostering inter- organisational networkedness (Dai, Derudder, Cao & Ji, 2023; Momeni, Raddats & Martinsuo, 2023). Such multilateral process harmonization across and within organizations can help to pool resources and capabilities to collaboratively optimize the

differentiated environmental value-added provided by increased solution delivery (Lafuente & Vaillant, 2023; Rapaccini & Visintin 2015).

As compared to standard solution delivery, effective environmental solution delivery increasingly requires coordinated action beyond the boundaries of individual firms (Lafuente & Vaillant, 2023), a need that can be effectively understood through the integration of the Natural Resource-Based View (NRBV) and the ecosystem perspective. The NRBV (Hart, 1995) extends the traditional Resource-Based View by emphasizing that firms can gain competitiveness by addressing complex environmental challenges through the development of adequate differentiated capabilities (Chowdhury, Ren & Jnr, 2025). However, the development and deployment of such capabilities often exceed the resources and expertise of any single organization. From this standpoint, the ecosystem perspective becomes critical, as it conceptualizes firms as part of broader, interdependent networks in which environmental solutions are co-created (Jacobides, Cennamo & Gawer, 2018). Environmental challenges, such as energy efficiency and waste management, are inherently systemic and span entire supply chains and sectors. As such, the formulation and delivery to clients of effective customised solutions to these challenges relies on collaboration with suppliers, customers, competitors, regulators, and other stakeholders to pool knowledge, align incentives, and coordinate action across the ecosystem. Multilateral collaboration amongst the different actors involved is essential to develop the adequate relational capital and frequent/constant interaction that will lead to mutual adaptation and sustainable fit between the applied solutions and the evolving nature of the problems being remedied (Lafuente & Vaillant, 2023). As cooperation enablers and interoperability facilitators, AI tool and platforms are likely to help assist the development of relational capital between all parties

involved in the solution delivery process addressing environmental challenges and, in this way, have a comparatively greater impact on inter-organisational networkedness as a lever for environmental solution delivery.

As a result, the research question that this study strives to answer is as follows: What is the impact of AI technologies and platforms on the different solution delivery levers leading to environmental orientation? To answer this question, the study tests the theoretically deduced hypotheses listed below using a unique database collected through a survey that encompasses a sample of 526 Spanish firms for 2023.

H1 *The use of AI technologies and platforms facilitates environmental solution delivery*

H2 *The positive impact of AI technologies and platforms on environmental solution delivery acts through the facilitation of inter-organizational networkedness.*

The core results of the full model estimated via regression analysis (see Table 1) shows that the use of AI technology and platforms does positively impact environmental solution delivery. It can also be seen from the results of the interaction terms in model 2, that the positive impact of AI on environmental solution delivery significantly flows through the multilateral solution delivery lever of inter-organisational networkedness as was theoretically hypothesized. Interestingly, the impact on environmental solution delivery for the bilateral customer embeddedness lever is limited to those firms not making use of AI.

The results of the study offer new theoretical postulates that help adjust the current body of knowledge in strategy, solution delivery, and business management to some of the changes brought on by the profound transformation brought on by the advent of AI and the environmental transition of industry and society (Chowdhury et

al., 2025, Lafuente & Sallan, 2024; Storbacka et al., 2013; Vaillant & Lafuente, 2024).

	Environmental solution delivery	
	(1)	(2)
Use of AI	0.50 (0.24)**	0.49 (0.24)**
Customer embeddedness	1.11 (0.19)***	1.17 (0.21)***
Inter-organizational networkedness	0.13 (0.06)**	0.14 (0.24)
Use of AI x Customer embeddedness		–0.36 (0.46)
Use of AI x Inter-organizational networkedness		0.12 (0.06)**
Firm size (ln employees)	0.06 (0.23)	0.08 (0.23)
Firm age (ln years)	0.04 (0.14)	0.03 (0.14)
Industry dummies	Yes	Yes
Region dummies	Yes	Yes
Intercept	0.34 (0.91)	0.31 (0.91)
Diagnostic statistics		
F-test	3.43***	3.34***
Adjusted R2	0.1096	0.1880
VIF (min-max)	1.31 (1.04-2.02)	1.32 (1.04-2.06)
Coefficient tests		
Customer embeddedness vs. Use of AI x Customer embeddedness		6.66**
Inter-organizational networkedness vs. Use of AI x Inter-organizational networkedness		2.25*
Observations	526	526

Robust standard errors are in parentheses. The omitted industry category is "Professional, scientific, and technical activities" (NACE: 70-74), while Andalusia is the omitted Autonomous Community (region). *,**, *** indicate significance at the 10 %, 5 % and 1 %, respectively.

Table 1. Regression results

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Artificial Intelligence to Achieve Revenue by Product Sales in Manufacturing Companies

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Abstract

This study examines how artificial intelligence (AI) can enhance positive effects of technology collaboration, technological innovation, and service innovation, linking them to revenue by product sales. This study delves into this approach by investigating the interaction effect of AI on these relationships. Using a dataset from the Spanish Survey on Enterprise Strategy in 2022 and 2023, the Tobit method was applied to 1795 manufacturing companies. The results show that companies that have technology collaborations, implement technological innovations, and service innovations, in a separate way, are not associated significantly with revenue by product sales. However, when companies implement these strategies in a combinative way with AI, they are associated positively with revenue by product sales. Thus, this research adds nuances to those relationships.

Keywords: Servitization, coopetition, tensions, repair.

Theoretical Framework

Nowadays, scholars and managers have agreed that manufacturing companies should implement digital strategies since today's digital

era revolves around using new technologies that create value for companies (Liu, Liu & He, 2023; Seclen-Luna, Fernandez-Olmos, M., & Paz-Aparicio, 2025). Manufacturing companies are increasingly attaching considerable importance to services in the value creation process (Kohtamäki, Baines, Rabetino, Bigdeli, Kowalkowski, Oliva et al., 2021). In that sense, manufacturing industries are offering a hybrid offer that contains both products and services (Vendrell-Herrero & Bustinza, 2020) or even digital service innovation (DSI) (Opazo-Basáez, Vendrell-Herrero, Bustinza & Raddats, 2024). DSI combines service offerings with advanced technologies such as internet of the things (IoT), artificial intelligence (AI), cloud computing (CC), allowing companies to align their business models with customer needs (Rabetino, Kohtamäki & Huikkola, 2024). Thus, value arises from the combination of advanced technologies and market conditions (Porter & Heppelmann, 2015; Berente, Gu, Recker, & Santhanam, 2021). By embedding advanced technologies into service provision, DSI enables companies to create new service and technological landscape, acting as a catalyst for continuous service design reconfiguration and innovation (Lafuente, Vaillant & Rabetino, 2023).

A critical question for servitization researchers and practitioners is how AI can be incorporated to enhance operational efficiency, market offerings and customer experience (Haefner, Wincent, Parida & Gassmann, 2021). Therefore, AI is increasingly becoming a focal point for manufacturers' innovation debate. Current developments in AI have supercharged the innovation process and service breakthroughs, which has far-reaching business and societal consequences. This AI development is driven by the explosion in available and accessible data warehouses, which in some cases, impact positively on servitization (Abou-Foul, Ruiz-Alba & Lopez-Tenorio, 2023). Thus, this study focuses on investigating the

individual impact of technology collaboration (H1), technological innovation (H2), and service innovation (H3), as well as their corresponding interaction effects with AI (H4a, H4b and H4c) on revenues by product sales (Figure 1).

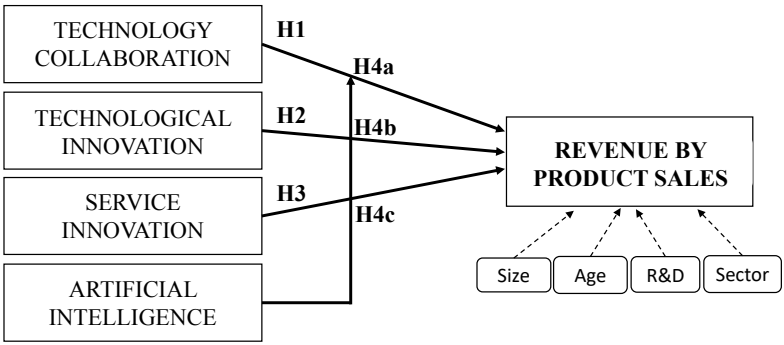

Figure 1. Conceptual Model

Method

We have used the Spanish Survey on Enterprise Strategy (2022) and 2023 because the independent variables are lagged, which has provided all the data at company level. Revenue by products is the dependent variable that corresponds to the percentage of total sales from sales of products. To advance research on smart manufacturing and digital service innovation, first, this study examines technology collaborations and technological innovation as independent variables measured as dummies. Second, this work also considers service innovation and artificial intelligence as independent variables measured as dummies, too. Control variables are size and age of the company, R&D intensity and sector. Data selection and depuration has been achieved following a five steps process: 1) Selection of years and industries; 2) Assignment of a unique industry code along the years for each company; 3) Removal

of observations without information about robotization; 4) With this process we have obtained a sample of 1975 companies in 20 different industries during a two-year period (2022-2023). Due to the nature of the dependent variable, we have used Tobit regression models to contrast our research hypothesis.

Preliminary Results

Our results are similar in all models. Our analysis yielded a significant direct effect for the relationship between service innovation and revenue by products. This is in line with previous literature that has suggested that service innovation allows to gain performance (Liu et al., 2023). Also, the results support the interaction effect between AI and technology collaboration/ technological innovation/service innovation facilitating sales growth through revenue by product sales, confirming our fourth hypothesis. This result is similar to previous studies (e.g., Abou-foul et al., 2023). Therefore, this study confirms the necessity to apply AI in a combinative way with technological collaboration, technological innovation, and service innovation. On the other hand, the sector and large companies are significantly associated with these relationships.

Variables	**(1)**	**(2)**	**(3)**	**(4)**
Technology collaboration	-.8059	-1.0631	-.7622	-.7562
	(0.9555)	(0.9626)	(0.9546)	(0.9551)
Technological innovation	0.7923	0.8287	0.6258	0.7859
	(0.8087)	(0.8080)	(0.8119)	(0.8081)
Service innovation	-3.9562***	-3.9314***	-3.9975***	-4.2372**
	(0.9009)	(0.8999)	(0.9001)	(0.9146)
Artificial Intelligence	0.9712	-7.7556	-10.0103*	-2.6291
	(2.6300)	(5.0104)	(5.9870)	(3.3493)
AI x Technological collaboration		11.9905**		
		(5.8622)		

AI x Technological innovation			13.5750**	
			(6.6504)	
AI x Service innovation				9.2525*
				(5.3373)
Firm Size	-.4927	-.5045	-.5352	-.5179
	(0.3741)	(0.3738)	(0.3743)	(0.3741)
Firm Age	-1.2805*	-1.2568	-1.2771*	-1.3115*
	(0.7677)	(0.7669)	(0.7668)	(0.7673)
R&D Intensity	11.7294	11.5442	11.7117	12.7780
	(16.5729)	(16.5539)	(16.5537)	(16.5701)
Constant	95.9582***	95.9841***	96.2181***	96.2698***
	(2.9398)	(2.9364)	(2.9392)	(2.9429)
Low technology sector	YES	YES	YES	YES
High technology sector	YES	YES	YES	YES
LR Prob>X^2	47.32***	51.50***	51.48***	50.32***
Pseudo R^2	0.0031	0.0034	0.0034	0.0033
Num. obs.	1795	1795	1795	1795

Note: ***p < 0.01; **p < 0.05; *p < 0.1

Table 1. Tobit Regressions – Revenue by products

Concluding Remarks

The present research provides a nuanced understanding of the impact of AI on a company's revenue by product sales. Specifically, when companies implement smart manufacturing through technology collaborations (with technological suppliers and customers), implement technological innovation (product and process innovations), and service innovation jointly with AI.

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Enabling Carbon-Neutral Business: The Role of Generative AI, Service Orientation, and Strategic Market Approaches

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Abstract

The push towards carbon-neutral business models has gained significant traction in response to growing environmental concerns, regulatory pressures, and market demands for sustainability. As businesses explore pathways to achieve carbon neutrality, a multitude of emerging technologies and strategies play crucial roles in this transformation. In particular, the adoption of generative AI, service-oriented business structures, and strategic market activities such as market exploration and exploitation are increasingly being recognized as critical enablers. However, the interactions between these factors remain underexplored, with limited understanding of how they synergize to support the transition to carbon-neutral operations. This study employs a fuzzy set qualitative comparative analysis (fsQCA) to examine how different configurations of generative AI adoption, service orientation, inter-organizational cooperation, market exploration, and market exploitation contribute to achieving carbon-neutral business outcomes. Drawing on survey data from young startup managers and entrepreneurs, our findings reveal multiple pathways to carbon neutrality, highlighting the complexity of the transition process. The study emphasizes that no single factor is sufficient on its own; instead, a holistic combination

of technological, structural, and market-based strategies is required. By providing these insights, this research contributes to the academic discourse on sustainability and digital innovation, offering actionable guidance to practitioners and policymakers seeking to facilitate carbon-neutral transformations in business operations.

Keywords: Carbon neutrality, generative AI, service-oriented structure, market strategies, startup entrepreneurs.

Introduction

The transition to carbon-neutral business practices is one of the most pressing challenges of the 21st century, driven by increasing environmental concerns, regulatory pressures, and a growing demand for sustainable products and services. As industries face significant disruption due to climate change and resource scarcity, the adoption of innovative technologies and sustainable business models has become essential for long-term success. Carbon neutrality, in particular, has emerged as a key goal for businesses across various sectors, with the objective of reducing greenhouse gas emissions to net-zero levels through a range of strategies, including energy efficiency, renewable energy, and sustainable resource management (Parida, Sjödin & Reim, 2019; Pizzichini, Sabatini, Gregori, Cillo & Sasso, 2025). In parallel with the push for sustainability, businesses are increasingly adopting digital technologies such as artificial intelligence (AI), machine learning, and automation to optimize their operations and reduce their environmental footprint. Among these, generative AI stands out due to its ability to create new solutions, optimize processes, and enhance decision-making capabilities (Sjödin, Parida & Kohtamäki, 2023). Generative AI can support sustainability by improving resource allocation, minimizing waste, and providing actionable insights that enable businesses to make data-driven decisions aligned with their carbon-neutral objectives. By integrating generative AI into their operations, businesses can not only enhance operational

efficiency but also develop innovative business models that align with circular economy principles, such as reducing, reusing, and recycling materials (Kirchherr, Yang, Schulze-Spüntrup, Heerink & Hartley, 2023).

Another critical element in transitioning to a carbon-neutral business is the adoption of service-oriented structures, which focus on delivering services rather than products. This shift is essential for achieving sustainability, as service-oriented models prioritize long-term use and resource efficiency over short-term consumption and waste. The rise of servitization, which involves transitioning from product-oriented business models into service and solution-oriented ones, plays a crucial role in enhancing business sustainability. It fosters customer engagement through continuous service offerings, such as maintenance and optimization, which help extend the product lifecycle and reduce environmental impacts (Sjödin, Parida, Kohtamäki & Wincent, 2020). In addition to these technological and structural shifts, market strategies such as market exploration and market exploitation are essential to ensuring the scalability and adaptability of carbon-neutral strategies. Market exploration involves seeking new opportunities, innovations, and market segments, while market exploitation focuses on maximizing value from existing capabilities and offerings. These strategies help businesses navigate the complex landscape of sustainability, ensuring that they can innovate while maintaining a competitive edge (Inoue, 2021; Kolagar, 2024). Together, these strategies create a robust framework for achieving carbon neutrality, enabling businesses to not only reduce their environmental footprint but also capitalize on emerging market opportunities.

Despite the growing recognition of these factors, there is a limited understanding of how they interact and contribute to achieving carbon-neutral outcomes. Most studies focus on isolated elements of this transformation, such as digitalization or market strategies,

without examining how these factors interact to support sustainability goals. This research aims to fill this gap by exploring the configurations of enabling conditions that lead to successful carbon-neutral business outcomes. Specifically, we investigate the interplay between generative AI adoption, service-oriented structures, inter-organizational cooperation, market exploration, and market exploitation. By analyzing survey data collected from young startup managers and entrepreneurs, this study aims to investigate how these factors interact in various ways to support the transition to carbon-neutral businesses. The findings of this research will not only advance academic understanding of the drivers of carbon neutrality but also provide valuable insights for entrepreneurs, practitioners, and policymakers seeking to facilitate the adoption of sustainable business practices.

Methodology

To identify configurations leading to carbon-neutral business outcomes, we employed fuzzy set qualitative comparative analysis (fsQCA) (Kolagar, Parida & Sjödin, 2024; Ragin, 2009). Data were collected from young startup managers and entrepreneurs, focusing on the adoption of generative AI, service-oriented structures, inter-organizational cooperation, market exploration, and market exploitation. fsQCA enabled us to examine the intricate relationships between these factors and their influence on carbon-neutral outcomes.

Preliminary Findings

Preliminary analysis reveals several distinct configurations that lead to successful carbon-neutral business outcomes. Key findings suggest that the adoption of generative AI, when combined with a service-oriented structure, can significantly contribute to achieving

carbon neutrality. Additionally, strong inter-organizational cooperation and active participation in both market exploration and exploitation are critical complementary factors. Specifically, businesses that leverage AI to optimize resource efficiency, while exploring new sustainable market opportunities, are more likely to achieve carbon-neutral outcomes. These findings underscore the need for a comprehensive approach that integrates technological innovation, organizational structure, and market strategies to foster sustainability.

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Corporate-wide or Business level implementation of AI for best market performance: does the production of smart products strategically matter?

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Abstract

This study explores how artificial intelligence (AI) implementation influences market performance in multi-business corporations, particularly distinguishing between corporate-wide versus business unit-specific strategies. While AI holds significant strategic potential, evidence suggests widespread inefficiencies in its implementation, amplified in multi-business firms where AI's impact spans both corporate strategy—focused on value creation across a corporate portfolio—and business strategy—centred on competitive positioning within individual markets and value chains. Using a unique sample of 667 manufacturing business units in Spain, this research builds linear models to assess whether market performance benefits more from AI integration at the corporate or business unit level. It also examines whether the presence of AI- enhanced smart products moderates these effects. Findings indicate that the locus of AI implementation—corporate versus business unit—significantly

affects performance outcomes, and that smart products can enhance value co-creation within ecosystems. The study contributes to emerging debates on digital strategy by emphasizing the need for disaggregated, business- level analysis of AI implementation and highlighting the shifting strategic role of smart product ecosystems in shaping firm performance.

Keywords: Artificial intelligence implementation, Multi-business corporations, Smart products, Strategy, Business units, Market performance.

Extended Abstract

To fully realize the strategic potential of artificial intelligence (AI), firms must carefully implement the technology in the most appropriate organizational and productive units (Helo & Hao, 2022; Kinkel, Baumgartner & Cherubini, 2022). When implemented effectively, AI can significantly enhance market performance by improving operational capabilities (Csaszar, Ketkar & Kim, 2024; Fosso-Wamba, Guthrie, Queiroz & Oyedijo, 2024). However, recent evidence points to widespread inefficiencies in corporate AI adoption. Fosso-Wamba, Guthrie, Queiroz and Minner (2024), for example, found that two-thirds of AI projects in UK and US firms stalled at pilot stages, and those that advanced often failed to deliver intended strategic outcomes, with benefits limited mainly to cost control and efficiency.

AI implementation becomes even more complex in multi-business corporations (Snihur & Tarzijan, 2018). These firms must balance AI's potential to enhance corporate-level synergies with its capacity to improve competitiveness at the business unit level, where strategic needs may vary significantly across markets and industries (Climent, Haftor & Staniewski, 2024; Krakowski, Luger & Raisch, 2023; Vaillant, Vendrell-Herrero, Bustinza & Xing, 2025). AI thus has a dual strategic influence: it can support broad corporate

strategies and enable business units to develop more effective, context-specific competitive positions (Menz, Kunisch, Birkinshaw, Collis, Foss, Hoskisson et al., 2021).

This debate echoes early discussions about information technologies (IT), which emphasized their impact on both business-level competition and corporate portfolio value creation (Bakos & Treacy, 1986; Cash & Konsynski, 1985). In today's digital environment, the line between corporate and business strategy is increasingly blurred. Contemporary strategy often emphasizes corporate-level value creation across diversified activities, sometimes at the expense of business-specific concerns (Massa, Tucci & Afuah, 2017; Spieth, Breitenmoser & Röth, 2025; Menz et al., 2021).

However, in the context of smart products—those integrated with AI to enable autonomous functionality—strategic dynamics shift. Firms producing these intelligent products increasingly operate within interconnected value ecosystems, where internal economies of scope give way to external co-specialization and interoperability (Jacobides, Brusoni & Candelon, 2021; Porter & Heppelmann, 2014). These smart business units act as components within broader networks of complementary firms, necessitating hyperspecialization for scalability and flexibility (Giustiziero, Kretschmer, Somaya & Wu, 2023; Cusumano, 2022). The strategic focus of such firms shifts from centralized portfolio management to enhancing the competitive positioning of individual smart units within an ecosystem.

This trend suggests that AI's role in multi-business corporations may be evolving. When AI is used to enable smart products, it supports not only internal efficiency but also interorganizational value creation. Accordingly, firms may need to prioritize AI implementation strategies that align with the specific needs and functions of individual business units.

Given this context, the core research question of this study is whether multi-business corporations achieve better market performance through a centralized, corporate-wide AI strategy or through a decentralized, business unit-specific approach. A secondary aim is to assess whether the production of AI-enhanced smart products moderates the effectiveness of these strategic choices.

To address these questions, the study analyzes a sample of 667 product lines from Spanish manufacturing firms, including both single- and multi-business organizations. Each product line is treated as a strategically independent business unit. The empirical model employs linear regressions to evaluate how the level and locus of AI implementation— corporate or business—affects product market performance and how this relationship changes in the presence of smart products.

The findings make several contributions to the field of digital strategy and AI management. First, they demonstrate that the strategic benefits of AI vary depending on the level of implementation and the type of product. Second, they reveal that AI-enhanced smart products play a moderating role in this relationship by enabling interorganizational value creation. Third, the study emphasizes the need to analyze AI implementation strategies at the business unit level, especially in diversified firms where strategic heterogeneity is high.

In sum, this research provides new insights into the strategic deployment of AI in multi- business firms, showing that a one-size-fits-all approach may not be optimal. As smart products continue to proliferate and ecosystems become more central to value creation, firms must carefully align their AI strategies with the structure and scope of their operations.

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Parallel Session 7

Business Model Innovation, Evolution & Co-creation in Servitization

Co-Chairs: Paul Mathyssens & Håkon Osland Sandvik

Theoretical Perspectives on Servitization: A Business Model Innovation View

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Introduction

Research highlights how firms leverage services to differentiate themselves and create sustainable competitive advantages (Baines, Lightfoot, Benedettini & Kay, 2009; Visnjic, Wiengarten & Neely, 2018). The transformation toward servitization involves reconfiguring business models, requiring firms to integrate service logic into their operations, develop new capabilities, and manage customer relationships differently (Kowalkowski, Lusch & Vargo, 2015). However, the literature lacks a unified framework that synthesizes different theoretical perspectives on servitization. This paper explores servitization through the lens of three established theoretical perspectives on business model innovation: rational positioning, evolutionary learning, and cognitive approaches. These perspectives offer valuable insights into why and how firms transition to service-based business models.

Methodology

This study employs an integrative review methodology (Snyder, 2019), which is well-suited for synthesizing existing knowledge and developing new theoretical perspectives. We choose an integrative review as a type of literature review that combines findings from various research designs, including both empirical and theoretical

studies, to provide a comprehensive understanding of a particular phenomenon. Our aim ist o build a theoretical model, based on business model innovation literature, to better understand transition phases and motivations of firms to enter servitization.

Related Works

Business models have been extensively studied, with a growing consensus that business models are systems of interdependent organisational activities (Zott & Amit, 2010). Prior research has identified three dominant theoretical perspectives in strategy research that explain business model change and innovation: the rational positioning school, which emphasizes deliberate managerial choices and optimal design (Zott & Amit, 2010; Teece, 2010); the evolutionary learning school, which highlights trial-and-error experimentation in response to external uncertainties (Chesbrough, 2010; McGrath, 2010); and the cognitive school, which focuses processes for schema changes like analogical reasoning as drivers of business model transformation (Martins et al., 2015). While these perspectives have been applied to business model innovation (Martins et al., 2015), their implications for servitization remain underexplored.

Results

Rational Positioning School

From the rational positioning perspective, business model change is viewed as a deliberate strategic decision that firms undertake to achieve a competitive advantage. This school emphasizes that firms assess market conditions, industry dynamics, and technological advancements to determine the optimal mix of product and service offerings. According to this view, servitization is a response to

external factors such as changing customer demands, regulatory shifts, or competitive pressures. Firms that adopt servitization based on rational positioning aim to maximize profitability through structured business model design and optimal resource allocation (Teece, 2010; Zott & Amit, 2010).

Example: Manufacturers from the rail sector such as Alstom and Siemens or from the elevator business such as TKE, Otis, Kone provide maintenance services with long-year contracts up to guaranteed uptime, leveraging contractual agreements to secure long-term revenue.

Evolutionary Learning School

The evolutionary learning perspective frames business model innovation as an adaptive process characterized by trial-and-error experimentation. Firms do not always have a clear strategic vision for servitization but rather develop service-based business models iteratively through market feedback and internal learning. This perspective highlights the role of experimentation, incremental adjustments, and flexibility in adopting servitization. Organizations that succeed in servitization under this school are those that continuously refine their offerings in response to customer needs and industry trends, often learning from both successes and failures (Chesbrough, 2010; McGrath, 2010).

Examples: Firms offering HVAC systems change their business model to subscription-based heating and cooling, they adjust pricing and service packages based on customer usage and performance data. Also the market for Performance-Based Contracts in the compressor sector has evolved over decades to focus on new regulations and energy-efficiency.

Cognitive School

The cognitive perspective suggests that business model innovation is driven by analogical reasoning and conceptual combination. This school argues that business model innovation describes the adoption of a set of activities and relationships proven to create value in a different context, which is considered to have structural similarities (Martins, Rindova & Greenbaum, 2015).

Examples: Firms like Rolls-Royce Power Systems, Trumpf or Kelvion try to establish new outcome-based contracts arising from the blueprint of e.g., power by the hour which was established decades ago in the aviation industry.

Conclusion

Perspective	Characteristics	Mechanisms	Managerial Focus	Outcome
Rational Positioning	Deliberate, strategic, market-driven	Strategic decision-making, market-driven innovation	Optimizing resources and market alignment	Maximizing profitability through structured service infusion
Evolutionary Learning	Adaptive, iterative, experimental	Trial-and-error, iterative learning from feedback	Encouraging experimentation and flexibility	Developing flexible service models in response to customer needs
Cognitive	Schema change	Absorptive capacity	Analogical reasoning and conceptual combination	Transfer of innovations from other industries to inform servitization

Table 1. Strategic Perspectives on Servitization

This paper contributes to servitization research by applying and integrating three dominant business model innovation perspectives.

By synthesizing rational positioning, evolutionary learning, and cognitive approaches, this study advances our understanding of how firms transition from product-based to service-oriented business models (Table 1). These insights have implications for both scholars and practitioners seeking to navigate the complexities of servitization and business model transformation in an evolving market landscape.

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Co-creating value with international clients: Lessons from the internationalisation of KIBS

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Abstract

The knowledge-intensive business services (KIBS) segment stands out for providing solutions tailored to its clients. These companies also need to expand their operations internationally to take advantage of their competitive advantages. However, they encounter new challenges and emerging business opportunities from their interaction with clients in such highly competitive environments. Thus, the objective of this study is to explore, from a qualitative perspective, how KIBS deliver their services in international markets, and in particular co-create value with their international clients. To this end, 16 semi-structured interviews were conducted with internationalised Basque KIBS companies.

Keywords: Value co-creation, international, Knowledge-intensive business services, KIBS.

Theoretical Background

KIBS internationalisation

Firms that offer knowledge-intensive business services (KIBS) are characterised as firms that provide solutions based on expert knowledge and expertise to other organisations (Miles, 2005; Miles, Belousova & Chichkanov, 2018). These services are intangible in nature and are most often customised to the specific problems of their business customers (Løwendahl, 2005). These particular

characteristics (knowledge-intensive, intangible, customised) generate additional challenges for the firm's internationalisation process (O'Higgins, Andreeva & Aramburu, 2021). For example, firms find it difficult to find the right people with both technical knowledge and linguistic and intercultural competences to deliver services in the international context.

Value co-creation

Value co-creation in services is a collaborative process where both service providers and customers actively participate in creating mutual value (Grönroos & Voima, 2013). This concept, central to Service-Dominant Logic, emphasizes that value is not solely created by the provider but emerges through interactions and experiences shared between the provider and the customer. It involves the integration of resources, knowledge, and skills from both parties, leading to customised and context-specific outcomes (Vargo & Lusch, 2008). Effective value co-creation requires a deep understanding of customer needs and preferences (Payne, Storbacka & Frow, 2008), but this is made more challenging if clients are in different and distant markets.

Digital technologies have undoubtedly facilitated the provision of services to international clients. Indeed, encouraged by the increase online communication between clients and service providers during the global COVID-19 pandemic, many service providers have taken advantage of digital technologies to increase the frequency of communication with international clients as well as reduce the costs of travel to their premises. However, the particular nature of KIBS poses certain limitations to online remote service delivery. In particular, in order for KIBS to understand the depth of a client's problems it is necessary for trust to exist between them (Boussebaa & Morgan, 2015) and it is unclear if this trust can be created

remotely. Furthermore, it is unclear if the co-creation of value –described above as occurring through interaction and shared experiences– can be achieved in a virtual environment or if it requires the sharing of a physical space.

This study aims to explore how KIBS deliver their services to international clients, and in particular which phases of their services do they carry out virtually or in person and why. We build on the theoretical framework proposed by Ball, Lindsay and Rose (2008), which suggests that services can be split down into different phases, and each of these can be delivered in the international context in different ways.

Methodology

In order to explore how KIBS deliver their services in international markets, and in particular co-create value with their international clients, a qualitative approach was chosen (Fletcher & Plakoyiannaki, 2011; Piekkari, Welch & Paavilainen-Mäntymäki, 2009). Interviews were carried out with 16 KIBS from the Basque Country, that offer services to international clients. Informants were asked first to share the internationalisation process of their firm, explaining how and why they expanded into different international markets. Thereafter, they were asked to choose a typical project (i.e. one similar to others) and to reflect on how they carried out their work in each of the five phases of the theoretical framework. Finally, interviewees were asked to share the challenges they faced during their internationalisation.

Interviews were recorded and transcribed, and transcripts were subsequently analysed and coded in order to understand when, how and why these firms interact with their clients remotely or in person on site.

Findings

Our preliminary analysis of the data confirms that, as suggested by the theoretical framework proposed by Ball et al. (2008), firms differentiate between activities that can be carried out remotely and in person. Those carried out in person are those which require trust-building and those in which the solution is co-created with the client.

Furthermore, our findings show that KIBS collaborate with local partners in the host market, and they therefore also differentiate between activities that can be delivered by the local partner and those they must deliver themselves. As such, local partners are also key actors in the co-creation of value, on some occasions in spaces shared by the local partner and the service provider, in other spaces by the local partner and the client and in yet others by all three actors together.

Conclusions

Our study aims to provide a more fine-tuned understanding of how value is co-created between KIBS and their international clients and in doing so contribute to extending the literature on value co-creation in international contexts as a lever for scaling and growth. Additionally, by extracting the key insights from the service context, we aim to provide manufacturing firms contemplating internationalisation through servitisation with practical suggestions on key elements they must consider.

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ARANCO's stepwise servitization: successful adaptations to punctuated equilibria

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Abstract

Many manufacturing firms seek to servitize their revenue streams in order to diversify their sources of income and strengthen their market relationships (Vandermerwe & Rada, 1988). While some companies expand their service offerings to increase revenues, others undergo more fundamental transformations by adopting business models in which products are marketed as services (Cusumano, Kahl & Suarez, 2015).

However, very few manufacturing firms succeed in generating (almost) 100 % of their revenues exclusively through pay-per-use or similar service-based earnings models. Even among the companies often cited as successful examples of this approach—such as Rolls-Royce, Xerox, or Atlas Copco—only about one-third of their revenues derive from pay-per-use schemes. Against this backdrop, the case and trajectory of ARANCO stands out as particularly remarkable. When the company was founded in 1988, its business model was based entirely on product sales. Today, by contrast, nearly 100 % of its revenue comes from value propositions rooted in a pay-per-use model. Over time, ARANCO has evolved from being a supplier of industrial packaging consumables to becoming a strategic partner in its clients' pallet-wrapping processes.

This leads us to the central research question of this study: How did ARANCO manage to shift almost entirely to a pay-per-use revenue model? More specifically: What types of innovation—incremental and/or radical—were implemented to achieve a business model fully grounded in advanced services? How did the company

transition from its original role as a seller of consumables (i.e., basic services) to a provider of integrated pallet-wrapping solutions (i.e., advanced services)? From a processual perspective, was this trajectory characterized by continuous change, or rather by alternating periods of stability and disruption—in line with a punctuated equilibrium model (Gersick, 1991; Uotila, 2018)?
To address these questions, we conduct a longitudinal case study of ARANCO, spanning approximately 35 years and employing a mixed-methods approach that integrates both quantitative and qualitative data. Specifically, we draw on financial and statistical data provided by the firm, interviews (in-person and via video-conference) with its CEO, and a documentary review of secondary sources.
The study concludes by outlining both managerial and conceptual implications derived from the findings.

Keywords: Servitization, pay-per-use, punctuated equilibrium model.

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Parallel Session 8

Industry-specific & Transformative Services

Co-Chairs: Beheshte Momeni & Yueling Zhou

Translating Servitization: A Multilevel Agency Perspective

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Abstract

As industrial manufacturers embrace servitization strategies, their strategic orchestration across multinational structures remains underexplored. This study investigates how servitization strategy is translated across organizational levels in a regionalized multinational enterprise (MNEs). Drawing on translation theory and strategic agency, we conceptualize servitization not as a linear rollout but as a multilevel process of reinterpretation, adaptation, and enactment by strategic actors embedded in diverse contexts. Using a qualitative case study of a global German pump manufacturer, we conduct interviews across group, regional, and country levels. Preliminary findings indicate that regional managers serve as powerful intermediaries, tailoring servitization narratives, selectively implementing initiatives, and navigating the tensions between global ambitions and local feasibility. Emerging translation mechanisms include selective framing, platform adaptation, and governance bridging. Our research contributes to servitization theory by unpacking how servitization strategy becomes meaningful and legitimate across organizational layers. This work moves beyond firm-level analyses and challenges assumptions of top-down coherence, highlighting instead the dynamic, actor-driven nature of global service transformation. These insights are especially relevant in today's geopolitical climate, where regionalized governance structures demand new understandings of strategy diffusion in complex, multinational settings.

Keywords: Servitization, Strategy, Organizational Change, Agency Theory, Translation Theory.

Introduction and Background

As industrial firms continue their journey from product-based to service-based value creation, the strategic orchestration of servitization strategies across organizational layers has become an urgent yet underexplored challenge. While the academic discourse on servitization has investigated its process of unfolding on the firm level (Baines, Bigdeli, Sousa & Schroeder, 2020; Adrodegari & Saccani, 2020) and the impact of endogenous and exogenous influences on it at both firm level and even ecosystem level (Sklyar, Kowalkowski, Tronvoll & Sörhammar, 2019), little attention has been paid to how servitization strategies are enacted and transformed across multiple organizational levels of a multinational manufacturing company – from corporate headquarters to regional hubs to national subsidiaries and ultimately to the frontline.

Our research addresses this blind spot by posing the following question:

> *How is servitization strategy translated across organizational levels in regionalized multinational enterprises, and what role does strategic agency play in shaping this process?*

This research is timely and relevant, as many globally operating manufacturers are responding to geopolitical tensions and increasing supply chain fragility by restructuring their governance and market access through regionalization strategies, splitting operations into regions such as the Americas, EMEA, and Asia-Pacific. These structures create nested hierarchies in which strategic direction and service transformation must travel not only downward (from group

to region to country to employee) but also laterally and upward through feedback loops, sensemaking, and agency. If done right, a regionalized structure allows for enhanced customer orientation through flexibility in processes but can also end in uncontrollable chaos and insufficient strategy commitment.

We explore this phenomenon through a multilevel theorizing lens (Kozlowski & Klein, 2000; Molloy, Ployhart & Wright, 2011) on data from qualitative research. Multilevel theorizing is not merely about collecting data at different levels but about explaining cross-level dynamics: How organizational phenomena are transmitted, interpreted, modified, or resisted across levels. This lens is surprisingly rare in servitization research, with most studies analyzing the servitization phenomenon on different firm levels or service units in isolation (Raddats, Kowalkowski, Benedettini, Burton & Gebauer, 2019).

To sensitize our analysis, we draw on two complementary theoretical perspectives: First, *translation theory* (Czarniawska & Joerges, 1996; Wedlin & Sahlin, 2017) views strategy not as a fixed artifact that is adopted or implemented, but as something that travels and transforms. As servitization strategies move through the MNE's hierarchy, they are reinterpreted by actors with differing logics, interests, and institutional settings. The process is iterative, contextual, and subject to modification, contestation, or reinvention.

Second, *strategic agency theory* (Jarzabkowski, Balogun & Seidl, 2007; Mantere, 2008), a descendant of the classic principal-agent theory from economics (Jensen & Meckling, 1976), draws attention to who does the translating. We focus on individuals and groups, i.e., *strategic agents*, who interpret and adapt servitization strategy in practice. Their actions are shaped by structural positioning, power, routines, and local constraints, as well as by intentionality and creativity.

Together, these lenses enable us to conceptualize servitization strategy not as a one-directional rollout, but as an adaptive process of translation, embedded in multilevel contexts and mediated by agency.

Research Method

Our ongoing empirical study draws on a qualitative single-case design conducted at a global pump manufacturer headquartered in Germany. The company, which has made servitization a strategic priority several years ago, operates in a regionalized setting. Data collection has already begun. We plan to conduct approximately 20 semi-structured interviews with senior managers involved in service strategy and transformation across group headquarters, regional business hubs, and country-level subsidiaries. Data are being coded abductively (Timmermans & Tavory, 2012), guided by sensitizing concepts from translation theory and strategic agency, using the three-step Gioia procedure (Gioia & Corley, 2013). We paid special attention to cross-level narratives, tensions between strategy and implementation, and variation across regions and country contexts. Within-case comparison is used to understand how strategy translation differs across levels and locations. Our findings are preliminary but already show different agency conditions, actors, and translation mechanisms across the various organizational levels.

Expected Findings and Discussion

Our findings suggest that the servitization strategy in regionalized multinational enterprises (MNEs) does not cascade uniformly from headquarters to local subsidiaries. Instead, it travels as a *translation*, a process in which the strategy is reinterpreted, reshaped, and recontextualized at different organizational levels. The informants

framed the strategic ambition of servitization as a necessary growth logic in one region, a controversial attack on established routines in another, and a mere marketing technique elsewhere. These variations reflect regional agency, institutional context, and customer proximity. Our study identifies the regional level as a particularly active site of strategic agency, where managers not only implement group strategy but also interpret, align with, or even resist it. In doing so, they acted as intermediaries, reconciling tensions between global objectives and local realities. For example, regional managers tailored global narratives to local market needs, selectively filtered initiatives for feasibility, or mobilized internal champions to build legitimacy. They ultimately act as *glocalizers* for the strategy. The preliminary translation mechanisms have emerged from the initial data analysis, including: *selective framing*, i.e., rearticulating the purpose of servitization to fit regional agendas; *platform adaptation*, i.e., modifying service models and infrastructure to accommodate local conditions; and *interpersonal bridging*, i.e., navigating tensions and contradictions between organizational levels through relational work.

These mechanisms help unpack how servitization strategies become enacted across contexts. Additionally, the lens of this research can be expanded to encompass even more organizational levels, including the country level, the functional level, and the individual employee (by incorporating a psychological perspective), to eventually constitute a layered and actor-driven framework for servitization strategy enactment. This is also what makes our findings novel within servitization research: While prior studies often treat servitization strategy as a cohesive top-down plan or focus on firm-level drivers and barriers (Bicakcioglu-Peynirci & Morgan, 2023), our work shows that servitization evolves through a process of continuous, situated translation across levels, often moderated and shaped decisively by intermediaries.

This is not merely a replication of general MNE governance insights (Kostova, Marano & Tallman, 2016). Servitization strategies, unlike traditional product-oriented strategies, are inherently relational, often requiring customer co-creation, long-term ecosystem commitments, and organizational learning across time and space. As such, understanding *how* servitization becomes meaningful, feasible, and legitimate in different parts of the organization is crucial to its success. Our findings directly address the complex and dynamic nature of global service transformation, offering new conceptual ground for servitization scholars seeking to understand not only where strategy is made but also how it becomes meaningful across various contexts.

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Digital Servitization and Transformative Services: An analysis of the Livestock Sector

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Abstract

This paper aims to analyze how digital servitization can contribute to individual and collective well-being within an ecosystem when digital solutions take the form of transformative services. The study focuses on the livestock sector, a particularly relevant context due to its strategic nature in the agri-food chain and the growing importance of digital transformation in this area. In recent years, various initiatives have shown how livestock companies are adopting digital servitization models, with startups playing a key role in generating technological innovations and facilitating the transformation process. However, the existing literature still offers a limited view of the strategic role played by these startups. Furthermore, unlike other sectors where digital transformation responds mainly to operational efficiency imperatives, in the livestock sector digital solutions incorporate an explicit focus on well-being. This reality requires the development of transformative services, an emerging approach in service research that seeks to improve individual, collective, and social well-being. In this context, this study adopts the TOE (Technology, Organization, and Environment) theoretical framework to explore how the process of digital servitization is articulated in the livestock sector, paying special attention to the moderating role of startups that enable its catalytic function. This broadens knowledge of digital servitization, extending its application beyond the manufacturing sector and integrating the transformative services approach into an area that has been scarcely explored in the literature.

Keywords: Digital servitization, transformative services, startups, wellbeing, livestock.

Introduction

Today, maintaining food safety and quality throughout the supply chain has become a major challenge (Aung & Chang, 2014). Growing concerns about animal welfare, transparency in how animals raised for consumption are treated, and environmental protection and sustainability have led the livestock sector to introduce changes in its production processes, with Precision Livestock Farming (PLF) becoming increasingly popular in livestock management (Markov, Stoycheva, Hristov & Mondeshka, 2022). These are smart products that integrate digital services (Kovács & Husti, 2018) and have led the industry to adopt a business model that aligns with digital servitization (Coreynen & Van Gosliga, 2023).

Digital servitization is considered a transformation process to include digital service solutions as part of the business of a traditionally product-oriented company (Kohtamäki, Parida, Oghazi, Gebauer & Baines, 2019). To include this offering, manufacturers need knowledge of software, hardware, networks, and services that are generally beyond the capabilities of individual manufacturers (Marcon, Marcon, Ayala, Frank, Story, Burton et al., 2022). This is even more evident in the livestock sector. As a result, many livestock farmers are turning to startups to get started in the digitization of the sector. However, little is known in the literature on digital servitization about how this sector is adopting the shift to this business model and the role of startups in this process.

In addition, a current of marked interest in the field of services is the so-called Transformative Services Research (Ostrom, Parasuraman, Bowen, Patrício & Voss, 2015). Initiated by

Rosenbaum, Ward, Walker and Ostrom (2007), it focuses on analyzing the impact of services on the individual and collective well-being of an ecosystem. Although well-being has not been sufficiently considered in the service literature, growing research in this field of knowledge suggests that customers may be willing to pay a higher price for services that care about and support their well-being (Rosenbaum, 2008). Furthermore, in some circumstances, organizations may be required to act due to new public policy legislation implemented to improve well-being (Rosenbaum et al., 2007). This is precisely the situation currently facing the livestock sector, where animal welfare and human health are a legislative requirement. Compliance with the standard, coupled with increasing public scrutiny of product traceability and environmental care, is forcing this sector to configure its business model with the provision of transformative services as a priority objective. This is where research trends in digital servitization and transformative services can converge. In this context, it is particularly important to understand which factors influence the development of transformative services and how they contribute synergistically to individual and social well-being.

Study Design and Methodology

Given the exploratory and contextual nature of this research, we opted for a case study design guided by the systematized qualitative methodology of Gioia, Corley and Hamilton (2013). This methodology allows us to rigorously and thoroughly capture the complexity of emerging phenomena that are insufficiently understood, such as the adoption of transformative digital servitization in the livestock sector. In this context, the TOE (Technology–Organization–Environment) theoretical framework not only provides an analytical structure for identifying and

interpreting relevant variables, but also guides the methodological design, facilitating data collection and triangulation in the three key dimensions of the model (Meng, Li, He & Dong, 2025):

- **Technological dimension:** we will explore how the technical characteristics of digital solutions—their complexity, compatibility, or perceived value—are interpreted and evaluated by the actors involved.
- **Organizational dimension:** internal adoption capacities, change management structures, and cultural dynamics within livestock farms and technology startups will be analyzed.
- **Environmental dimension:** institutional pressures, market conditions, collaboration networks, and the regulatory role of public administration will be explored in depth.

In order to holistically capture the perceptions, motivations, limitations, and dynamics of change that shape this phenomenon, a mixed methodological approach (qualitative-quantitative) will be used. To obtain qualitative data, we plan to develop a focus group with key players in the ecosystem: agri-tech startups, livestock farmers, and expert consultants, in order to generate collective discussion about the drivers, barriers, and perceptions surrounding digital servitization. We will also conduct in-depth interviews with representatives of livestock associations and public policy makers in rural areas to gather rich and contextualized information about the institutional and regulatory environment. For quantitative data, a consumer survey will be developed to collect data on attitudes, expectations, and perceptions regarding responsible consumption, digital traceability, animal welfare, and sustainability in livestock products. This dimension will allow for triangulation of results from the demand side and complete the analysis of the social impacts of transformative digital servitization. Both phases will be articulated in an integrated and sequential manner, so that the qualitative findings

inform the design of the quantitative instrument, and the quantitative results complement, validate, or contrast the emerging patterns of the qualitative analysis (Yin, 2015).

Expected Results

This study aims to offer new perspectives on digital servitization in the livestock sector, emphasizing the strategic role of startups as agents of innovation and change. Through an empirical approach based on the TOE model and the transformative services paradigm, the study seeks to develop a conceptual framework to guide the effective integration of digital solutions in a sector characterized by traditional structures, high fragmentation, and growing regulatory and social pressure.

The main results expected to be achieved are as follows:

Identification of the role of startups as key agents in the digital servitization of the livestock sector: It is expected to show that these entities not only act as providers of innovative technological solutions but also play a central role as facilitators of organizational change and digital learning, filling the structural and competency gaps of many traditional livestock farms. This finding will enable startups to be positioned as strategic nodes within the TOE model environment.

Characterization of transformative services in the agricultural and livestock context: The aim is to conceptualize how certain digital solutions can become transformative services, contributing not only to the technical efficiency of farms, but also to individual well-being (of farmers and animals), collective well-being (of rural communities), and environmental well-being. This contribution will broaden the scope of application of the transformative paradigm, which until now has been predominantly focused on sectors such as health, education, and social services.

Demonstration of the strategic value of digital servitization for the competitiveness and sustainability of the sector: It is expected to be empirically demonstrated that the adoption of business models based on digital servitization enables livestock companies to improve their operational efficiency and align themselves with the growing expectations of the market and society in terms of traceability, sustainability, and animal welfare.

From an academic perspective, this study will contribute to expanding the frontier of knowledge in digital servitization, extending its application beyond the manufacturing sector and integrating the transformative services approach into an area that has been scarcely explored in the literature. This theoretical integration will enable the generation of new constructs and explanatory relationships around the digitization of primary sectors. In practical terms, the findings will offer valuable implications for livestock farmers, startups, industry associations, and public policy makers by providing a structured guide for designing, implementing, and scaling digital solutions that not only improve economic performance but also contribute to sustainable development and the well-being of rural areas.

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Satellites for Services, Services for Satellites: Bidirectional Innovation in the Space Industry

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Abstract

Servitization, the shift from delivering stand-alone products to integrated services, is advancing unevenly in sectors such as the space one. This study explores the dynamics of servitization in the space sector, a traditionally product-centric industry now facing pressures to deliver service-based value. Drawing on two case studies within European space programs, we examine how legacy space organizations transition toward service-oriented models through early user engagement, organizational redesign, and architectural innovation. Findings reveal distinct learning pathways and innovation flows. In the first Case, early stakeholder involvement led to product architecture redesign, especially where service providers were present in the industrial consortium. In the second Case, engagement primarily reshaped service offerings, which then drove product reconfiguration, reversing the typical product-to-service flow. Overall, the main barrier was not technical but cognitive, as legacy firms struggled to unlearn product-centric assumptions. We argue that servitization in space demands not only technical adaptation, but also organizational learning and structural integration of user feedback into early design processes. Last, we emphasize the enabling role of space agencies in structuring procurement and collaboration to support this transformation and overcome organizational barriers.

Keywords: Servitization, product-service systems, satellite systems, service-driven architectures.

Introduction

Servitization, the strategic shift from selling stand-alone products to delivering integrated services (Vandermerwe & Rada, 1988; Baines, Lightfoot, Benedettini & Kay, 2009), has reshaped various manufacturing sectors, including automotive, aerospace, and industrial equipment (Raddats & Kowalkowski, 2014; Hein & Rosete, 2022). Servitization has proven advantageous in creating higher customer value (Baines et al., 2009), securing recurring revenue streams (Raddats, Baines, Burton, Story & Zolkiewski, 2016; Neely, 2008), and fostering long-term user relationships (Oliva & Kallenberg, 2003). However, the journey is rarely smooth. Key challenges include capability development (Davies, Brady & Hobday, 2006; Baines & Lightfoot, 2013), shifts in organizational culture (Gebauer, Edvardsson, Gustafsson & Witell, 2010; Vendrell-Herrero, Bustinza, Parry & Georgantzis, 2017), resistance to change (Kindström, Kowalkowski & Sandberg, 2013), and the need to rethink business models from the ground up (Sjödin, Parida, Kohtamäki & Wincent, 2020; Tongur & Engwall, 2014; Kohtamäki, Parida, Oghazi, Gebauer & Baines, 2019).

The space industry historically revolved around the design and delivery of bespoke, high-reliability hardware systems (e.g. satellites), funded by public agencies for scientific or national objectives (OECD, 2022). This legacy model was defined by long development cycles, rigid specifications, and one-off mission architectures (OECD, 2014). Today, however, the sector is undergoing a paradigm shift, often termed "New Space" (OECD, 2019). New commercial actors are driving a shift from a product-centric to a service-centric logic. Rather than viewing space infrastructure as the final output, these companies position it as a platform to deliver data-driven services. This service orientation allows to reach a broader set of end users (e.g. agriculture, insurance, and climate monitoring sectors) (EUSPA, 2024), and to adapt or reconfigure products based

on evolving service needs and user feedback. In this evolving landscape, traditional space incumbents (e.g. legacy space contractors and space agencies) face growing pressure to rethink how they deliver value. The servitization of space is underway, but uneven. In this context, servitization is not a shift in business model solely; it entails deep organizational and architectural transformation.

Research Objective and Research Questions

While surface-level similarities to other industries exist, the space sector presents unique conditions for studying servitization. Importantly, some organizations are prevented from delivering services directly due to divisions of responsibility within space alliances or functional separations within space agencies' governance structures. Nevertheless, these organizations must still embed service logic into product design to remain relevant in emerging service-driven contexts. Our guiding research questions are:

- How can servitization be enabled in sectors like space, where the product remains highly embedded and essential, yet a shift toward service-based value creation is increasingly expected?
- What roles can institutional actors (e.g., space agencies), commercial entrants (e.g., New Space firms), and unconventional stakeholders (e.g. private end-users) play in easing this transition and fostering collaboration across traditional and emerging logics?

Methodology

To address these questions, we conducted a multiple case study (Eisenhardt, 1989; Yin, 1984) across two projects within European space programs, using a combination of action research, semi-

structured interviews, participant observation, and public and confidential documents. Both cases were part of space programs aimed at developing new satellite architectures with a shared goal, i.e. integrating early user and service provider engagement into the design of service-enabling space systems.

Case 1: involved action research, interviews, and observation of technical and managerial meetings. The project featured two self-organized consortia, one composed solely of legacy space companies, and another combining traditional manufactures with service-oriented entrants. The space agency required stakeholder engagement but allowed firms to define the approach.

Case 2: combined action research and interviews. The space agency took a more active role, beginning to reconfigure its own processes to involve external users earlier in the design cycle.

The cases are well-suited to address our RQs for the following reasons. First, both entail legacy space organizations undergoing the transition toward service-oriented models. Second, they both incorporate perspectives from service providers and unconventional users within the space sector. Third, both are embedded within institutional programs where the space agency plays a central role, shaping conditions for experimentation, coordination, and innovation.

Preliminary Findings

Reverse flows of service innovation and product reconfiguration

The preliminary findings suggest reverse flows of service innovation and product reconfiguration, alongside distinct engagement models and learning paths. The first case demonstrates how early stakeholder engagement directly influences product architecture and sub-system design and digitalization. Specifically, the consortium with service-oriented partners engaged users early,

enabling iterative design processes that informed novel architectural decisions. On the contrary, the consortium without such partners tended to follow traditional, sequential development logics, where the internal architecture definition was followed by selective external engagement, limiting the satellite digital enhancement.

Case 2 highlights a different pathway: stakeholder engagement led to revised service offerings, which then prompted satellite architectural reconfigurations reversing the usual product-to-service trajectory. This finding highlights the recursive relationship between service design and technical system evolution.

Institutional design as enabler

The agency's decision in Case 1 to fund multiple parallel architectures allowed for experimentation without direct competition. Moreover, pushing consortia to perform industrial consultation for use cases and applications building forced companies to experiment new approaches, to establish novel partnerships, and to identify outsourcing opportunities. Particularly in the legacy consortium, this proved vital to limit the dominance of rooted products and practices in new architecture design. In Case 2, institutional change became a variable itself: by rethinking procurement and engagement structures within the agency, the latter began to directly support early-stage service innovation through user co-creation, identifying service considerations as valuable inputs for satellite's instruments design and selection.

Unlearning as a barrier

The main barrier was not technical skill but cognitive inertia. Legacy firms struggled to adopt service-first thinking, reverting to specification-driven assumptions, preference for technical

requirements, and internal stakeholder prioritization. The first consortium within Case 1 (i.e. the one including service providers) favored cross-fertilization and learning among firms with different backgrounds, maturity, and market focus (i.e. product vs service). Building a shared understanding between hardware- and service-centric actors emerged as a key success factor for architecture re-design.

Implications

This study contributes to the servitization literature by illuminating its complexities in high-reliability, infrastructure-intensive and institutionally-embedded sectors. Servitization here is not merely a matter of adding services into existing products but involves architectural redesign of products for novel, data-driven services, and rethinking how external actors participate in innovation processes. Practically, space agencies play a key role in supporting servitization. By structuring procurement to encourage stakeholder engagement, and supporting hybrid consortia, they can help overcome organizational inertia. Yet, they must also recognize that legacy firms may struggle to unlearn and capitalize in recently learnt practices, especially if lacking internal, proactive motivation to unlearn. For industry actors, the takeaway is clear: enabling servitization requires reimagining not only the system architecture but also the relationships, processes, and mindsets that shape how value is created and sustained.

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Parallel Session 9

Business Models & Platformization

Co-Chairs: Yancy Vaillant & Timon Urs Knapp

Reconfiguring business models through platformization:The case of connected cars

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Abstract

Many product manufacturers are transitioning into platform providers, a shift that entails a series of organizational changes. Nevertheless, limited attention has been paid to the specific organizational changes required in value proposition, creation, delivery, and capture for manufacturers to successfully adopt platform-based business models. To address this gap, this paper explores the connected cars landscape. Specifically, it examines the organizational transformation of automakers as they evolve from traditional product suppliers toward platform providers following the introduction of connected cars. This study draws on data from 12 automakers in the Brazilian automotive industry. Our findings reveal that the transformation of connected car business models follows three distinct patterns: (i) vehicle-oriented connectivity, (ii) driver-oriented connectivity, and (iii) ecosystem-oriented connectivity. Within each pattern, organizational changes in value proposition, creation, delivery, and capture are necessary to support the transition. These insights offer valuable theoretical and managerial contributions for servitization scholars and practitioners engaged with platform-based business models.

Keywords: Digital servitization, Digital platforms, Connected cars, Business model transformation.

Introduction

Driven by advances in digital technologies, manufacturers have increasingly developed smart products and services as part of their digital servitization strategies (Frank, Mendes, Ayala & Ghezzi, 2019). More recently, many have transitioned into platform providers, creating new opportunities for value creation, delivery and capture (Jovanovic, Sjödin & Parida, 2022). This shift is particularly evident in the automotive industry, where connected cars enable innovative mobility solutions (Turienzo, Cabanelas & Lampón, 2023). For instance, General Motors, through its OnStar platform, offers vehicle diagnostics, geolocation, infotainment services, and over-the-air updates that enhance the driving experience. However, most automakers struggle to implement platform-based business models as they fail to establish the organizational changes required to support this transformation (Bohnsack, Kurtz & Hanelt, 2021). Given this scenario, we propose the following research question: *What organizational changes are necessary to support the transformation toward platform-based business models?*

Theoretical background

Our study draws on Pettigrew's (1988) perspective on organizational change, which posits that transformations within companies arise from the interplay between context, content, and process. These dimensions highlight the circumstances surrounding the change (context), the specific aspects of the organization that changed (content), and how the change occurred (process) (Baines, Bigdeli, Sousa & Schroeder, 2020; Pettigrew, 1988). Given the limited research on the organizational changes automakers undergo with the introduction of connected cars, we focus on the content dimension to examine the specific shifts involved in the transition to a platform-based business model.

Research methodology

We employed a qualitative multiple case study approach to investigate the organizational transformation of 12 automakers in the Brazilian automotive industry that transformed into platform providers following the introduction of connected cars. Data collection included 16 semi-structured interviews with key informants from the automakers (conducted between March and October 2024, totaling over 18 hours), as well as secondary sources such as websites, newspapers, and internal documents to. Following the methodological guidelines of Gioia, Corley and Hamilton (2013), we performed a thematic analysis using NVivo 11 software.

Results

We identified three patterns in the transformation of connected car business models. The first is *vehicle-oriented connectivity*, where the value proposition centers on the product and technology, including services such as preventive fault detection and diagnosis aimed at increasing vehicle availability. Organizational changes in value creation, delivery, and capture involve new practices for data processing, the development of internet network architecture, and the introduction of subscription packages. The second pattern, *driver-oriented connectivity*, focuses on enhancing driver convenience and experience through infotainment and assistance services. Key organizational changes in this pattern include the development of new features and the establishment of partnerships with external developers. Finally, the third pattern, *ecosystem-oriented connectivity*, positions data and platforms at the core of the value proposition. Here, data monetization takes place within a broader ecosystem, enabling direct transactions between third parties and customers through services that leverage vehicle data.

Theoretical and practical contributions

This study offers two key contributions to the literature. First, it extends prior studies (e.g., Lerch, Horvat & Jasny, 2024; Van Dyck, Lüttgens, Diener, Piller & Pollok, 2024) by illustrating how traditional manufacturers can evolve into platform providers. Second, drawing on Pettigrew's (1988) perspective, it examines the organizational changes (content) that automakers undergo during this transformation. For practitioners of digital servitization, the study highlights the organizational changes required to support automakers' transformation to connected car business models.

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Iteration of experimentation and optimization: the path towards digital servitization and business model innovation

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Abstract

As manufacturing firms seek to remain competitive in increasingly digital and service-oriented markets, many undertake the complex transition toward digital servitization. Based on a longitudinal, multi-case study of four global B2B manufacturers, this study develops a process theory of digital servitization using an inductive, grounded approach. The research identifies a four-stage transformation path, across which firms gradually reconfigure their business models (BMs) - redefining value creation, delivery, and capture - through technological integration, enhanced customer engagement, and innovative revenue models. Rather than a linear or static change, digital servitization unfolds through continuous cycles of experimentation and optimization, shaped by both internal dynamics and external feedback. The findings contribute to servitization research by framing digital servitization as an ongoing, adaptive process. They also advance BM innovation (BMI) theory by showing how incumbent firms align their offerings with customer needs and market demands over time. Extending the concepts of problem–solution fit and product–service system (PSS)–market fit, the study highlights how companies alternate between addressing customer challenges and validating the viability of digitally enabled service solutions. The resulting framework offers practical and theoretical guidance for navigating the transition from smart products to integrated service ecosystems.

Keywords: digital servitization, iterative business model innovation, problem-solution fit, PSS-market fit.

Digital servitization has become a strategic priority for manufacturing firms seeking to deliver personalized, data-driven services (Shen, Sun & Parida, 2023). Enabled by real-time connectivity, predictive analytics, and customer-centric platforms, it offers new ways to compete in volatile markets by enhancing customer value and relationships (Dalenogare, Le Dain, Ayala, Pezzotta & Frank, 2023). However, this shift goes beyond technological adoption; it entails deep organizational transformation in how value is created, delivered, and captured (Coreynen, Matthyssens & Van Bockhaven, 2017). Yet this transformation is fraught with tensions. While firms aim to build integrated, interoperable digital-service systems (Kolagar, Parida & Sjödin, 2022), internal structures often remain fragmented: technical systems evolve toward modularity and ecosystem coordination (Langley, van Doorn, Ng, Stieglitz, Lazovik & Boonstra, 2021), while organizational routines, incentives, and governance frequently lag behind (Hanelt, Bohnsack, Marz & Antunes Marante, 2021). These misalignments become critical during the transition from experimentation to scaling, hindering progress.

Consequently, digital servitization unfolds as a nonlinear, iterative journey driven by cycles of experimentation, learning, strategic adaptation, and scaling (Sjödin, Parida, Jovanovic & Visnjic, 2020). Although existing literature explores key elements - such as service types, enablers, and value propositions (Aas, Breunig, Hellström & Hydle, 2020; Karttunen, Pynnönen, Treves & Hallikas, 2023) - it often overlooks how firms connect technological, service, and BM shifts over time (Kohtamäki, Rabetino, Parida, Sjödin & Henneberg, 2022). Accordingly, this study investigates how incumbent manufacturers navigate this transition through a longitudinal multi-

case study, revealing a path-dependent process shaped by continuous organizational adaptation (e.g., Lamperti, Dosi & Roventini, 2025). A multi-case study was carried out on four global B2B manufacturing firms operating across different industrial contexts and comprising two large companies and two medium-sized ones.

The analysis showed that the transition toward digital servitization follows a stepwise trajectory. We identified four key stages, beginning with the hybridization of value offerings - through either digitalization or servitization strategies - and progressing toward portfolio expansion, optimization, and ecosystem integration. At each stage, firms progressively redefine how they create, deliver, and capture value, ultimately leading to the scaling of initial conceptualized solutions. The findings demonstrate that this path-dependent process unfolds through iterative cycles of experimentation and optimization, echoing the notions of problem-solution fit and product-market fit from the start-up domain. Rather than undergoing a single, transformative shift, firms progressively reconfigure their BMs through a sequence of adaptations shaped by internal dynamics and external feedback. By unpacking this evolutionary process, our study offers a more refined understanding of BMI within digital transformation and provides actionable insights for incumbent manufacturers aiming to scale and sustain their servitization efforts.

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Do digital platform initiatives pay off for product manufacturers?

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Abstract

Product manufacturers increasingly emphasize digital platform initiatives. Manufacturers invest into product connectivity, service offerings and software applications to strengthen their company performance. But current research is still very case study oriented, with too little empirical knowledge about impact of product connectivity, service and software offerings on the performance of product manufacturing companies. The article draws upon a mixed method approach consisting of three exploratory case studies and a panel dataset. Study 1 substantiates key constructs for digital platform initiatives with product connectivity consisting of number of connected products and intensity of product connectivity, service offerings capturing service scope and service sophistication, as well as software offerings also capturing also software scope and software sophistication. Study 2 develops and tests hypotheses using panel survey data from 36 manufacturers over a period of ten years. Digital platform initiatives strengthen company performance through increasing service and software sophistication rather than extending their scope. Scope and sophistication of service and software offerings benefit from both increasing the number of connected products and the intensity of product connectivity.

Keywords: Digital Servitization, Digital Platforms, Services, Software offerings, Company Performance.

Summary

Digital platform initiatives have become increasingly prominent in manufacturing industries, reflecting a global shift toward data-enabled, service-centric, and software-enhanced business models. Companies across diverse sectors have introduced digital platforms as strategic responses to the rising demand for smart, connected products. Prominent examples include digital platforms launched by global leaders in automation, aerospace, energy, agriculture, and industrial technology. Although these initiatives differ in execution, their core logic remains similar: first, to connect physical products via digital infrastructure, and second, to use that connectivity as a foundation to extend the firm's service and software offerings. The overarching objective is to establish new avenues for revenue growth beyond traditional hardware sales.

A typical illustration of this trend can be observed in the global machinery industry, which is projected to grow significantly in the coming years. A substantial proportion of this growth is expected to stem directly from digital platform initiatives that enable connectivity-based service and software extensions. While some firms have successfully captured new value from these initiatives, others have faced stagnation or underwhelming results. These mixed outcomes raise important questions about the underlying mechanisms that determine the effectiveness of digital platforms as growth engines. Despite their growing prevalence and potential, research to date offers limited insights into how digital platform initiatives impact revenue generation, particularly through their connectivity, service, and software dimensions.

This paper addresses this gap by offering a theoretically grounded and empirically supported analysis of how digital platform initiatives contribute to revenue growth in manufacturing firms. The study draws on a mixed-method research design that combines three in-depth exploratory case studies with a panel dataset of 36 manufacturing firms that adopted digital platform strategies between 2014 and 2024. Through this design, the study systematically examines the structural capabilities of digital platform initiatives and empirically tests their relationship with firm-level revenue performance.

The study begins by developing a robust conceptualization of digital platform initiatives in the manufacturing context. Drawing from the case studies and supported by existing theory, we define digital platform initiatives as a multidimensional construct composed of six core capabilities:

- The ability to connect a large number of products (product connectivity scope),
- The ability to intensify product-level data exchange (connectivity intensity),
- The breadth of services offered via the platform (service scope),
- The complexity and technological advancement of those services (service sophistication),
- The range of software applications delivered through the platform (software scope), and
- The depth and intelligence of these software offerings (software sophistication).

This six-dimensional framework enables a more nuanced assessment of how digital platforms operate and evolve within industrial firms. The framework not only provides a foundation for empirical testing but also serves as a practical diagnostic tool for managers aiming to

benchmark and evaluate the maturity of their digital platform strategies. Unlike previous studies that focus narrowly on platform architecture or technical features, our approach offers a holistic view that captures both structural and value-creating aspects of digital platforms.In the next step, we investigate how each of these six dimensions influences revenue growth, identifying two underlying mechanisms through which digital platform initiatives are expected to contribute:

- The extension mechanism posits that a broader scope of connected products facilitates the expansion of service and software offerings. In this model, revenue growth is driven by the increased availability and accessibility of platform-enabled solutions to a larger installed base.
- The sophistication mechanism assumes that the intensity of product connectivity leads to more advanced service and software offerings. Here, value is created by enhancing the intelligence, automation, and predictive capabilities of offerings, thereby generating higher margins and stronger customer loyalty.

Our empirical analysis confirms that all six platform capabilities are positively associated with revenue growth. Both the extension and sophistication mechanisms significantly contribute to this growth. However, the sophistication mechanism exhibits a stronger and more consistent impact, indicating that firms are likely to benefit more by prioritizing quality and depth in their digital service and software portfolios than by merely expanding their reach. This insight has practical implications: when firms face resource constraints and must choose between scaling reach or enhancing capability, investments in sophistication tend to deliver superior returns.

Building on these findings, we also explore boundary conditions that moderate the effectiveness of digital platform initiatives. Specifically, we examine how market maturity, competitive intensity, customer structure, and product complexity influence the relationship between platform capabilities and revenue growth. Our results show that both the extension and sophistication mechanisms are more effective in mature markets and under conditions of lower competitive intensity. This suggests that firms operating in stable environments with less pressure from rivals are better positioned to monetize their platform capabilities. In contrast, customer structure (number and distribution of customers) and product complexity do not significantly alter the effectiveness of platform strategies. These findings offer managers a more refined understanding of when and where to expect returns on platform investments.

Altogether, this study makes three important contributions to the literature and practice: First, it introduces a comprehensive and empirically validated framework for assessing digital platform initiatives in manufacturing firms. The six-dimensional model provides a shared language and diagnostic structure for scholars and practitioners alike, enabling more precise measurement, comparison, and strategic planning. Second, the study empirically confirms the dual mechanisms—extension and sophistication—through which digital platforms contribute to firm revenue. It highlights that not all growth is equal: while extending reach is important, deepening service and software sophistication yields greater and more sustainable impact. This insight can guide firms in making informed strategic decisions about capability development and resource allocation. Third, the study identifies key boundary conditions that influence platform effectiveness. By uncovering how environmental and contextual factors shape the impact of platform initiatives, the study helps managers tailor their strategies to organizational and market realities. For example, firms operating in mature, less

competitive markets can expect more immediate gains, while those in volatile or highly contested spaces may require greater strategic alignment and investment to realize platform benefits.

In conclusion, digital platforms represent a powerful vehicle for industrial transformation, but their potential is realized only when firms build the right capabilities, understand the mechanisms of value creation, and align their strategies with external conditions. This research advances both theory and practice by showing how digital platform initiatives can be systematically conceptualized, measured, and optimized to achieve revenue growth in manufacturing industries. By doing so, it lays the foundation for a more rigorous and actionable understanding of digital servitization in the age of smart, connected products.

Managing Business Model Portfolios in Servitization: A Complexity-Reducing Approach

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Abstract

Managing business model portfolios is a complex activity requiring firms to engage in complexity-reducing approaches. Modularity is one way of reducing complexity by breaking down business model portfolios into more manageable components. Modularity is best exploited when architectural knowledge is developed for business model portfolios. This requires that firms develop component knowledge and integrate components across business models in a portfolio. Our work takes into stock the underexplored role of modularity and architectural knowledge in business model research, aiming to investigate how modularity and architectural knowledge reduce complexity in managing a business model portfolio in a servitized firm. Our findings show that both component knowledge and the level of integration of components across business models are determinants of reducing complexity and enhancing complementarity in business model portfolios. This study adds to the current literature on business model portfolios while bringing modularity and architectural knowledge concepts closer to those of business models.

Keywords: Business model portfolio, modularity, complexity, digital servitization.

Introduction

Today's companies rarely compete with a single business model but simultaneously use several that result from a development trajectory over time. Increasing competition in many industries has triggered firms to adapt their value-creation architectures (Teece, 2010). Firms respond to these increasing external threats (Snihur, Thomas & Burgelman, 2023) by developing new business models that tap into unexplored opportunities (Snihur & Tarzijan, 2018) or operating in a multi-business model setting to explore multiple opportunities (Aversa, Haefliger & Reza, 2017) while rationalizing the use of internal resources (Snihur et al., 2023). Consequently, individual business models become business model portfolios that evolve and are reconfigured longitudinally based on the firm's strategic decision in response to internal and external factors (Höök, Stehn & Brege, 2015). These circumstances are typical during servitization, particularly when companies must offer product lifecycle solutions to many customer segments (Rabetino, Kohtamäki & Gebauer, 2017). Indeed, these conditions have become common in digital servitization due to the opportunities opened by digital technologies (Kohtamäki, Rabetino, Parida, Sjödin & Henneberg, 2022).

Although research on business models has flourished and grown since the early 2000s (Foss & Saebi, 2017; Wirtz, Pistoia, Ullrich & Göttel, 2016), the business model portfolio concept has seen less prolific development over time, although important contributions to the field can be highlighted (Aversa et al., 2017; Snihur & Tarzijan, 2018). This paper taps into the growing interest in business model portfolio research (Snihur & Markman, 2023) by exploring the critical need for increasing complementarity (Aversa et al., 2017) while decreasing complexity (Snihur et al., 2023; Snihur & Tarzijan, 2018) in business model portfolio management. In leveraging business model modularity (Aversa, Haefliger, Rossi & Baden-Fuller, 2015) and architectural knowledge (Henderson & Clark, 1990) as

powerful concepts for managing multi-business models, our research aims to investigate how manufacturing firms develop necessary architectural knowledge in managing business model portfolios in order to reduce complexity and increase complementarity across business models.

Literature Review

Business Models and Business Model Portfolios

Business models are conceptualized as value-creation architectures highlighting value creation, delivery, and capture mechanisms (Teece, 2010) or as a system of interdependent activities whose links allow for value creation and capturing (Zott & Amit, 2010). As business model innovation is a way to respond to competitive pressures (Foss & Saebi, 2017), it also enables the development of multiple and alternative business models, giving rise to business model portfolios (Aversa et al., 2017). Business model portfolios enable firms to compete in multiple market segments, while portfolio management requires firms to manage both complexity and complementarity to increase performance and enable adaptation over time (Snihur & Tarzijan, 2018).

Modularity in Business Model Portfolios

Modularity helps firms manage complexity in business model portfolios by breaking it into more manageable, fine-grained elements (Schilling, 2000). In business model portfolios, modularity enables the mixing and matching of components within (Hsuan, Jovanovic & Clemente, 2021) and across underlying business models (Aversa et al., 2017) in order to enhance adaptation, recombination, and evolution of the portfolio (Snihur & Tarzijan, 2018). This

increases cross-business model synergy and complementarity while reducing complexity within business models (Snihur et al., 2023).

Architectural Knowledge in Business Model Portfolios

A business model portfolio requires an architectural knowledge perspective that calls for understanding the knowledge around developing business model components and the way they are integrated across different business models in a portfolio (Henderson & Clark, 1990; Tuna, Brusoni & Schulze, 2018). This offers a new lens to understanding management practices in business model portfolios and a novel application of architectural knowledge concept that departs from traditional product innovation literature (Henderson & Clark, 1990; Tuna et al., 2018). This approach highlights how firms define and embody value creation, capture, and delivery functions within the business model's components (Teece, 2010) and to what degree they are integrated across business models in the portfolio for enhanced complementarity (Snihur & Tarzijan, 2018).

Methodology

This study draws on exploratory, single-embedded case study research (Yin, 1994) based on purposive sampling (Patton, 2015). Single case studies allow for in-depth and robust analysis of the phenomena under investigation to provide greater explanation and contextualization (Eisenhardt, 1989). Our case company is a large incumbent Finnish firm that has operated multiple business models across different markets, showcasing its business model innovation activities. The unit of analysis is the addition of business models to existing business model portfolio configuration. This provides the necessary context for longitudinally exploring the evolution of the

business model portfolio. Data collection was based on semi-structured interviews and secondary sources such as annual reports, public corporate documents, and press and conference releases.

Findings

Our paper contributes to the business model literature by developing novel theorizing based on modularity and architectural knowledge. The findings show that both component knowledge and the level of integration of components across business models are determinants of reducing complexity and enhancing complementarity in business model portfolios. Thus, this study adds to the current literature on business model portfolios while bringing modularity and architectural knowledge concepts closer to those of business models. In doing so, the findings illustrate the role of modularity and architectural knowledge throughout twenty-five years of business model innovation in a servitized company. The paper also includes managerial implications and directions for future research.

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Servitisation and Digitalisation through Immaterial Design: User Motivations as Drivers of Sustainable Value Creation

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Abstract

Sustainability in design has long been addressed through material efficiency strategies such as reuse, maintenance, and eco-efficiency. However, the growing convergence of servitisation and digitalisation challenges this paradigm, suggesting that sustainable value creation increasingly depends on immaterial dimensions—such as motivation, participation, and user experience. This study examines how immaterial design can act as a systemic bridge between digital and service-oriented approaches to sustainability. It builds upon empirical data from international experts in design and sustainability (2015–2017), reinterpreted in light of recent literature (2019–2025) in digital servitisation and systemic design. The analysis indicates a transition from material-based conceptions of sustainability toward knowledge- and motivation-driven strategies, where immaterial design enhances the scalability of sustainable innovation. Furthermore, to deepen the understanding of evolving perceptions, a follow-up phase is envisaged to re-administer the expert survey and assess whether valuations have shifted relative to the original study. Although those results lie beyond the scope of this extended abstract, this trajectory highlights how the present research establishes a foundation for a fuller empirical contribution in future work.

Keywords: Sustainable Design; Servitisation; Digitalisation; Immaterial Design; User Motivation; Scalability; Value Creation.

Introduction

Since the early 2000s, sustainability in design has largely been pursued through material-oriented strategies—reuse, recycling, maintenance, and eco-efficiency—rooted in life cycle thinking. While these approaches have reduced environmental impact, they offer limited capacity for the systemic transformations demanded by contemporary production and consumption models (Vezzoli, 2014; Morelli, 2007; Manzini & Vezzoli, 2003). Scholars have thus emphasised the need to integrate social, digital, and organisational dimensions to move beyond material efficiency (Tukker & Tischner, 2006). In parallel, servitisation and digitalisation have emerged as transformative paradigms redefining how value is created and delivered. Servitisation facilitates a shift from ownership to access-based models (Baines, Lightfoot, Benedettini & Kay, 2009; Reim, Parida & Örtqvist, 2015), while digitalisation enables data-driven innovation and dematerialised value creation (Kohtamäki, Parida, V., Oghazi, Gebauer & Baines, 2019; Coreynen, Matthyssens & Van Bockhaven, 2017). Together, these paradigms open new pathways for sustainable scalability (Vendrell-Herrero, Bustinza, Parry & Georgantzis, 2020; Kowalkowski, Gebauer & Oliva, 2017).

Yet, research has often overlooked immaterial dimensions—human motivations, emotions, and values—that influence adoption and long-term impact (Chapman, 2005; Rivera-Pedroza, 2017). Building on empirical data from expert assessments (2015–2017) and an updated review of literature (2019–2025), this study explores the transition from material optimisation toward motivation-driven, immaterial sustainability. Furthermore, to deepen the understanding of evolving perceptions, a subsequent empirical phase is envisaged to re-administer the expert survey and examine whether these valuations have shifted, setting the stage for a fuller contribution in future research.

Methodology

The study follows an abductive research design combining empirical and bibliometric methods. It builds on quantitative data gathered through a structured questionnaire administered between 2015 and 2017 to 47 international experts in sustainable design—primarily from academia—who evaluated 21 design strategies according to their contribution to sustainability (Table 1).

1. Design of Services (shift from tangible products to intangible services)
2. Design for Digitization/Digitalization (from atoms to bits)
3. Design for Product-service Systems (integration of products and services in hybrid solutions)
4. User-centred systems design (focus on user needs, contexts and participation)
5. Design for Dematerialisation (minimize material content/elements)
6. Design for an appropriate lifespan (extend product life by avoiding premature obsolescence)
7. Emotional Design (create attachment through emotions, values and experiences)
8. Designing for Reliability (ensure durability, robustness and trust in use)
9. Design for Functionality (add components/multifunction/modularity/flexibility)
10. Design for Use (Usability) (optimise ease of use, ergonomics and accessibility)
11. Design for Serviceability/Maintainability (ease servicing/maintenance)
12. Design for Upgrading and Adaptability (facilitate updates, modular changes and flexibility over time)
13. Slow Design (encourage reflection, local production and mindful consumption)
14. Design for Social Equity and Cohesion (promote fairness, inclusion and community well-being)
15. Design for Reuse (secondary use, renewal, refurbishment, remanufacturing)
16. Design for Disassembly (enable separation of components for repair or recycling)
17. Design for Recovery and Recycling (materials, components)
18. Design for Transmaterialization (shift or replacement of materials by others)
19. Design for Glocalisation (thinking and acting with global and local interests)
20. Design for Eco-efficiency (optimise energy, resources and emissions across lifecycle)
21. Reverse logistics (facilitate return flows of products and materials at end-of-life)

Table 1. Sustainable Design Approaches Evaluated by Experts: Framework for Servitisation and Digitalisation Analysis.

To explore how these perceptions have evolved, a comparative bibliometric analysis was conducted in 2025, mapping research trends related to the same 21 strategies. Searches in the Web of Science used tailored queries for each concept across two periods: 2000–2017 and 2018–2025. This allowed identification of

publication patterns and thematic prominence over time, revealing how academic attention toward servitisation and digitalisation has increased.

In this study, the 21 sustainable design strategies evaluated by experts were categorised into three clusters. These clusters reflect different degrees of connection with servitisation and digitalisation:

Cluster A – Servitisation Core: Directly related to the transition from product to service-based models (e.g., Design for Services, Design for Product-Service Systems).

Cluster B – Product-Service Systems: Indirectly related to servitisation, focused on product longevity and reliability (e.g., Design for Appropriate Lifespan).

Cluster C – Digital and Intangible Transition: Dematerialisation and digitalisation of services (e.g., Design for Digitalisation, Design for Dematerialisation).

This classification provides a structured basis for analysing the scalability of sustainable design transitions across material, service, and digital domains.

Results

The 2017 dataset revealed a clear preference for material-centric strategies, reflecting the dominance of life cycle–based approaches in sustainable design. Experts prioritised reuse, maintenance, and eco-efficiency, whereas digitalisation and service design were rated lower, underscoring a traditional view of sustainability focused on material optimisation rather than systemic or digital transitions.

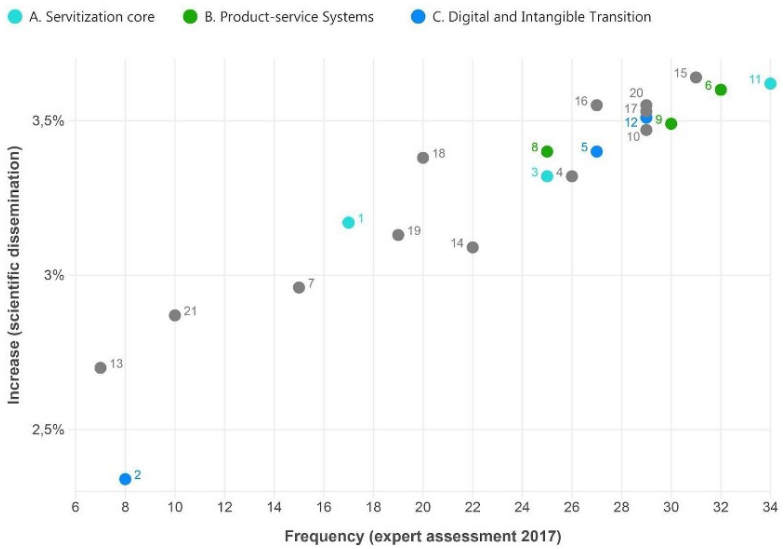

Figure 1. Expert assessment by frequency on 21 approaches to design sustainability (2017 questionnaire).

Figure 1 presents the relationship between expert assessments (x-axis) and the increase in scientific dissemination (y-axis) for the 21 design approaches. The distribution reveals that while experts highly valued material-based strategies, their academic diffusion over time has not grown proportionally. Conversely, digitalisation- and service-oriented approaches—initially rated lower—displayed stronger subsequent expansion in scholarly attention, suggesting a shift in the research landscape toward more systemic and intangible perspectives.

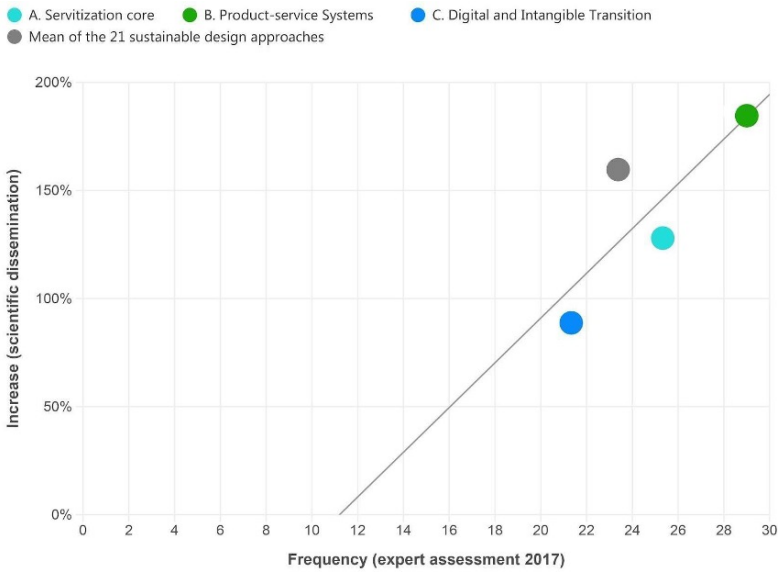

Figure 2. Comparison of results from the questionnaire analysis and bibliometric analysis in clusters A, B, and C.

The comparative bibliometric analysis (2025) confirmed this trend. As shown in Figure 2, the overall increase in publication volume for the three clusters follows a consistent descending order: Cluster B (Product–Service Systems) +185 %, Cluster A (Servitisation Core) +128 %, and Cluster C (Digital and Intangible Transition) +89 %. Despite differences in magnitude, all three clusters exhibit above-average growth compared with the general sustainability literature. These results indicate a temporal gap between expert perception and academic dissemination, where initially undervalued strategies—particularly digitalisation and service-based models—are gaining increasing prominence as enablers of scalable and motivation-driven sustainability transitions.

Discussion and Conclusion

The bibliometric analysis confirms a substantial increase in sustainability-related publications; however, this trend does not fully align with the priorities identified by experts in 2017. The expected convergence between expert foresight and subsequent research evolution remains partial, revealing a temporal and conceptual gap between perceived and actual developments.

The comparative analysis reveals a descending order (B–A–C), where Product–Service Systems (Cluster B) attract the most academic attention, followed by Core Servitisation (Cluster A) and the emerging Digital and Intangible Transition (Cluster C). This hierarchy reflects both the industrial consolidation of product–service integration and the still-developing role of digital and immaterial design strategies.

The observed divergence between expert perceptions and research trends raises critical questions about the alignment between scholarly inquiry and professional insight. These differences may indicate evolving understandings of sustainability or a lag in integrating digital and human-centred approaches. A forthcoming empirical phase will reassess expert perspectives to determine whether current evaluations converge with these evolving research patterns.

Overall, the findings evidence a paradigm shift from material-centric to immaterial-driven sustainability strategies, positioning servitisation and digitalisation as key enablers of scalable, motivation-based sustainable innovation.

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Parallel Session 10

Sustainability, Circular Economy & Strategic Entry

Co-Chairs: Paavo Ritala & Eduardo Sisti

Sustainable Servivization: How advanced digital services foster eco-innovation: Evidence from German Manufacturing firms

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Abstract

Digital Servitization has been identified as an important strategy for increasing the ecological sustainability of the manufacturing sector. Advanced service-based business models often go along with degrees of ownership retention by the goods manufacturer, who then operate their products and solutions on behalf of their customers. Such ownership-based business models potentially incentivize manufacturing companies to design their products and solutions based on circular principles. Accordingly, this paper assesses the impact of advanced digital services on the eco-innovativeness of a firm's product innovation. Based on a sample of 1,300 firms from the German manufacturing sector, we employ a novel measure for the degree of digital servitization of a firm and assess its impact on the circular economy properties of the firm's product innovation. We find that firms who offer advanced digital services are significantly more likely to also introduce eco-innovative product innovation. However, further research is required to assess the impact of the breadth and depth of firms' digital service portfolios on the eco-innovation intensity, as well as the impact of different moderating variables, such as financial resource slack, digital capabilities and R&D intensity.

Keywords: Sustainable Servitization, Digital Servitization, Eco-Innovation, Circular Economy

Introduction

Digital servitization has been identified as an important strategy for increasing the ecological sustainability of the manufacturing sector - a research stream known as sustainable servitization (Kohtamäki, Bhandari, Rabetino & Ranta, 2024; Menon, Bigdeli, Adem, Schroeder, Awais, Baines et al., 2024; Rabetino, Kohtamäki, Parida & Vendrell-Herrero, 2024). Advanced digital manufacturing services often involve manufacturers retaining product ownership (e.g. by offering so-called "pay-per-use" or "pay-per-performance" business models). Literature postulates, that such novel digital service business models, may incentivize manufacturers to invest in eco-oriented product improvements, such as extended lifecycles, or enhanced energy and material efficiency, potentially reducing environmental impacts and improving the eco-innovative and circular properties of their product portfolios (Baines, Ziaee Bigdeli & Kapoor, 2024; Tukker, 2015).

Empirically, however, the link between digital servitization and eco-product innovation is still underexplored (Lee, ., Kim & Roh, 2024; Wang, Wang, Wu & Liu, 2023; M. Wang & Sun, 2024). Hence, this study seeks to contribute to this discussion, by empirically assessing the link between digital service innovation and eco-innovative product innovation, in the context of the German manufacturing industries. Thus, we examine the research question: Does digital servitization increase manufacturing firms' likelihood of introducing eco-innovative products?

Methodology

For the empirical analysis, we employ data from a representative data set of over 1,300 German manufacturing firms, from the 2022 version of the *German Manufacturing Survey* (GMS) (Jäger & Maloca, 2022). The GMS 2022 survey items were used to construct both

dependent and independent variables, with the aim of measuring the impact of digital servitization on firms' eco-innovative capabilities. As dependent variable, we use a binary variable for measuring product innovation, where one represents the case that a firm had introduced a new product since 2019, labelled product innovator, and zero otherwise. The measure for eco-innovation is an extension to this measure and captures whether a firm's product innovation possessed characteristics that improved or reduced the environmental impact of the product and/or its operation (including a reduced health risk while use, reduced resource use and energy consumption during use, or improved recyclability, etc.). Following Horvat, Jäger and & Lerch (2024), we defined eco-innovators as firms that indicated to have improved their products in at least two of the assessed eco-dimensions.

Following calls for more comprehensive measures of digital servitization (Menon et al., 2024), we construct a comprehensive measure of digital servitization, based on prior work by Lerch et al. (Forthcoming) and Marjanovic, Horvat, Rakic and Lerch (2025). Our measure combines two types of services, standard (product-centric) services and advanced (outcome-based) services, with two levels of digitalization, manual delivery and digital delivery. The resulting indicator consists of five categories, or levels: 1) non-service provider (equals one for firms that did not offer any type of service offering); 2) manual standard services (equals one for firms that offered at least one type of manually delivered, product-centric services); 3) manual advanced services (equals one for firms that offered at least one type of outcome-based, manually delivered services); 4) digital standard services (equals one for firms that offered at least one type of digital, product-centric services); 5) and digital advanced services (equals one for firms that offered at least one type of outcome-based digital services).

To assess the impact of digital servitization on product innovation and eco-oriented product innovation, we employ a logistic regression approach for each dependent variable. Following well established practice, we control for the influence of structural parameters that otherwise impact the innovativeness of manufacturing firms, such as industry affiliation, product complexity, firm size and batch size.

The preliminary results of our regression analysis show that firms that provide both standard and advanced digital services solutions to their customers have a much higher likelihood of introducing eco-oriented new products (both significant at least at $p < 0.05$). In contrast, firms that only employ manual services do not have a higher likelihood of doing so (see column (2) of Table 1).

Interestingly, when comparing the magnitude of the odds ratios of the regression estimations (1) and (2), we find that the effect sizes of standard digital and digital advanced services is even higher for eco-innovation (2) than generic product innovation (1). Accordingly, firms that offer digital services tend to be more likely product innovators and furthermore focus to an even larger extent on eco-innovations, compared to their competitors without digital service offers.

Results (Preliminary)

	(1) Product Innovator [b]		(2) Eco-Innovator [c]	
Variables	OR	Sig.	OR	Sig
Digital servitization [a]		***		**
Manual standard services	1.550**	39	2,164	0,206
Manual advanced services	1.205	575	1,720	0,508
Digital standard services	3.180***	0	3,563**	0,033
Digital advanced services	2.807***	0	5,279***	0,009
Context Variables				
Industry Dummies	***		**	
Product Complexity	**		**	
Batch Size	N.S.		N.S.	
Firm Size	***		***	

Note: Logistic regressions: (1) n= 1.176, p<0.001, (2) n=505, p<0.001. Odds ratios are reported.
Significance levels at *** p<0.01 ** p<0.05 * p<0.1 N.S. p>0.1.
Reference groups: (a) no service offering, (b) no product innovators, (c) no eco product innovator. Source: German Manufacturing Survey 2022, own calculations.

Table 1. Regression table for main models: Digital servitization as determinant of product innovation and eco-innovation.

Conclusions (Preliminary)

Our findings show that both standard digital and advanced digital services, and the related capabilities, significantly improve manufacturing firms' capabilities of developing eco-innovative product innovation. We show that more than the sophistication of service levels alone, it is how firms combine different types of services with digital technologies, that increases eco-innovation capabilities. Especially the group of advanced digital services (i.e. ownership-based services) prove to increase firms' capabilities to bring eco-innovative products to the markets. Hence, we show that digital servitization positively affects eco-innovation capabilities, as suggested by Baines et al. (2024) and Tukker (2015). This finding is

in line with recent work by Lee et al. (2024), who find that servitization has a positive effect on green innovation, with digitalization being a moderator of this relationship.

We plan to conduct further research to further illuminate the relationship between digital servitization and eco-innovation in respect to potential moderating and mediating effects, such as the role of digital capabilities (Vilkas, Bikfalvi, Rauleckas & Marcinkevicius, 2022), resource slack (Nasirov & Castaldi, 2025) and R&D expenditures (Benedettini & Kowalkowski, 2022). Furthermore, the impact of digital servitization breadth and depth, and its impact on the intensity of eco-innovation activities is a promising avenue for further research (Nasirov & Castaldi, 2025; Wang et al., 2023; Zhang, Wei & Gao, 2023).

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Powering the Loop: Suggesting Servitization Concepts Creating a Circular Business Ecosystems for Industrial Electric Motors

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Abstract

Industrial electric motors, numbering over 300 million globally, are critical to production but often operate inefficiently, contributing to 45 % of global energy consumption. To improve resource efficiency, servitization offers powerful concepts for transitioning from linear value chains to circular business ecosystems. Through a qualitative case study of firms engaged in the production, use, and recycling of industrial electric motors, this study investigates how servitization concepts can enable circularity by redefining firm relationships and business logic. This includes the shift from ownership to access, increases product utilization, and facilitates resource recovery strategies such as remanufacturing and reuse. By identifying a number of concepts that vary from basic to more advanced, this study presents a framework to guide firms in developing and selecting circular business models. The results offer both theoretical and practical contributions: highlighting how servitization can create value beyond product sales, foster collaboration across business networks, and drive sustainable transformation in industrial settings.

Keywords: Servitization, circular business models, business ecosystems.

Empirical Background and Relevance

Every industrial production process relies on complex systems of machines and motors built out of countless materials and minerals.

Imagine these valuable resources being transformed into new opportunities instead of being discarded at end-of-life.

The industrial sector consumes 45 % of global energy, driven by 300 million electric motors, a number expected to double by 2040. Yet, 80 % of these motors run inefficiently (West Sweden Chamber of Commerce, 2018 and Swedish Energy Agency). This highlights the urgent need for firms to adopt circular, resource-efficient strategies, utilizing new innovative concepts.

Servitization-based concepts such as product-service-systems (PSS), digital sharing platforms, and subscription- or rental-based systems offer scalable pathways to shift from ownership to access, thereby increasing product utilization and improving energy and resource efficiency (Li, Che, Wang, Du, Zhao, Sun et al., 2021). Integrating circular economy principles into business models can maximize resource efficiency, particularly by considering all life-cycle stages (Frishammar & Parida, 2019).

When combined with pioneering resource recovery strategies such as remanufacturing, repurposing, and recycling, servitization and digital platform technologies (Blackburn, Ritala & Keränen, 2023) could have the potential to reverse the ongoing decline in circularity (Cicle Economy, 2025; Bocken, Pinkse, Ritala & Darnall, 2025). While products remain important, PSS-based business models can support sustainability by shifting a company's focus from selling goods to offering integrated solutions and services. However, to unlock the potential circularity benefits, firms need to avoid the servitization paradox (Gebauer, Fleisch & Friedli, 2005), where the shift toward services increases complexity, costs, and material throughput without resulting in according economic or environmental gains. When implemented thoughtfully, circular practices can potentially offer a competitive edge, open new revenue streams, and enhance resilience to resource scarcity and market volatility.

Problem and Research Purpose

There is a lot of literature on servitization (Reim, Parida & Örtqvist, 2015), circular business models and business ecosystems that highlight the potential and challenges (Bocken et al., 2025). But there is still a lack of empirical studies that explore how servitization can act as a catalyst for developing circular business ecosystems in established industrial contexts. This is needed because it requires a transition from traditional hierarchical value systems to more collaborative ecosystem with a set of actors with varying degrees of multilateral, non-generic complementarities that are not fully hierarchically controlled (Jacobides, Cennamo & Gawer, 2018; Sjödin, Liljeborg & Mutter, 2024). There is a need for more research to outline effective circular economy ecosystem strategies suitable for adoption by businesses (Peçanha & Ferreira, 2025).

This study addresses that gap by examining how firms can utilize different servitization concepts (from basic to highly advanced) depending on how they are able to redefine their relationships with suppliers, customers and emerging partners as part of the formation of business ecosystems. By investigating how servitization strategies influence this transformation it will support the development of reasonable circular business models and enabling new forms of value creation and collaboration. The study contributes to the generation of insights that are both academically valuable and practically relevant for industry stakeholders and creates practical recommendations for policymakers and business leaders.

Research Design

The study will employ a qualitative, exploratory case study design where the unit of analysis is the (evolving circular) business ecosystem and the participating firms represent embedded units of analysis (Yin, 2009). For this research, a case study approach is

appropriate as it facilitates an in-depth exploration of the firm's collaborations and circular economy practices with a focus on servitization within a business ecosystem.

To gain in-depth insights, data will be collected through about 30 semi-structured interviews with participants from four firms who participate in the business ecosystem, all who have knowledge of industrial electric motors from various aspects as producer, customer and recycler. First-order codes will be assigned and grouped into second order and third order themes (Gioia, Corley & Hamilton, 2012).

Discussion and (Expected) Contribution

The research highlights key challenges to advancing circularity in sustainability efforts, such as short-term economic priorities, siloed organizational structures, and a lack of long-term strategic alignment. It also explores how servitization can help address these challenges by enabling innovative approaches that support the development of circular business models.

By drawing on insights from business model transformation, technical and digital innovation, and enabling incentives, the research proposes a framework to support the transition toward more circular and collaborative industrial practices.

Among the fundamental elements of the result is the development of structured guidance aimed at addressing key challenges such as:

i. Developing "pay-as-you-use" service models to boost product and resource use, enabled by performance-monitoring digital tools.

ii. Implementing digital solutions for improved tracking, lifecycle data sharing, and service history transparency.

iii. Addressing the trade-off between upgrading to energy-efficient motors and the challenges of critical material use and closed-loop systems.

iv. Balancing in-house expertise and outsourcing, especially amid difficulties in hiring specialized maintenance staff.

v. Standardizing products to support circularity, while finding ways to meet customization demands without compromising circular design.

vi. Creating a global strategy that ensures consistency and scale, while adapting to local regulations, culture, and market needs.

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Capturing value from shared services in eco-industrial parks

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Abstract

Industrial firms need services and may also offer their own services, to supplement their goods-centric business. Service sourcing and delivery are dominantly investigated at the level of specific focal manufacturing firms or in their dyadic service relationships. However, service sourcing and delivery may benefit from firms' collaboration at the level of a business network. Eco-industrial parks represent exemplary contexts for such business networks that enable and require inter-organizational collaboration to promote partner firms' capture of value. Firms co-located within an eco-industrial park tend to require such services as logistics, waste management, security, and digital platforms and tools. Instead of each firm sourcing their own services separately, eco-industrial parks may offer benefits from organizing services centrally and enabling service sharing among the firms. Sharing of business services in industrial settings is a challenging optimization task, through the firms' different strategies, priorities, and expectations. This case study investigates firms' expectations toward and the value capture from shared services in an eco-industrial park. Interviews with different firm representatives reveal versatile expectations and experiences of benefits and challenges with shared services. While the motivation and justifications for service sharing are generally aligned among firms, conflicting expectations and challenges for implementation of sharing emerge depending on the scope, strategies, and firm-specific processes. We discuss requirements for firms' value capture through service sharing in eco-industrial parks

and identify such mechanisms of service sharing that may contribute to service infusion at the level of a business network.

Keywords: Eco-industrial park, services, collaboration, business network.

Introduction and background

Industrial firms cooperate with each other and source and deliver services in their business networks. Network perspective on firms builds on the influence of their social context and its actors (Gulati, 1998). Interaction between companies in these networks may include exchange, sharing, and development of products and services (Gulati, 1998). The logic of sharing implies access to resources and services without the firms' own ownership, and it has so far been discussed to a limited extent in business-to-business markets (Melander & Arvidsson, 2021). However, some research advocates acknowledging the systemic, network-level view to value creation in service business (Edvardsson & Tronvoll, 2013; Helkkula, Kowalkowski & Tronvoll, 2018). Shared services, for example, in logistics could lead to economies-of-scale benefits, and efficiency in inventory management (Qiu & Huang, 2013). Overall, sharing physical assets and services helps firms avoid the constraints of ownership and could offer more diverse options of assets and services (Qiu, Luo, Xu, Zhong & Huang, 2015). This study deals with firms' cooperation and sharing of services within eco-industrial parks.

Various industrial companies such as manufacturing factories and energy plants depend on each other and may benefit from co-location in areas such as industrial or eco-industrial parks. Such parks may result from local or regional pursuits of industry expansion, and co-location generates synergies, for example, through shared road, energy, and spatial infrastructures (Qiu &

Huang, 2013). For eco-industrial parks, synergy is reached especially through the exchange of materials and energy that would otherwise be wasted (Tudor, Adam & Bates, 2007). In connection with such exchanges, companies need to share information and collaborate with each other, potentially in the form of shared services (Bellantuono, Carbonara & Pontrandolfo, 2017). Sharing of services in eco-industrial parks is essential for the efficiency, pricing, and availability of such services, but may also be challenging due to the firms' different expectations, strategies, and processes.

Firms may access and use external services in different ways. Manufacturing firms may, for example, involve their own service supplier networks to access the competences and support they need (Freije, de la Calle & Ugarte, 2022; Gebauer, Paiola & Saccani, 2013). They may also collaborate with other firms, for arranging efficient service delivery in a specific area (Gebauer et al., 2013). Co-located companies in eco-industrial parks may share a variety of services ranging from basic utilities, logistics, and maintenance to energy management and regulatory consulting (Bellantuono et al., 2017). Shared services have been studied in different contexts such as logistic parks and maritime supply chains (Rivera, Sheffi, & Knoppen, 2016; Schiefer, Mahr, van Fenema & Mennens, 2024). Despite the expectations of superior services, interfirm collaboration does not always result in beneficial relations and outcomes (Heirati, O'Cass, Schoefer & Siahtiri, 2016). Weak commitment and explicit self-interest may prevent value capture for customers, which may reduce firms' interest for the collaboration (Heirati et al., 2016).

The aim of this study is to identify firms' ways to capture value through the use of shared services in an eco-industrial park. The investigation is guided by the following research question:

> *RQ: What expectations do firms have toward shared services in an eco-industrial park, and how do they capture value from such services?*

This case study focuses on a firm level view on collaboration in an eco-industrial park's business network. Both manufacturing and service firms are considered. Several of the companies operate in multiple sites but only the activities within the focal eco-industrial park are covered.

Methods

A single case study was conducted in an established, diverse, medium-sized eco-industrial park with an ongoing initiative to develop shared services. The focus is on selected manufacturing and service organizations operating and cooperating in the eco-industrial park, whereas the park as such represents their operating context. Primary data were collected through thematic interviews concentrating on the firms' current activities related to collaboration and services in the park's business network, a focal example of ongoing collaboration, and new possible service opportunities. An abductive approach is used for analyzing the primary data. Observation during a full-day site visit in the eco-industrial park, some secondary data concerning the organizations, and public documents concerning the eco-industrial park were used both as background information and to validate the findings.

Findings and discussion

Our analysis reveals different potential modes of service sharing: centralization of services, organizing or procuring services jointly, and exchanging information on preferred services. The organizations in the eco-industrial park share a common interest to organize services together. Motivators for collaboration include cost and resource saving by improving efficiency and having greater negotiation power with service providers. By characterizing the

modes of sharing and firms' preferences concerning them, we add nuanced understanding on service sharing specifically in business-to-business networks (Melander & Arvidsson, 2021).

The findings offer evidence on alternative mechanisms for firms to capture value from shared services and promote future value creation. Interviewees described some experiences with successful shared services both directly related to their supply chain (e.g., transportation services) and indirectly in developing their business (e.g., education), and we will characterize and discuss both the operational and strategic value capture mechanisms. One of the collaborations resembled the sharing of logistic services reported by Qiu and Huang (2013). Attempts to promote future value creation were in progress in the form of many development projects with the aim to develop new shared services. Commitment to collaboration across the firms involved in the eco-industrial park was seen as vital, supporting previous research (Heirati et al., 2016). The park's strategic interest in advancing circular economy was reflected on emphasizing circularity in many of the current and planned new services, placing emphasis on both current and future ecological value capture.

With regards to the alternative modes of service sharing, our findings revealed evidence of potential barriers to service sharing especially through centralization. Interviewees expressed some challenges in centralizing some of the support services. For example, larger corporations with multiple manufacturing sites have strong companywide policies and processes that do not necessarily adapt to the ways of operating in a certain local industrial park. Regulations and the nature of some processes also made centralized organizing of shared services difficult. Interest in shared digital tools and services was expressed by the interviewees, but implementing such tools was identified especially challenging due to security concerns. These findings offer input to understanding the

unique requirements of networked, systemic service settings (Edvardsson & Tronvoll, 2013; Helkkula et al., 2018).

This study contributes by offering a tentative framework of value capture mechanisms among alternative modes of shared services, as observed in the case of an eco-industrial park. Collaboration in an eco-industrial park's shared services is shown to offer value for firms not just in economic terms, but environmentally and socially as well. Some of the services relate to environmental benefits through increased resource efficiency and material tracking, for example, which lends support to previous research (Bellantuono et al., 2017). Generally, the value that firms in the eco-industrial park's business network capture through shared services can also be utilized in creating customer value. We recommend further research to investigate the alternative service sharing modes and related value-capture mechanisms in comparative settings of multiple eco-industrial parks. Another future direction concerns how firms in business networks overcome the challenges of using shared services.

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Organizing cross-sectoral collaboration for developing resource efficient energy services

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Theoretical and empirical background and relevance

This planned research will focus on servitization and cross-sectoral collaboration between construction companies, property owners and energy companies in the development of new innovative energy services. In Sweden the real estate and construction sector accounts for 20 % of the total greenhouse gas emissions, and the buildings for 40 % of the energy use (Fossilfritt Sverige, 2021). To meet sustainability goals, these levels must be drastically reduced. Achieving this requires well-planned energy solutions developed early through collaboration between energy companies, construction firms, and property owners. However, cross-sector collaboration causes challenges, as the actors involved have different perspectives and objectives (Andersen, Geels, Steen & Bugge, 2023; Ohlendorf, Löhr & Markard, 2023). In addition, the service focus in the energy companies, as well as in the construction companies and property owners, is not very well developed. This means that these different actors also need to undergo a servitization, which means to transforming into an increased service focus (Baines & Lightfoot, 2013). But, for infrastructural industries, such as energy, often face low customer interest, making it challenging to structure necessary customer participation in the service production (Kindström, Ottosson & Thollander, 2017). In the energy sector, both customers

and providers lack of knowledge and participation have hindered the development of innovative, customer-adapted energy solutions (Kindström et al., 2017; Gonçalves & Patrício, 2022). Understanding customer participation and collaboration between actors is fundamental for successful service development (Wilson, Zeithaml, Bitner & Gremler, 2016), particularly in the energy service industry, where providers are moving from traditional business models toward a service-based approach (Gonçalves & Patrício, 2022). To achieve service value in the energy context (cf. Gonçalves & Patrício, 2022), involved actors should consider implications for end-consumers when designing service systems, develop innovative solutions and integrating different business models. Service and marketing research have given limited attention to collaboration in traditional service industries, leaving the application of such theories underexplored. However, theories on servitization, co-production and innovation ecosystems (Lusch & Nambisan, 2015; Chesbrough, 2011), emphasize how companies can jointly develop service solutions.

Research objectives, problem and/or hypotheses

Previous research has shown that cross-sectoral collaboration in general (Ohlendorf et al., 2023), and between energy companies and customers in particular, is challenging (cf. Kindström et al., 2017; Poblete & Halldórsson, 2023; Gonçalves & Patrício, 2022). Therefore, this planned research will focus on investigating how the collaboration between construction companies, property owners as customers, and energy companies should be organized and managed for the development of innovative customized energy services.

But also further explore the on-going servitization transformation in these different actors. The collaboration will be investigated, for example, in terms of how to align and balance customization

complexity with customers' willingness to participate in energy services, and how to develop efficient business models within this network of actors to support the spread of energy-efficient services. Hence, this research will investigate the following three research questions:

1) How are different actors involved in the development of innovative energy services?

2) How can the collaboration between the actors be organized to further customer-adapted and energy-efficient services?

3) What challenges are the different actors facing in their servitization transformation?

Research Design

The three research questions have not previously been thoroughly researched and are questions concerning "how", therefore a case study research approach is well suited (Yin, 2009). This planned research will start by an explorative study of selected real estate projects, focusing on mapping and analysing the collaboration between energy providers and decision-making processes. Challenges, both in the servitization transformation and in the collaboration, will be identified by semi-structed interviews with relevant actors; energy companies, construction firms, and property owners. The aim is to develop principles for organizing and managing the collaboration effectively. To contribute to answer the three research questions we will also use, and combine, data collected in a previous research project in which we interviewed energy companies and analysed the web pages of 150 energy companies. These interviews offered insights into the adaptation of energy services, highlighting challenges in collaboration with customers and other actors.

Discussion And (Expected) Contribution

This planned research will explore how collaboration between construction companies, property owners, and energy companies should be organized for developing new advanced, innovative, and customer-adapted energy services. But, also further investigate the on-going servitization transformation in these different actors. This includes the provision of various energy services through new flexible and customer-adapted business models. These business models can be adapted to different types of real estate projects, helping to develop more sustainable energy solutions that meet both customer and societal needs. The research will contribute both theoretical and practical by generating new knowledge and develop practical recommendations on how collaboration between construction companies, property owners, and energy companies should be organized for developing innovative customer-adapted energy services. Findings and implications are aimed at how actors effectively can develop customized and energy-efficient energy services. By developing basic principles for cross-sector collaborative development of energy services the project will help strengthen the competitive advantage for all involved parties, and contribute to a more integrated, flexible, and robust energy system.

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Entry modes for managing servitization transitions: a study of exporting companies

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Abstract

With globalization reshaping international business dynamics, manufacturers are transitioning from product-centric models to servitization, integrating value-added services like maintenance and customization. This strategic shift enhances competitiveness and profitability, especially in export-intensive markets. While existing literature has explored servitization and internationalization separately, limited research addresses how servitized SMEs, particularly exporters, adapt their entry modes to accommodate service delivery. Unlike physical products, services—especially soft services—require high localization and customer proximity, making traditional export strategies insufficient. For SMEs with resource constraints, this presents a major challenge in managing international service provision. This study fills this gap by investigating how exporting manufacturers adjust their internationalization models amid servitization. Using a qualitative multiple-case study approach, the research analyses interview data from three Chinese SMEs undergoing servitization. Findings reveal that as services are bundled with products, firms often shift from export-based models to modes with higher local involvement, such as licensing or partnerships, to meet service delivery demands. The study contributes to the servitization and international business literature by highlighting the need for differentiated entry strategies when services are involved and offers practical insights for SMEs managing international expansion under servitization pressures.

Keywords: Servitization, Entry modes.

Introduction

In today's highly competitive global market, manufacturers operating internationally face intensified pressure and greater challenges. Manufacturers are now expected not only to deliver standardized products but also to offer value-added services such as installation, maintenance, and customized solutions in order to meet evolving customer demands (Bıçakcıoğlu-Peynirci & Morgan, 2023). This shift from a traditional product-centric model to a service-oriented business model is known as servitization (Baines, Ziaee Bigdeli, Bustinza, Shi, Baldwin & Ridgway, 2017). Studies highlight that the integration of services with products can significantly enhance a manufacturer's profitability, competitive edge, and sales performance (Oliva & Kallenberg, 2003; Gebauer, Fleisch & Friedli, 2005; Gebauer & Fleisch, 2007). For example, in Belgium, firms that exports both goods and services account for only 8 % of all exporters, yet they contribute to approximately 30 % of the total export volume (Ariu, 2016). This suggests that bundling products with services can deliver greater value compared to selling standalone physical products (Brax & Jonsson, 2009). Meanwhile, prior research has proven a positive correlation between product-service bundling strategies and export intensity (Aquilante & Vendrell-Herrero, 2021), indicating that servitization is closely linked to internationalization.

An increasing number of enterprises have turned their attention to overseas markets in search of new opportunities and to achieve their strategic objectives. Previous research has shown that operating in foreign markets can enhance a firm's internal management skills and capabilities, while through strategic resource allocation can drive growth and profitability in international competition (Carlos Pinho, 2007). For firms seeking to expand internationally, selecting the appropriate market entry mode and formulating suitable strategies are critical steps in the internationalization process. Entry mode

decisions represent a core aspect of resource allocation and market commitment in a firm's international strategy (Brouthers & Hennart, 2007; Canabal & White, 2008). The choice of entry mode determines the extent of resource investment, the level of risk exposure, and the degree of control the firm exercises over its operations in the host country (Laufs & Schwens, 2014). As Ragland, Widmier and Brouthers (2015) highlight, the performance of firms in international markets is significantly influenced by the strategic alignment of entry modes. This underscores the necessity for managers to systematically evaluate the institutional environment, resource endowments, and firm-specific advantages in the host country to make optimal entry decisions (Reim, Yli-Viitala, Arrasvuori & Parida, 2020). Conversely, an inappropriate choice of entry mode can negatively impact a firm's performance and internationalization outcomes (Nakos & Brouthers, 2002). Therefore, the core objective of this paper is to evaluate the optimal entry modes for manufacturers engaging in internationalization within the context of servitization.

Methodology

This study adopts a qualitative multi-case research design with the aim of evaluating the international market entry modes employed by exporting manufacturers undergoing servitization transitions. The multi-case study approach serves as a constructivist narrative methodology. For this study, analyzing and comparing multiple cases provides comprehensive and complementary insights into the international servitization process. This study investigates three Chinese business-to-business (B2B) manufacturing exporters. Rather than seeking breadth in the number of cases, the study prioritizes depth of insight and richness of data derived from a limited yet well-selected sample. The three selected firms operate in

the elevator, fitness equipment, and industrial cooling equipment sectors.

This study's data collection primarily focused on conducting interviews with decision-makers from three case companies. The main objective was to explore whether, why, and how the studied manufacturers modified their original export models when incorporating value-added services in overseas markets, with particular attention to their choice of entry modes in the context of service internationalization. Interview discussions centered around themes such as internationalization, value-added services, service localization, localization strategies, and entry mode selection. Accordingly, the unit of analysis in this research is at the organizational level. The interviewees were primarily drawn from the companies' decision-making ranks, including regional managers, customer solutions managers, and company founders.

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Parallel Session 11

Data, Applications & Platforms

Co-Chairs: Oscar Bustinza & Clara Filosa

Unfolding the Dynamics of Pay-per-Use Services: A Longitudinal Study from the Aviation Industry

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Abstract

This longitudinal study examines the evolution of pay-per-use (PPU) services through a 17-year case study of a leading European aerospace manufacturer's Flight Hour Services (FHS). Addressing key empirical and theoretical gaps, the research traces how FHS scaled across product categories and geographies, integrating digital technologies and ecosystem partners. Through four strategic phases —piloting, early expansion, organic growth, and global digital integration—the company grew FHS from a test service to a multi-billion-dollar offering. The study contributes to servitization literature by uncovering dynamic growth mechanisms and offering actionable insights for firms aiming to implement and scale PPU models in complex industrial settings.

Keywords: Pay-per-use services, outcome-based services, digital servitization, ecosystem, aviation industry.

Introduction

Pay-per-use (PPU) service models—such as "power-by-the-hour" or "pay-per-copy"—have long been considered compelling approaches for enabling servitization, securing recurring revenue, and aligning

value creation with value capture. While isolated successes in this domain have been well publicized, the broader diffusion and systematic implementation of PPU models across industries has remained limited and uneven. This study addresses this paradox by offering a detailed, longitudinal analysis of how a leading European aerospace manufacturer (here anonymized as Aviation Inc.) developed and scaled its pay-per-use offering—Flight Hour Services (FHS)—between 2007 and 2024.

Our research is driven by two major gaps in the literature. The first is an empirical gap: despite the long-term nature of PPU services, prior research has largely relied on cross-sectional studies or single-point-in-time analyses, thereby missing the unfolding, processual dynamics that characterize their evolution. The second is a theoretical gap: PPU has either been treated narrowly as a discrete service innovation or broadly as a business model shift, without adequately exploring its interdependencies with product architecture, customer heterogeneity, digital enablement, and ecosystem evolution.

Empirical Context and Research Method

To address these gaps, we conducted a 17-year longitudinal case study of Aviation Inc.'s Flight Hour Services. Data were collected through 46 semi-structured executive interviews conducted biannually from 2007 to 2024, supplemented with internal workshops, company documents, customer case studies, and secondary materials such as press releases and industry reports. We employed Langley's process methodology, using temporal bracketing to identify and analyze key strategic phases in the development of FHS.

Our study is situated in the commercial aviation industry—a domain characterized by highly complex, safety-critical products, extended

product life cycles, and interdependent value chains involving aircraft manufacturers, airlines, lessors, and Maintenance, Repair and Overhaul (MRO) providers. At the outset, Aviation Inc. held a strong position in the product market (approximately 62 % share) but was significantly underrepresented in the service market (around 5 % share). With the launch of FHS in 2007, the firm sought to rebalance its position by introducing a PPU model designed to offer predictable service costs, enhanced uptime, and performance-based value for its customers. Aviation Inc.'s product portfolio included three main categories: i) high-value, very-low volume products (e.g., flagship long-haul aircraft), ii) medium-value, low-volume products (e.g., new-generation wide-body aircraft), and iii) low-value, high-volume products (e.g., single-aisle short-haul aircraft widely used by low-cost carriers).

Customers included both airlines and leasing firms, each with different levels of in-house maintenance capabilities and outsourcing tendencies. MROs and vertically integrated carriers presented strong competitive pressure in the service ecosystem. In 2017, Aviation Inc. launched a digital platform that enabled real-time data integration with FHS contracts, further advancing service depth and enabling predictive analytics.

Four Strategic Phases

Over the study period, FHS annual revenues grew to approximately $3 billion by 2024, accounting for about 5 % of Aviation Inc.'s total revenue (excluding hardware). The number of aircraft under FHS contracts grew from just 2 in 2007 to about 1,200 in 2024, representing 10.3 % of the global product fleet. The service scope within these contracts also evolved from basic component coverage to comprehensive, "nose-to-tail" packages, significantly increasing customer value and contract revenue. We identify four partly

overlapping phases in the evolution of FHS, each characterized by distinct strategic intents and growth mechanisms:

Phase 1: Piloting (2007–2012)

This initial phase was framed as a strategic experiment. Aviation Inc. leveraged the launch of a new high-value, very-low volume product to test FHS. Using an A/B testing setup, one customer received FHS, while another with a similar fleet operated without it. This provided insights into cost structures, reliability, and customer satisfaction. Two core growth mechanisms emerged: i) replication - the initial customer expanded FHS across its fleet of high-value aircraft, and ii) transfer - the FHS model was adapted to medium-value, low-volume products, demonstrating portability across product types. This phase laid the foundation for standardized processes and internal learning.

Phase 2: Early Expansion (2010–2015)

The second phase focused on expanding into fast-growing Asian markets, where competition in aftermarket services was less entrenched. Targeted airlines across countries such as South Korea, Vietnam, China, and Japan were brought into the fold. These markets had a growing need for long-range, high-capacity flights, aligning with Aviation Inc.'s high- and medium-value products. However, the replication logic that succeeded in this regional context proved less applicable in other environments, signaling the need for a more diversified strategy in subsequent phases.

Phase 3: Organic Growth (2013–2021)

During this period, the company's strategic focus shifted from customer acquisition to service scope expansion and deeper integration into customers' operations. Two interrelated trajectories were pursued: i) entering the low-value, high-volume product segment, especially around a product renewal that made these aircraft attractive for FHS and ii) extending service coverage from component-level support to full, integrated maintenance and availability solutions, thereby increasing average annual contract revenue substantially.A regional service ecosystem emerged, especially in Asia, involving third-party MROs, suppliers, and data partners—enhancing flexibility and responsiveness. Growth became increasingly self-reinforcing.

Phase 4: Global Growth and Digital Integration (2019–2024)

In the final phase, Aviation Inc. expanded its FHS offering globally, targeting: i) new, rapidly growing airlines with limited internal maintenance capacity, ii) mid-sized carriers expanding their fleets of low-value, high-volume products, and iii) large global airlines with a full range of aircraft categories and complex service needs. Crucially, this phase saw the blending of FHS with digital technologies, especially via a central data platform capable of real-time monitoring, predictive maintenance, and performance optimization. The result was a dual benefit: increased operational efficiency and competitive differentiation that traditional MROs struggled to imitate. Growth became balanced—driven both by customer acquisition and improved service delivery with existing customers.

Contributions

This study contributes to both theory and practice. Empirically, it offers one of the first in-depth, longitudinal process studies of PPU service evolution in a complex industrial setting, highlighting how such models are developed, tested, expanded, and digitized over time. Theoretically, it enriches understanding of how PPU models interact with product categories, customer heterogeneity, and digital enablers through multiple growth mechanisms—replication, transfer, scope expansion, and digital augmentation. Managerially, it provides actionable insights for firms aiming to pursue servitization via PPU models. Key takeaways include the importance of strategic sequencing, market selection, digital integration, and the orchestration of ecosystem partners.

Pay-per-use services are more than contractual innovations—they are complex, evolving systems that require organizational learning, ecosystem management, and technological foresight. This study demonstrates how PPU can become a scalable, competitive advantage when pursued with strategic persistence and adaptive growth mechanisms. It provides a rare empirical window into the dynamic realities of long-term servitization in a high-tech, capital-intensive industry.

Developing data-enabled services in a service network

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Abstract

Digitalization enables firms to develop and offer data-enabled services and, thereby, reach new customers and serve customers in new ways. Firms operating in the business-to-business (B2B) market need data-related capabilities and service expertise to develop these services, but they do not necessarily possess such capabilities. Instead, they may collaborate with other firms, information technology suppliers, and customers in a service network. While previous research covers data-enabled services at the firm level, more knowledge is needed to supplement understanding at the service network level and to consider data as a central point for developing service capabilities. This paper investigates how different firms develop their data-enabled services within a service network. We conducted a single case study focusing on a B2B service network in the hospitality industry pursuing digitalization jointly. The findings show several challenges that hinder firms from developing their data-enabled services and motivate them to seek capability combinations at the network level. In response to these challenges, firms engage in co-creation activities that enable them to exchange capabilities related to both data and customer understanding. These exchanges support the gradual development of their own capabilities for data-enabled services in the long term. The findings extend digital servitization research by introducing data-related co-creation to advance network-level knowledge and capabilities. Empirical insights are offered on value co-creation, highlighting the central role of data at the network level.

Keywords: Digitalization, data-enabled services, business-to-business, service network.

Introduction and Background

Data-enabled services integrate digitalization-related resources like connectivity, sensors, actuators, interfaces, computing technologies, localization, and identification (Herterich, Dremel, Wulf & vom Brocke, 2023) with customer-centric business logic (Zhou, Wu, Lee, Li, Sun & Peng, 2023). Delivering data-enabled services requires companies to develop strategic and operational capabilities and understand customers well (Momeni, Raddats & Martinsuo, 2023; Sklyar, Kowalkowski, Tronvoll & Sörhammar, 2019). Many firms, especially manufacturers, lack sufficient data-related capabilities and service-centric expertise. Therefore, they need to collaborate with business partners such as information technology suppliers and customers to develop their data-enabled services (Momeni, Martinsuo & Härkälä, 2025; Weigel & Hadwich, 2018; Zhou et al., 2023). Service networks provide an ideal environment where manufacturers, software suppliers, integrated solution suppliers, and end customers can collaboratively develop data-enabled services (Kohtamäki & Rajala, 2016; Li & Tuunanen, 2022; Zhou et al., 2023). This study concerns business-to-business (B2B) firms' development of new data-enabled services in a service network.

Previous research on digital servitization and service innovation already covers developing services within a service network, but also reveals research gaps. Firstly, most studies on data-enabled services are conducted at the firm level or in dyadic settings, while network-level research remains limited (Gebauer, Paiola & Saccani, 2013; Kohtamäki & Rajala, 2016; Momeni, Vaittinen, Jähi & Martinsuo, 2023; Zhou et al., 2023). Secondly, with emphasis on data-enabled services, there is a need to understand data as a core resource and

explore value-creating activities in the network for data-enabled service offerings specifically (Li & Tuunanen, 2022; Momeni et al., 2025; da Silva & Marques Cardoso, 2024). Thirdly, dominantly the manufacturer's (i.e., service supplier's) viewpoint is taken, but there is a need to complement that with other actors in the network, such as information technology suppliers, customers, and possible third parties (Marcos-Cuevas, Nätti, Palo & Baumann, 2016; Momeni, Vaittinen et al., 2023, Momeni et al., 2025). Furthermore, conducting in-depth case studies is essential to gain a deeper understanding of the specific contexts in which value co-creation occurs (Kohtamäki & Rajala, 2016).

This study investigates different firms' ways to develop their data-enabled services within a service network. The research has two objectives: identifying value co-creation activities on data in a B2B service network and uncovering enabling and hindering factors for developing data-enabled services in the network.

Research questions are:

- *How do firms co-create value with data in a service network?*
- *How do firms develop their data-enabled services in a service network, and what factors enable or hinder this development?*

We focus on firms operating in B2B settings within a service network where participating firms share equal power and influence. Our study interest lies in more balanced, multi-actor collaboration in networks, so we exclude networks centered around a dominating focal firm. Additionally, although "network" and "ecosystem" are related terms (Gölgeci, Ali, Ritala & Arslan, 2022), they reflect different complexities of value creation. This study focuses on the network perspective, which emphasizes direct and planned co-creation of value through clear resource exchanges (Aarikka-Stenroos & Ritala, 2017; Gebauer et al., 2013). In contrast, the ecosystem perspective would involve more complex, indirect

interactions and co-evolution in response to external dynamics (Aarikka-Stenroos & Ritala, 2017; Gebauer et al., 2013), and is therefore excluded from the scope of this research.

Research Design

We conducted a single case study focusing on a B2B service network in the hospitality industry, as it reflects a good example for our research focus: a balanced, multi-actor setting without a dominant firm, where participating firms actively pursue the development of data-enabled services. This network included two hardware suppliers, one software supplier, two integrated solution suppliers, and two customer firms that deliver services. We gathered data from both suppliers (hardware, software, and integrated solution suppliers) and customers (two restaurants). These five firms formed the primary network base involved in developing and implementing data-enabled services.

Primary data were collected through nine workshops and eight interviews among the network participants. Three co-authors attended monthly project meetings and seminars within this network, while the first author also conducted participant observations during meetings. Two co-authors interviewed representatives from each participating company. The interviewees represented various management levels with experiences in developing data-enabled services. Interview themes included participants' views on the most valuable value co-creation activities in the network, why these activities were valuable to them, how these activities supported the development of data-enabled services, and what kinds of data-enabled services were being developed. Secondary data were gathered from reports, internal project meetings, and views of other researchers in the network.

The workshop data were thematically analyzed by two co-authors, who first independently coded the meeting notes of workshops and transcripts of interviews and then discussed to resolve differences and agree on key themes. Both inductive and deductive coding approaches were applied: initial codes were guided by our research questions and relevant literature (e.g., value co-creation, data-enabled services), but we also allowed new codes to emerge from the data. For both the interviews and workshops, we coded the value co-creation activities, data-enabled services, mechanisms to develop data-enabled services, and enabling and hindering factors.

Findings and Discussion

Some firms struggle to develop data-enabled services at the firm level due to weak data-related capabilities and limited ability to engage with customer firms. Hindering factors are underdeveloped data capabilities, insufficient data sources, lack of motivation to explore data-enabled solutions, and limited opportunities for customer collaboration. This responds to the need for knowledge to support the development of data-enabled services beyond the firm level and move toward a network level (Kohtamäki & Rajala, 2016; Zhou et al., 2023). While this study does not focus on a dominating focal firm, combining the findings with studies that emphasize focal firm capabilities (Gebauer et al., 2013) helps extend digital servitization theory with network knowledge.

The findings confirm that data-related capabilities and an understanding of customer needs are critical for developing data-enabled services (Momeni, Raddats et al., 2023; Sklyar et al., 2019). Collaboration within a network allows firms to complement each other. For example, manufacturer suppliers contribute knowledge on how products support services, customer firms share insights into unmet needs, and software suppliers provide data expertise.

Each firm combines its own capabilities with those of others in the network to develop its data-enabled services. These findings further contribute to the view that attention should go beyond manufacturers (Marcos-Cuevas et al., 2016; Momeni, Vaittinen et al., 2023, Momeni, 2025), offering a lens on capabilities.

Moreover, we offer evidence from multiple network partners regarding ways in which firms conduct value co-creation activities with a focus on data value, which supplements previous research (Li & Tuunanen, 2022; Momeni et al., 2025). Examples include open data sharing, cross-firm data analytics, and piloting solutions in real customer environments. These activities help firms exchange capabilities related to both data and customer understanding. Through this exchange, firms gradually build their own capabilities to develop data-enabled services in the longer term.

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Digital servitization on B2B platforms: A cyber-physical perspective

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Abstract

This paper explores generative innovation in industrial business-to-business (B2B) settings through the lens of cyber-physical systems (CPSs). In this context, combinatorial innovation arises through layered modular architectures that integrate heterogeneous physical and digital components, enhancing generative potential. Using a qualitative, multiple-case study of Nordic machinery and manufacturing firms, we address how incumbents integrate physical and digital assets on industrial platforms to foster innovation. We show how physical assets simultaneously facilitate and constrain innovation; while embedded sensors provide valuable data for innovative services and business models, operational constraints such as limited network connectivity restrict real-time data utilization. In this context, we find that manufacturing firms often initially utilize CPSs by capturing diverse data without a necessarily clear monetization strategy. Over time, proactive strategies such as retrofitting of machinery with sensors emerge, enabling new service offerings through advanced data analytics. Overall, our study highlights interdependencies between technical CPS design and business model decisions, where choices about monetization strategies influence digital architecture, and vice versa. Our study contributes to digital servitization, open innovation, and platform

ecosystem literatures by demonstrating how the process of cyber-physical integration drives innovation and expands industrial ecosystems through novel data-driven value propositions.

Keywords: Digital servitization, B2B platforms, cyber-physical systems, innovation, data.

Introduction and Background

The increased access to data, connectivity, and digital technologies is part of the broader trend of digital transformation, which changes both the ways in which companies operate internally and how they engage with their complementary partners to develop and deliver innovative offerings (Dąbrowska, Almpanopoulou, Brem, Chesbrough, Cucino, Di Minin et al., 2022). While the "double transformation" from interfirm exchanges to broader open innovation ecosystems, and from analog to digital innovation is well documented, this transformation is more recent in industrial and B2B settings, and often explained under the literature on digital servitization (Kohtamäki, Parida, Oghazi, Gebauer & Baines, 2019). Indeed, industrial incumbents have invested in data harvesting via digital technologies, IoT sensors, software, to enable AI capabilities into their products, often making complementary or outcome-based data-driven service offerings (Ritala, Keränen, Fishburn & Ruokonen, 2024). This shift has prompted a transition from product-centric to service-enhanced strategies built around digital interfaces, data, and collaborative ecosystems (Cenamor, Sjödin & Parida, 2017).

In such industrial settings, developing platforms and ecosystems around digital servitization strategies can be challenging due to small customer bases and strong and heterogeneous complementors (Springer, Randhawa, Jovanović, Ritala & Piller, 2025). However, it is unclear to what extent these characteristics of industrial settings

constrain but also potentially facilitate digital innovation. Our study addresses this lacuna in the research by examining the question of *how incumbent firms can develop industrial platforms that incorporate physical and digital assets to create new innovative value propositions and offering?* We answer this research question via an empirical multiple-case study in the Nordic machinery and manufacturing industries, covering five case companies and 4-8 interviews per case, including interviews with company representatives and from key complementors and partners.

Findings and contributions

Our study utilizes the lens of Cyber-Physical Systems (CPS) to explain how physical assets simultaneously facilitate and constrain innovation (Geisberger & Broy, 2015; Nardelli, 2022), and how combinatorial and generative innovation (Thomas & Tee, 2022) arises from interactions between physical and digital components in the overall product system. First, we show that while machinery-embedded sensors provide valuable data for innovative services and business models, operational constraints such as limited network connectivity restrict real-time data utilization. In this context, find that industrial incumbents initially design CPSs to capture diverse sets of data as preparation for the future potential of value capture from the acquired data. In the early stages of CPS, firms recognize the strategic value of data as a source for generative innovation but lack vision on how to practically leverage data for value realization. Second, we find that physical machinery is a gateway to data accessibility through which incumbents capitalize by analyzing, refining, and recombining data insights from different data points from across diverse machinery and clients. By enriching raw data (e.g., telemetry data) together with cross-analysis, incumbents can develop innovative services. Often, these new value propositions

expand the system boundaries as novel data-based service bundling is offered to next-tier customers and to entirely new customers outside of the incumbent´s traditional ecosystems and markets. Finally, our study illustrates that there is a strong interconnection between the technical and digital design of CPSs as well as business model design. Specifically, value propositions and monetization strategies impact digital architectural design decisions, and vice versa.

Overall, our results contribute to the digital servitization research stream by introducing an inter-disciplinary cyber-physical design perspective to combinatorial and generative innovation.

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Parallel Session 12

AI, Governance & Strategic Pathways in Servitization

Co-Chairs: Jean Pierre Seclen & Glauco Mendes

A Rising Tide Only Lifts Some Boats: AI Enhances Scalability, But Not All AI Applications Have a Significant Impact

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Abstract

Artificial intelligence (AI) is frequently celebrated as a universal catalyst for exponential growth, yet evidence suggests that its benefits materialise unevenly across organisations. This study interrogates that discrepancy by reconceptualising scalability as a multidimensional capability encompassing revenue expansion, cost containment and market reach, and by positioning AI as a baseline enabler whose contribution is contingent on complementary digital strategies. A theory-driven framework is advanced in which analytics-based communication, automation-driven efficiency and Internet-of-Things coordination act as amplifiers, transforming discrete algorithmic insights into organisation-wide routines and inter-firm synchronisation. The empirical inquiry integrates survey

responses from technology-adopting manufacturers with a structural modelling approach that captures both direct and interactive effects. Results demonstrate that AI adoption alone delivers only incremental performance gains, whereas the orchestrated deployment of analytics, automation and coordination capabilities yields a multiplicative scalability dividend. Among these complements, IoT-enabled coordination emerges as the pivotal mechanism, because it embeds AI output in real-time sensing and distributed decision making, thereby unlocking network externalities that are inaccessible to standalone analytics or automation. The study enriches resource- and capability-based perspectives by clarifying that scalable growth is an emergent property of coherent digital ecosystems rather than isolated technology investments. Practically, it offers managers a sequenced investment roadmap that prioritises coordination infrastructure, streamlines routine processes and finally institutionalises data-driven communication. Policymakers aiming to foster resilient digital economies should likewise promote bundled technology adoption schemes instead of narrow AI incentives. Overall, the research explains why a rising tide of AI lifts only those firms equipped with complementary digital capabilities.

Keywords: Artificial intelligence; business scalability; digital transformation; complementary technologies.

First Section: Theoretical framework and hipotheses

The concept of scalability—an organisation's capacity to accommodate surging demand without performance loss—has moved centre-stage in strategic-management research (Piaskowska, Tippmann & Monaghan, 2021). Digital-transformation studies posit that advanced technologies such as cloud computing, the Internet of Things (IoT) and, decisively, artificial intelligence (AI) lower scale barriers by enabling real-time data processing, agile resource allocation and predictive analytics (Verhoef, Broekhuizen, Bart, Bhattacharya, Qi Dong, Fabian et al., 2021; Lafuente & Sallan,

2024). Empirical evidence demonstrates that AI streamlines complex decision cycles, while IoT sensors and analytics platforms furnish granular operational intelligence, thus aligning strategic intent with execution (Sjödin, Parida, Palmié & Wincent, 2021). Yet, research also cautions that technological gains are contingent upon complementary capabilities and governance structures (Brinckmann, Grichnik & Kapsa, 2010; Moro-Visconti, 2024). High integration costs, legacy-system frictions and data-governance challenges may dampen returns, particularly for resource-constrained SMEs (Favoretto, Mendes, de S., Filho, Gouvea de Oliveira & Ganga, 2022). Consequently, scholars increasingly conceptualise scalability as an emergent property of digital ecosystems rather than a unilateral outcome of any single technology (Pfotenhauer, Laurent, Papageorgiou & Stilgoe, 2022). This perspective foregrounds complementarity—the synergetic interplay among AI, analytics, automation and IoT—as the fulcrum of sustainable scale. Building on this stream, the present study theorises that AI adoption constitutes a baseline enabler that must be bundled with function-specific digital strategies: analytics for enhanced communication, automation for efficiency, and IoT for inter-firm coordination (Haefner, Parida, Gassmann & Wincent, 2023). By integrating these insights, the research positions scalability at the intersection of resource-based and capability-based views, arguing that firms create scale advantages through orchestrated digital investments rather than technology acquisition alone.

From this theoretical scaffold, four testable propositions emerge. Hypothesis 1 (H1) predicts a positive direct effect of AI adoption on scalability, reflecting AI's role in automating workflows and enabling data-driven scaling (McElheran, Li, Brynjolfsson, Kroff, Dinlersoz, Foster et al., 2024). Hypotheses H2 a,b and **c,** posit that this effect is *moderated* by three complementary strategies. First, analytics-based communication technologies should intensify AI's

impact by transforming predictive insights into organisation-wide action (Shahzadi, Jia, Chen & John, 2024). Second, automation capabilities are expected to enhance AI-enabled scaling via costless replication of routine tasks (Bosse, Thompson & Ekman, 2023). Third, coordination technologies—particularly IoT networks—should yield the strongest moderation because they synchronise distributed assets and unlock network externalities (Wasim, Ahmed, Kalsoom, Khan & Rafi-Ul-Shan, 2024). Collectively, the hypotheses articulate a *selective-lift* view: AI raises the ceiling for scalable growth, but only firms with robust complementary stacks capture the full benefit. This study contributes to three debates. First, it extends scalability theory by specifying digital complementarity as a boundary condition, responding to calls to "unpack the black box" of scaling mechanisms (Jansen, Heavey, Mom, Simsek & Zahra, 2023). Second, it refines digital-transformation scholarship by empirically ranking the relative salience of communication, efficiency and coordination capabilities—thereby nuancing prior blanket assertions that "all" digital tools matter equally (Omrani, Rejeb, Maalaoui, Dabic & Kraus, 2024). Third, it enriches the resource-based view with ecosystem logic, demonstrating that competitive advantage stems less from AI per se and more from the orchestrated configuration of mutually reinforcing technologies (Ranjan & Foropon, 2021). The ensuing empirical analysis tests these propositions using a cross-sectional survey, validated measurement model and GSEM estimation, offering rare quantitative evidence on how AI interacts with complementary technologies to drive scalable outcomes.

Second Section: Methodology and results

Sample and data collection

Data were gathered via a web-based questionnaire (June–August 2022) targeting the universe of 1,504 Spanish manufacturing firms (NAICS 31–33) that market service components. Executives holding CEO, COO or CMO roles served as key informants to ensure strategic insight, and follow-up verification was conducted with a 15 % random subsample. A total of 297 usable responses were obtained (19.8 % response rate), yielding a representative sample of medium-sized enterprises (50–249 employees) engaged in servitization and digital innovation. Table 1 present the sample resume.

Characteristic	Category	Count	%
Firm size (employees)	50–99	118	39.7
	100–249	179	60.3
Industry segment	Machinery & equipment	122	41.1
	Food & beverages	68	22.9
	Chemicals & plastics	48	16.2
	Other manufacturing	59	19.9
AI adoption status	Users	153	51.5
	Non-users	144	48.5

Table 1. Sample characteristics.

Measurement and hypotheses testing

AI adoption was operationalised as a binary variable indicating production-level AI integration. Scalability was modelled as a latent

construct with four reflective indicators—sales growth, non-increasing marginal costs, customer-base growth and blue-ocean penetration—measured on 5-point Likert scales. Complementary strategies were captured as summated indices: analytics-driven communication, automation-led efficiency and IoT-based coordination. A Generalised Structural Equation Model (GSEM) with logit link for the binary predictor was estimated in Stata. Confirmatory factor analysis confirmed construct validity (CFI = 0.97, RMSEA = 0.031). Harman's single-factor test (largest factor = 29 %) indicated no substantial common-method bias. Conclusively, the direct path supports H_1, confirming that AI users enjoy significantly greater scalability. Interaction terms validate H_2a–c, with IoT-driven coordination exerting the strongest amplifying effect, followed by automation and analytics respectively. Table 2 summarize the results.

Table 2. GSEM results (standardised)	β	z	p
Direct effect			
AI → Scalability (H_1)	0.81	7.36	< 0.001
Moderation effects			
AI × Communication (H_2a)	0.32	2.24	25
AI × Efficiency (H_2b)	0.39	3.18	1
AI × Coordination (H_2c)	0.75	3.24	1
Model fit	Log pseudo-LL = –1557.83		

Table 2. Preliminary results.

Finally, the study refines the discourse on digital-enabled growth by demonstrating that AI's scalability dividend is contingent upon a triad of complementary technologies that differentially magnify its impact. Theoretically, the findings advance scalability research by integrating complementarity logic into resource-based theory, illustrating that value creation hinges on synergistic, not standalone, capabilities. Empirically, the work provides one of the first large-sample tests of AI–scalability linkages using GSEM, thereby offering a replicable blueprint for future inquiries into complex digital ecosystems. Managerially, the complementarity hierarchy furnishes executives with an actionable roadmap: prioritise IoT coordination infrastructure, embed automation to streamline processes, and invest in analytics to translate AI insights into collective action. Policymakers seeking to nurture SME digital competitiveness should likewise promote bundled technology adoption schemes rather than piecemeal AI initiatives. In sum, the research elucidates why "a rising tide only lifts some boats" and delineates the conditions under which AI becomes a catalyst for truly scalable growth.

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The Pyramid of Value: Governance, Innovation and Service Co-Creation in the Generative AI Ecosystem

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Abstract

Generative AI (GenAI) is rapidly diffusing across industries, yet research has primarily focused on technological capabilities while offering limited insight into how value is co-created within ecosystems. This study explores how actors across the GenAI ecosystem contribute to value co-creation and what interdependencies are formed among these actors. Through an exploratory qualitative inquiry and based on 105 interviews with senior managers, researchers, policymakers, and service providers, the study reveals a multi-layered framework in which each stratum performs a distinct service role. Theoretically, the paper contributes to the conversation on service-dominant logic by demonstrating how resource integration and institutional arrangements are critical for value creation in GenAI. It also contributes to the literature on digital servitization by demonstrating how continuous reconfiguration, through evolving models, APIs, and governance

protocols, defines the innovation process. The findings also extend ecosystem research by highlighting governance and trust as endogenous service layers, rather than external constraints, that sustain adoption and legitimacy. For managers and policymakers, the study underscores that the economic promise of GenAI lies less in technological breakthroughs than in the disciplined orchestration of services across layers. By reframing GenAI from a technological stack to a service ecosystem, this paper advances understanding of how digital technologies become socially and economically valuable. It offers insights for designing sustainable, trustworthy, and innovation-enabling GenAI ecosystems.

Integrating sustainability value in services: Perceptions and practices

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Abstract

Sustainability value concerns the ratio of environmental, social, and economic benefits and sacrifices in business. Firms attempt to integrate sustainability value into their services both in response to regulations and in pursuit of competitive advantage. Achieving successful integration is not easy, as it requires that sustainability is clearly addressed through one or more of its dimensions and that customers are willing to pay for the benefits delivered through services. The subjective nature of value perception by individuals, the resources and risks involved in integration, and the inherent complexities of the three dimensions of sustainability make this integration even more challenging. This study uses a multiple case study approach to explore how company decision-makers perceive sustainability value and how it becomes integrated into services. The findings categorize decision-makers' perceptions at the macro, meso, and micro levels, supported by practical examples. Decisions in the early phase of service delivery support integration, when decision makers convert sustainability goals into concrete, actionable plans. This study contributes new knowledge on promoting sustainability in services. It also offers practical guidance for decision-makers and sustainability experts on sustainability value integration.

Keywords: Value perception, sustainability value, business benefits, environmental sustainability.

Introduction and Background

Value in business-to-business (B2B) settings refers to a compromise between benefits and sacrifices (Ahola, Laitinen, Kujala & Wikström, 2008). It centers around customers, meaning it brings benefits to them as well as to the firms that deliver it (Broccardo & Zicari, 2020; Hurtado Jaramillo, Chiu, Arimany-Serrat, Ferràs & Meijide, 2018). Integrating value into services is not easy. Firstly, value is subjective, and perceptions of it vary among individuals based on their backgrounds, experiences, and job positions (Martinsuo, 2020). Secondly, integrating value requires resource investment, risk management, and dedicated effort (Stanitsas, Kirytopoulos & Leopoulos, 2021), which presents challenges for firms (Al-Saleh & Taleb, 2010). Thirdly, it also requires that customers are willing to pay for the benefits (Banihashemi, Hosseini, Golizadeh & Sankaran, 2017).

Sustainability value is an emerging value domain that encompasses both sustainability issues and value as an outcome (Broccardo & Zicari, 2020; Hurtado Jaramillo et al., 2018). Firms seek to integrate sustainability value into their services, both in response to regulations and in pursuit of competitive advantage (Kohtamäki, Bhandari, Rabetino & Ranta, 2024). However, the inherent complexities of sustainability make this integration difficult. Sustainability consists of three dimensions (Aagaard & Ritzén, 2020), where the economic aspect is easy to be emphasized due to its monetary nature, while the relevance of ecological and social aspects to business is less obvious (Kohtamäki, Parida, Oghazi, Gebauer & Baines, 2019).

Firms that successfully integrate sustainability value into services need to understand both the benefits they deliver to customers (Broccardo & Zicari, 2020; Hurtado Jaramillo et al., 2018) and how economic, environmental, and social aspects are addressed (Aagaard & Ritzén, 2020; Stanitsas et al., 2021). For example, manufacturing

suppliers clarify the environmental aspect of sustainability using indicators related to emissions and energy consumption, based on data collected by sensors (Brundage et al., 2018). They also deliver benefits to their B2B customers, such as lower emissions, reduced energy consumption, reduced material waste, thereby responding to regulations and pursuing competitiveness (Brundage, Bernstein, Hoffenson, Chang, Nishi, Kliks et al., 2018). This example shows the importance of concrete and measurable actions of sustainability (Aagaard & Ritzén, 2020; Broccardo et al., 2023; Kohtamäki et al., 2024) in this integration.

Decision-makers in firms are important for integrating sustainability value into services (Hurtado-Jaramillo et al., 2018). They receive and process both external and internal information and communicate it to employees, customers, investors, and partners (Hurtado-Jaramillo et al., 2018). Their perceptions of sustainability value are directly related to the translation of sustainability value into measurable actions. More knowledge is needed in both decision makers' perception of sustainability value and its translation into measurable actions.

This study explores company decision-makers' perceptions of sustainability value and ways of integrating it into services (measurable actions) during servitization. The research questions are:

- How do decision-makers perceive sustainability value (economic, ecological, and social) in business operations?
- How do firms integrate sustainability value into their services?
- This study focuses on companies that develop and offer services in the business-to-business (B2B) context. Pure product-oriented firms and business-to-consumer (B2C) contexts are excluded. Although the alignment of expected

value among different decision-makers is important, it is not addressed in this study.

Research Design

This research adopts a multiple cases study approach. The focus is on service development in five companies: two manufacturing companies, one software supplier, and two integrated solution suppliers. These companies are exploring ways to integrate sustainability value into their services. Data were collected through semi-structured interviews with key informants, along with extensive secondary data. In the thematic analysis, we coded perceptions of sustainability value and mechanisms for integrating sustainability value. We first conducted a single case analysis for each company and then carried out a comparative analysis.

Findings and Discussion

Findings show that decision-makers' perception of sustainability value is closely linked to external factors and its relevance to their own work. The cases reveal that these perceptions can be categorized into three levels: the macro level, such as regulatory and policy pressure (Broccardo, Truant & Dana, 2023); the meso level, such as parent company influence, customer demands in B2B relationships, departmental objectives, and KPIs; and the micro level, such as personal beliefs (Martinsuo, 2020). Decision-makers' perceptions help define the value more clearly and make it better understood communicated to other staff and customers (Hurtado-Jaramillo et al., 2018), which supports its successful integration into services.

The research evidence suggests that decision-makers' actions in the early phase of service delivery support the integration of

sustainability into services later. For example, decision-makers identify customer requirements and translate them into economic, environmental, and social objectives (Al-Saleh et al., 2010; Banihashemi et al., 2017). These concrete actions (Stanitsas et al., 2021) in the early phase support a successful integration. The findings also lend support to previous research on barriers (Al-Saleh & Taleb, 2010) to this integration, such as limited awareness, lack of a trained workforce, limited knowledge and/or misinformed views, and a lack of a risk-taking culture.

Cases show differences in integration when considering (1) whether there is influence from a parent firm, (2) how diverse the market is where the firm operates, and (3) whether the firm's business logic is goods-dominant or service-dominant. For example, firms with a service-dominant business logic invest in sensors and integrate sustainability value into data-driven services such as analytics, dashboards, and reports. In contrast, firms with a goods-dominant business logic integrate sustainability value into services related to maintenance, repair, upgrades, or usage optimization over the lifecycle of physical products.

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This Book of Abstracts summarizes the proceedings of the **12th International Conference on Business Servitization (ICBS 2025)**, hosted by Deusto Business School in Bilbao, Spain. This edition placed a strong emphasis on the theme Digital servitization as a key enabler of organizational scalability, exploring how advanced digital technologies combined with innovative service offerings can support scalable growth. Although the promise of digital servitization is widely recognized, examples of high-growth firms fully leveraging it remain limited, making this discussion both timely and essential.

The volume brings together 52 contributions across 12 parallel sessions, covering not only scalability but also business model innovation, digital transformation, service ecosystems, and the role of emerging technologies. The conference features speakers from Europe, China, and Latin America, highlighting its global scope.

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