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Characteristics of industrial service ecosystem practices for industrial renewal

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Abstract: The emergence of service ecosystems can accelerate the industrial renewal required because of urgent global challenges. However, existing research has not sufficiently grasped the social dynamics of coevolution in ecosystems that enhance industrial renewal. This study aimed to advance ecosystem research through a practice lens and to present the key characteristics of industrial service ecosystem practice involved in industrial renewal. Consequently, its three characteristics – *accomplishment*, *attractiveness* and *actionability* – were configured based on an abductive study derived from the ecosystem literature, three practice-oriented approaches to learning, and two case ecosystem examinations. These features created the logic for resource integration and enhanced ecosystems to evolve as units, thus exceeding the actors' independent avenues of renewal. The findings of this study provided a deeper understanding of the coevolution in ecosystems needed to accelerate industrial renewal as well as a novel conceptualisation of an *ecosystem-as-practice* for further studies.

Keywords: service ecosystem; industrial renewal; social dynamics; coevolution; ecosystem-as-practice; forest industry; construction industry; case study; sustainability; learning.

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1 Introduction

Ecosystems in business are suggested as a means to address complex global challenges through diverse networks of actors at various levels. By integrating resources, such as technology, data and skills, and interacting, ecosystem actors build new value-adding combinations that create and shape markets and lead to industrial renewal (Valkokari, 2015). However, the systemic elaboration of value co-creation has indicated that once established and if the environment is stable, ecosystems can be relatively averse to change (Meynhardt et al., 2016). Furthermore, ecosystems are not free from ambiguity and opportunism driven by self-interested motives, which have been recognised as *the dark side of agency* (Mele et al., 2018); unpredictability and conflicts are also part of social interaction in business (Becker et al., 2015). What collaborative dynamic is behind ecosystems' power to enhance industrial renewal?

In this study, we adopted the service ecosystem concept, which is described as follows: "a relatively self-contained, self-adjusting system of resource-integrating actors connected by shared institutional arrangements and mutual value creation through service exchange" [Vargo and Lusch, (2016), pp.10–11]. Phillips and Ritala (2019) found that conceptual considerations explain how we think about an ecosystem. Recently, Hou and Shi (2021) highlighted the advantages of bridging the two perspectives within ecosystem theory. This process involves connecting the structure view (Adner, 2016; Jacobides et al., 2018) with the coevolution view (Dattee et al., 2018) in a constructive context, forming the foundation for our study.

Industry-specific institutional arrangements, practices, meanings and cultural norms guide and limit industrial actors' pursuit of improvements (Koskela-Huotari et al., 2016; Siltaloppi et al., 2016). Practices arising from evolving ecosystem collaboration, marked

by clashes of traditions and institutional pluralism (Kraatz and Block, 2008), can challenge and accelerate innovations, fostering industry renewal. However, these differences can pose collaboration challenges as the basic assumptions of development can differ in industry sectors, requiring cross-industry learning.

Recent service ecosystem research has explored nested, overlapping ecosystems and institutions. A number of studies have been conducted on industrial service ecosystem dynamics (e.g., Aarikka-Stenroos and Ritala, 2017; Hannah and Eisenhardt, 2018; Polese et al., 2021; Perks et al., 2017; Shipilov and Gawer, 2020). However, the social dynamics within an ecosystem are still largely unexplored, especially in studies that delve deeper into these dynamics with adequate frameworks. The persistent query is whether an ecosystem, initially comprised of independent entities, can transform into a cohesive unit capable of actively engaging in knowledgeable collective action – a practice (cf. Gherardi, 2009).

This study followed the growing interest in examining actors' collaboration beyond traditional organisational boundaries. However, instead of zooming out, we opted for an in-depth examination of the collaborative dynamics within service ecosystems. We used a practice lens as a theoretical and methodical tool to connect structures and coevolution in ecosystem research. Theories of practice view activity as something that is *taking place* or *happening*; this constitutes a practice that holds together a community's people, artefacts and social relations [Gherardi, (2009), p.115]. Thus, we also responded to the recent suggestion of incorporating new theories and perspectives that provide insights into service ecosystems and their evolution (Gölgeci et al., 2021) and following the notion of a human perspective focus as the most significant characteristic of research in the service field (Gustafsson and Kristensson, 2020).

This study enhances the understanding of industrial service ecosystems by addressing the following research question:

- What are the main characteristics of an ecosystem practice for resource integration in industrial renewal?

Our approach involved an abductive study that presented conceptual and illustrative-empirical findings from two carefully selected case ecosystems. These ecosystems feature multiple actors pursuing new business opportunities through digitalisation and sustainability, resulting in the emergence of novel practices for co-creating value.

The remainder of this paper is organised as follows. A literature review establishes the conceptual foundation, followed by a description of the research process in a broader methodological context. Next, the empirical findings are provided, together with the conceptual framework. The concluding section presents the discussion, implications for scholars and managers, and reflections on the study's limitations.

2 Theoretical background – building the preliminary framework

In the following section, we present the selected theoretical perspectives to explain the collaborative dynamics of a service ecosystem. First, we review the ecosystem literature to better understand how perspectives on ecosystem structure and coevolution can be bridged. Second, we adopt a practice lens and dig deeper using the three learning

approaches presented by Kallio et al. (2017): *knowing in practice*, *knowing in between practices* and *expansive learning*.

2.1 Literature on industrial service ecosystems

Various ecosystem concepts have proliferated since Moore (1993) introduced the notion of business ecosystems. The ecosystem literature is diverse, and its concepts are often used loosely and without clear theoretical roots (Gölgeci et al., 2021).

Services are considered a foundational approach to applying knowledge 'for the benefit of another' [Vargo and Lusch, (2004), p.2]. In service ecosystems, intangible resource exchange happens through interaction (Barile and Polese, 2010), and various organisations and individuals work together with common or complementary objectives based on a non-hierarchical form of collaboration (Wiesner et al., 2013). Service ecosystems can be very complex, with different layers, value linkages and development stages (Gummesson et al., 2018; Deng et al., 2015). Shared meanings generated by critical actors are the key to successful ecosystem operations (Ketonen-Oksi and Valkokari, 2019). Guiding the evolution of actor engagement over time requires accepted rules of exchange and participation (Blasco-Arcas et al., 2020). These practices connect the *ecosystem structure* with *coevolution*, as suggested by Hou and Shi (2021).

The *ecosystem-as-a-structure* approach views ecosystems as configurations of activity defined by a value proposition. Accordingly, activities, actors, positions, and transfer links between actors provide four essential elements for a value proposition to materialise (Adner, 2016). This description is consistent with the *production system* approach to ecosystems (Gölgeci et al., 2021). Similarly, the service-dominant view highlights the role of institutions and institutional arrangements that guide resource integration (Koskela-Huotari et al., 2016).

Several ecosystem approaches encourage companies to broaden their views of industrial borders and practices related to industry-specific partnerships (Aarikka-Stenroos and Ritala, 2017; Adner, 2016; Valkokari, 2015; Phillips and Ritala, 2019). Similarly, Adner (2016) noted that *ecosystem-as-affiliation* approaches emphasise macro-level perspectives.

Coevolution is a vital feature of a service ecosystem (Aarikka-Stenroos and Ritala, 2017), but it has also been applied in organisational and network research (Zhang et al., 2020). Co-evolutionary logic defines "the interactions and processes between the actors, technologies and institutions of an ecosystem" and "examines the system-based features of constant dynamism and evolution, as well as the inherent interdependence of the actors involved" [Aarikka-Stenroos and Ritala, (2017), p.67]. Institutions and institutional arrangements provide social structures that connect people and technology (Vargo and Akaka, 2012) with interactions that lead to value creation and innovation (Vargo et al., 2016). Institutional thinking covers an ecosystem's rules, norms, values and beliefs. Thus, through the continuous interaction of components (i.e., ecosystem actors and resources), the ecosystem forms new properties: new resources, values, institutional arrangements and practices (Polese et al., 2021). In addition to internal dynamics, the external environment may disturb the interactions within the ecosystem from a state of stability, leading to de-institutionalisation and re-institutionalisation (ibid.). Even though the old mode may not yet have reached its bifurcation point (the order being critically challenged, for example, by a massive loss of trust or a frame-breaking experience; see

Meynhardt et al., 2016), interventions can be made by introducing a better way, thus creating a purpose for resource integration.

Diverse institutional elements guide and constrain individuals and organisations, ultimately contributing to the emergence of novelty (Koskela-Huotari et al., 2016; Siltaloppi et al., 2016). Crossing industrial boundaries enables institutional pluralism, placing actors at the intersection of two or more institutional spheres (Kraatz and Block, 2008). In this context, actors are influenced and guided by varying normative orders, different cultural logics and multiple institutionally defined identities (Kraatz and Block, 2008). This pluralism brings renewal power and challenges daily cooperation, necessitating collaborative learning. In summary, the ecosystem concept is often used metaphorically – studies refer to a complex and broad system of multiple actors or may use it as an analogy to describe the increased connectivity of business environments, relationships and networks. Following our aim to surpass macro-level views and bridge ecosystems-as-structures and coevolution perspectives (Adner, 2016; Ketonen-Oksi and Valkokari, 2019; Hou and Shi, 2021) using a practice lens, we then turn to elucidating the social dynamics of ecosystem development.

2.2 Practice research and the ecosystem as a practice for renewal

Practice research is far from a united approach in organisational studies, and a canonical theory of practice does not exist (Kuhn, 2021). Within the practice lens adopted for this study, the logic of practice is considered necessary for creating order and continuity in an organisation [Gherardi, (2000), p.216]; the activities themselves generate a community [Gherardi, (2009), p.121]; and knowledge is an activity – a knowing (Corradi et al., 2010).

We then used the theoretical lens of practice to further examine how ecosystems can determine ways to initiate and hold the development of an ecosystem practice for industrial renewal. To study an evolving ecosystem as a practice, we utilised three practice-based approaches to learning as a "collaborative learning process[es] of creating something new in a better way" [Kallio et al., (2017), p.83]:

1 *knowing in practice* focuses on the practices of organisational members and their knowledge creation

2 *knowing in between practices* highlights the interconnected nature of practices

3 *expansive learning* in a collective interaction highlights the need to organise activities as activity systems.

2.2.1 Knowing in practice – finding an area of mastery through integrating resources

Co-creating value by integrating the resources of different ecosystem actors is the main activity to pursue in a new service ecosystem. Progress can be sought by focusing on a tentative value proposition that holds the promise. The rules of resource integration should also be defined. How can a practice that builds on shared meanings, accepted rules, and efficient ways of working for shared or complementary objectives be achieved? To clarify this process, we applied the ideas of the classical theory of learning

in communities of practice by Lave and Wenger (1991) and Wenger (1998, 1999) to analyse knowing in practice (Kallio et al., 2017).

The theory emphasises the influential role of a social community in shaping and sustaining practices that integrate knowledge and diverse skills to achieve *mastery* in a specific context. This community of practice facilitates interconnected learning and identity formation for its members. Therefore, the evolution of identity, skills, and knowledge constitutes an integral process (Lave and Wenger, 1991). This perspective is particularly pertinent when considering ecosystem development, which aims to create a distinctive *area of mastery* that generates new, extended, or enhanced value with genuine business potential. However, relying solely on the founding members' community may not be sufficient for realising identified business opportunities, scaling up the ecosystem or adapting to changes in the business environment. Additional resources become crucial. We delve further into this perspective with the next concept: *knowing in between practices*.

2.2.2 Knowing in-between practices – engagement through tying practices together over industry boundaries

Crossing industrial borders offers fertile ground for new value creation and renewal. However, navigating this process requires learning to collaborate amid institutional pluralism in which different games with varying or concealed rules are played. The knowing-in-between-practices approach underscores the role of learning within and across communities, emphasising the *nexus of practices* to provide links between practices (Gherardi and Nicolini, 2002). In our ecosystem context, this approach suggests that an ecosystem practice emerges from a network of relations within interconnected communities of practice. Gherardi and Nicolini (2002, p.423) highlighted the importance of showcasing a community's strengths through material and discursive means. Simply understanding what a community is good at is insufficient; new participants bring knowledge that, when transferred and expanded through relationships (c.f. Kallio et al., 2017), enhances the ecosystem's ability to solve challenges and provide value. For an ecosystem to thrive, it must continuously open itself to new participants, fostering strength and renewal. However, this openness challenges organising activities to realise and scale up business opportunities in a dynamic ecosystem.

2.2.3 Expansive learning – finding productive collaborative action in continuous evolution

Ecosystems, shaped by the continuous coevolution of actors, require a mechanism to organise actions towards ambitious objectives for industrial renewal dynamically. Exploring this, we turn to the expansive learning approach (Engeström, 1987; Engeström et al., 1999), which focuses on developing human capacities and fostering collective skills and practices (Kallio et al., 2017). Engeström viewed the activity system as the primary unit of analysis, underscoring the role of objects in shaping work organisation (Blacker, 2009). To achieve the objective by operating with the object, tools, division of labour, and community rules are needed to form the activity system (Engeström, 1987). In changing collaborative activity for new business potential, the object may be vague, presenting organisational challenges for the ecosystem. Engeström's concept of *runaway objects* (e.g., environmental threats) suggests the need for intermediate objects, like a

social movement in organic farming, to drive productive actions for solving ambitious challenges. For these objects to be effective, they should have intrinsic properties beyond profit, produce useful but incomplete intermediate products, be visible, cumulable and accessible, and facilitate effective feedback and exchange among participants [Engeström, (2009), p.306]. The new ecosystem must maintain its ambitious mission while organising productive activities across diverse communities of practice or activity systems.

2.3 Propositions for empirical analysis

Based on this rich background, we posited propositions to guide our study on the main characteristics of an ecosystem practice of resource integration for industrial renewal.

They were set to be used in the empirical analysis as follows:

1 The structural characteristics of a service ecosystem start forming from the beginning of the collaboration; even though they are not static, they are essential framing elements for the further development of an ecosystem.

2 To enable coevolution on a trajectory towards industrial renewal, an ecosystem initiative should be able to perform activities that do the following:
   - a Support finding a unique area of mastery (as a unit) and being good at something distinguishable in terms of new, extended, or better value, thus formulating a knowing and learning community to identify with and belong to.
   - b Enhance engagement by creating material and discursive means for all (also potential) participants to transfer and widen their knowledge, thus catalysing the area of mastery to develop in a continuous process to become something more.
   - c Transform a general mission into an attractive object that triggers productive collaborative activities in institutional pluralism.

Before tackling the empirical results, we briefly describe the research methodology and empirical cases in the next section.

3 Research methodology

3.1 Research strategy and process

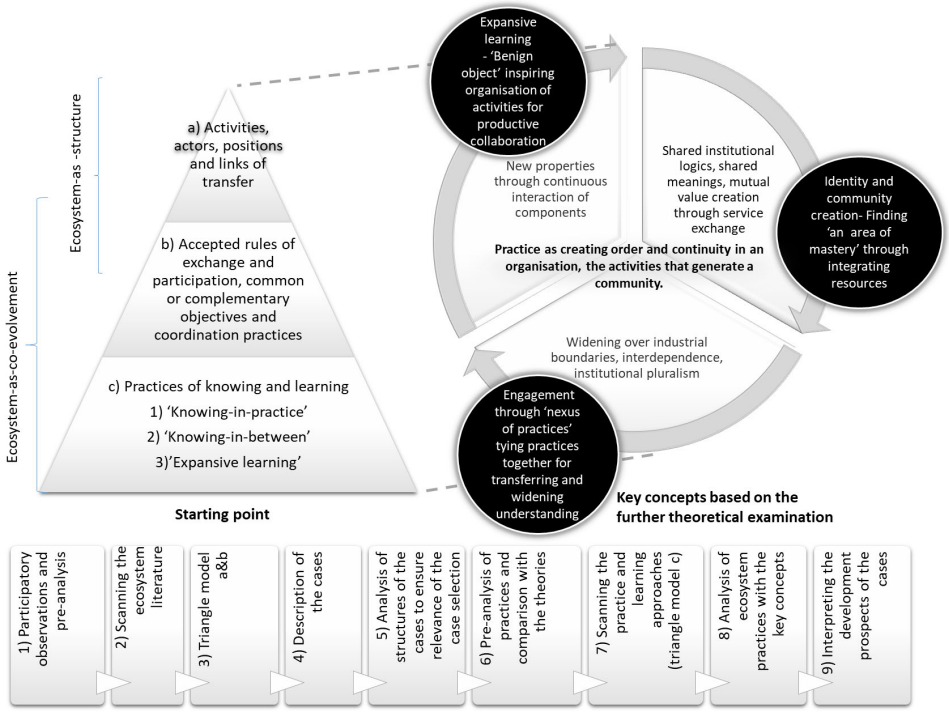
We focused on complex social issues to determine what is happening in ecosystem collaboration. To assess this phenomenon ‘in a new light’ [Robson, (2002), p.59], an explorative study with an abductive approach fits our purposes (Makri and Neely, 2021). Following the abductive approach, the theoretical framework, the empirical fieldwork, and the case analysis evolved concurrently, facilitating the development of new theoretical openings (Dubois and Gadde, 2002). This longitudinal study involved several iterative cycles between the literature review, data collection and analysis.

The selection of the case study approach and cases aligns with our objectives and the approach of emergent theory building on ecosystem practice, following Eisenhardt’s (1989) framework. To bridge the two perspectives, we intentionally selected two cases with distinct structures (see Figure 2 in the next chapter), ensuring sufficient similarities in size, member type, focus, purpose, ways of collaborating, and ecosystem member

policy (see Table 1 in the next section). These similarities provide comparability, while the inevitable differences reflect the diverse realities found in ecosystems and are expected to create enough variety in coevolution. This deliberate selection of two cases facilitated a meaningful and manageable setting for our study [Yin, (2014), pp.3–15]. Additionally, an essential criterion for case selection was the researchers' access, allowing an insider's *from-within* perspective on collaboration that is essential in practice research (Gherardi, 2009) beyond the confines of rich, collected, and available data (contributing to construct validity) (see Table 2 in the next section).

Figure 1 presents the preliminary frameworks of ecosystem practice. The triangle is the starting point of the study, based on the theoretical examination. As demonstrated in the figure (left), the approaches partly overlap, and methodologically, the top of the iceberg is visible from outside the ecosystem. However, the bottom part can best be reached by using the from-within perspective as a participant in collaboration. The circle summarises the collaborative dynamics and key concepts used to form propositions for the last empirical round.

Figure 1 Preliminary frameworks developing along the abductive process



The data used included participatory observations of ecosystem activity at numerous meetings and workshops and their results, different project plans and documents, online discussions, interviews and facilitated online discussions conducted as part of the ecosystem collaboration, contributing to construct validity [Yin, (2014), p.45]. The material covers the period from initiating a collaboration project until two and a half years later in two ecosystem cases presented in the following section.

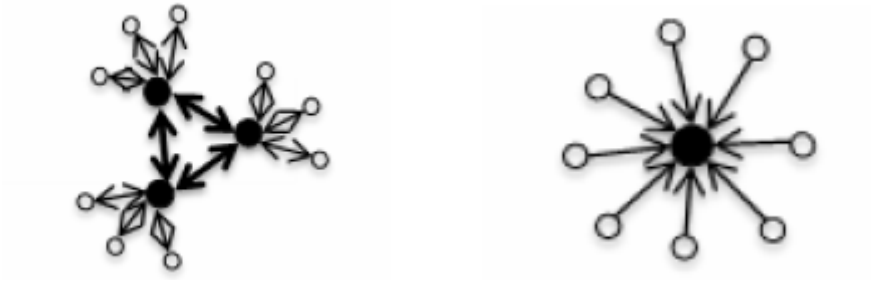
Consistent with the service ecosystem view (Vargo and Lusch, 2011), we broadened the level of analysis from the firm's activities to include aspects of ecosystem-level co-creation. The first ecosystem (case A) was built around an array of ecosystem actors who aimed to boost the forest industry's competitiveness through digitalisation. The second ecosystem (case B) aimed to co-create an ecosystem that would outline the future of the built environment and digitalise the building sector.

The overall process of analysis is presented in Figure 1. Both in-case (narrative descriptions of the cases) and cross-case analyses (comparisons according to multiple categories reflecting different theoretical and data-driven constructs) with similar protocols were utilised (Eisenhardt, 1989). These provide suitable conditions for both internal and external validity as well as for reliability, together with the significant role of theories [Yin, (2014), p.45]. The identified propositions and key concepts guided the analysis. Finally, we interpreted the development prospects in both cases using the selected theories. Then, we concluded the entire process by establishing a framework of flourishing ecosystem practice with the power of industrial renewal.

3.2 Description of the cases and research material

The overall description of the cases is presented in Table 1. Case ecosystem A started in December 2019 as a research and development project, which served as a joint action to form an ecosystem that links forest sector manufacturers, engineering companies, technology suppliers, the information technology sector and design companies. The building phase of ecosystem B started in November 2019 when the partners representing service providers, suppliers, technology providers and constructors in the Finnish building sector, as well as a research institute and a funding agency, were gathered. By joining the ecosystem, the partners hoped to find new business opportunities outside their current operating fields through collaboration.

Figure 2 Network structures of the ecosystem cases, (a) case A: shared target but distinct sub-aims for a different network (b) case B: shared target for a network



(a) (b)

One of the criteria for selection was the distinct *structure* of the cases (Figure 2). Both cases emphasise crossing traditional industrial boundaries as a primary driver of ecosystem-level collaboration. However, they differ in resource integration for renewal, reflecting distinct aims and business development logic. The ecosystems also vary in the number and roles of the actors. Case A features actors with specific roles based on resources, while case B involves actors providing unique resources for collaboration.

These differences in structures and objectives can be expected to impact coevolution dynamics.

Table 1 Description of the ecosystem cases

	CASE A	*CASE B*
Field	Forest industry	Smart buildings
Partners	22 companies + three research organisations	Six companies + one research organisation
Participating companies	12 large companies, nine small- and medium-sized companies (SMEs)	Eight SMEs
Focus and purpose	To develop the competitiveness of the national forest industry by focusing on digitalisation and boosting existing work processes in factories. To study the growth potential and scalability of new digital solutions developed within the ecosystem.	To outline the future of the built environment and digitalise the building sector. To form an ecosystem to connect stakeholders and digitalise the building sector with building-wide networks of sensors, devices and services. To study global business opportunities that can be realised with smart building platforms and with the involvement of innovative SMEs and start-ups offering the latest technologies.
Means of collaborating	The joint development work took place in cases that were entirely independent and project-like with their own development communities and consisted of a use-case owner company (i.e. a forest company) and solver companies that were interested in solving the use-case owner's specific challenge, relating to, for example, the reporting and follow-up of maintenance tasks, through digitalisation.	The core of ecosystem B is the design process, in which the idea is to gather core partners and talented SMEs and start-ups and to explore and co-innovate world-class service concepts and applications in the smart building context. The design process in the ecosystem started with value identification and user experience studies and the definition of a practical operational model for planning SME engagement. Design ethnography was used to examine the daily lives of humans in a smart building environment.
Ecosystem member policy	The ecosystem was open, meaning new companies could join it and leave it if they wanted to. The ecosystem started with eight use cases, which form a living layer; new ones can be established if the need arises, and the use cases may also be terminated if the ecosystem participants jointly decide to do so.	The aim is to raise the number of companies belonging to the ecosystem with SMEs or start-up companies in the near future. The first efforts to integrate SMEs into the ecosystem were conducted as a challenge competition targeted at SMEs. However, additional actions are necessary to ensure the ecosystem's growth.

Table 2 summarises empirical material, categorising researchers' roles for transparency in their participatory involvement.

Table 2 Research material categorised based on the researchers' role

	Researchers as facilitators or active contributors	*Researchers as observers or interviewers*	*Additional material that researchers have access to*
CASE A	• Use-case-specific development processes	• Workshops for ecosystem operation model development • Introductory interviews (25) with all ecosystem partners • Use-case-specific interviews (50)	• Monthly meetings • Steering group meetings (10) • Kick-off event and final seminar (face-to-face)
CASE B	• Use-case-generating process • User experience goal-generating process • Future service opportunity-generating process • Challenge competition processes • Use-case-specific development processes	• Introductory interviews (7) of all ecosystem partners • Stakeholder interviews (25) on user experience in smart buildings • Design probes/diaries (18) from stakeholders	• Weekly meetings • Steering group meetings (19) • Internal workshops (31) • Public dissemination events (2)

4 Empirical results

Building on the analysis of the similarities and differences beyond the structures between the cases, we move on to how the service ecosystem actors found practices that helped them integrate resources and recognise the potential for co-creation value. We then concluded with the three characteristics that unite the actors, thus supporting the ecosystem practice of developing and creating new value.

4.1 Ecosystem-as-practice – creating a practice of renewal to flourish

The main content of resource integration was information and knowledge, among which the actors shared according to their predefined (case A) or unique competency-based (case B) roles and positions in the networks. Agile work on the use-case topics was the primary activity for achieving the value proposition, which shaped the positions and linked with the actors according to their participation.

In analysing the developed collaboration practices for renewal, the studied cases were quite *similar* regarding their ecosystem-level decision making and coordination, knowledge-sharing practices between actors, regular meetings at different project organisation levels and case-specified action groups. However, the large number of different communication tools (notably in case B) can also be considered a simple

example of how institutional pluralism is reflected in daily working; partners introduced tools for common use based on their own industry's preferences and had not (yet) created the core of a *new shared practice* or *lasting links between practices*.

Both ecosystems adopted a design thinking approach (e.g., see, Brown, 2008) as a baseline for discourse and organising work; thus, both user involvement and agile development practices were highlighted. In both cases, the primary practices focused on new, extended, or better value based on a design process approach that engaged and involved user perspectives. In case B, the development of a smart building platform enabled the interaction of different actors by providing availability and accessibility, elements of structure, and the necessity for developers and small- and medium-sized companies to join the platform. This pilot platform is a hybrid consisting of a digital platform (for sharing and analysing data and developing digital services) and a physical realisation (as technology collects data and enables services) on different construction sites. It provides concrete ways in which users and customers could become essential parts of resource integration as actors of a service ecosystem if and when integrated, for example, through organised challenge competitions. However, a similar form of engagement can be found in case A, where the facilitated co-development process started by defining the challenge to be solved, which was guided by actual customers (use-case owners).

The state of *community and identity* building in the ecosystems was still in the early phases in both cases, but for several reasons. In both cases, the ecosystem contact persons were committed to building the ecosystem. In case B, the non-transparency of the partner companies' internal plans and projects, as well as different resource allocations, resulted in different levels of participation and difficulties in finding a shared area of mastery that was interesting enough – but not too attractive – within the area of one participant. Furthermore, in case A, dyadic relationships were still built with customer companies, which limited the potential to expand the area of mastery. However, in both cases, some of the companies used the ecosystem's brand in their external communication; they felt they were members of the ecosystem. In case B, the ecosystem brand and vision statement were formulated, and external communication and challenge competitions to engage new actors were conducted as units, not as individual companies.

4.2 Interpreting the development prospects of the cases with the key concepts

Although the studied ecosystems had several common issues, they also had fundamental differences. Regarding the primary *structural differences*, the overall alignment structure (referring to the actors' interpretations of the members' positions and activity flows) was still inconsistent in both cases. The multilateralism of interdependencies was evident in both cases at the ecosystem activity level, although in case A, we recognised a tendency towards bilateral interactions. Membership was defined by joint value-creation efforts as a general goal. Divergences – both in interest and from the perspective of incorporating partners – are required for the activities enabling the value proposition to materialise. The smart building platform development in case B seemed to open promising ways for the resource integration of network actors, enabling a scalable platform business if the core interaction crystallises. This requires a demonstration of the (still too) general value proposition with a set of interconnected solutions reflecting the ecosystem's future

potential. In contrast, case A can provide the engine for several business networks to develop clear but narrower value propositions.

As both ecosystems cross the boundaries of industries, they must face *institutional pluralism*, for example, reflected in terms of preferred ways of working, understanding the meaning of used concepts, and making decisions in daily practice. When the basic structure is considered, in case A, the rules for resource integration (or how to proceed) may be easier to define relative to the sub-aims of the limited actors and their particular focus compared with case B. This may limit the renewal power of case A as finding *new properties* might be weaker.

Table 3 Comparison of the ecosystems from the three practice-based learning perspectives

Perspectives	*Case A*	*Case B*
	Prospects for a shared ecosystem practice	
Knowing in practice: knowing and learning in community practice	Several new (temporary) communities formed around problems to be solved (use-case) – participation can vary from peripheral (or none) to full participation as mastery.	Community building around a hybrid platform – the ability to build and maintain a continuous multi-sided community process.
Knowing in between: knowing and learning within and across communities	Increasing capability to solve more difficult problems and integrate new actors with complementary competencies with a facilitated co-development process.	Expand by connecting different resources using a hybrid platform and a process of engagement.
Expansive learning: actionable objects as concerns that generate and focus attention, motivation, effort and meaning	Ecosystem activity enhances learning by recognising shared objects of activity crossing industry boundaries – the promise of maintaining a balance between producing useful intermediate products and remaining incomplete.	Ecosystem activity enhances learning by recognising shared objects of activity crossing industry boundaries – the essential role of pilot sites in making the object visible, accessible and cumulative.

To further clarify the hidden processes of practice, we compared the cases concerning the three different perspectives of learning summarised and interpreted in this study for ecosystem evolvement in Section 2.3 (Table 3). The differences in practices mentioned earlier are related to the kind of community building that is happening, how the ecosystems benefit from integrating resources, and how they achieve actionable objects. These are then further discussed in relation to the kinds of future avenues for development that they might open.

The cases somewhat differed regarding the community to be identified (see Table 3). However, the stated aims of the ecosystems provide a basis. A common learning process still defines what a community is supposed to do, how it does things, and how it relates to other communities. In other words, it has a community identity. The crucial question for both ecosystems is how to enable each of the participants to take on an identity within the shared area of mastery and to define a unique area of common accomplishment (not just one master), in which each actor has a role and an opportunity to progress in their knowledge through deepening participation.

The ecosystems also vary in their openness, and although both aim to grow and expand, the rules and processes of joining and participating in the ecosystems differ. The visibility of these rules and processes as material and discursive means to interlink practices seemed to have a clear influence on the attractiveness of the ecosystem. In both cases, the use-case orientation was a *nexus* for finding concrete ways to integrate resources for value co-creation. In case A, the defined co-development process (based on the design thinking approach) as the primary discursive means enabled others to join the nexus of practice, whereas in case B, the challenge competition served this purpose. However, in considering the future, case A's strength lies in going deeper into mastery within each new community (instead of expanding as one ecosystem). In contrast, case B can expand through the platform.

The risks can also differ. In case A, the solution developed may be too customised (or traditional) for scalability for other customers; in case B, differentiation and attractiveness compared with other platforms are crucial. The established attractiveness is particularly critical in the latter case. By contrast, accomplishing use cases for real business is crucial in case B to demonstrate that the business development logic is working. Furthermore, in case A, the scalability of the co-development process can be enhanced through digitalisation (i.e., making it more platform-like).

Finally, the expansive learning perspective highlights the essential role of the shared object of work as providing object-oriented collaborative forms of action that require the activity system to organise itself. When we are interested in the capabilities of ecosystems to accelerate industrial renewal, shared objects should have the potential to escalate and expand to achieve a global scale of impact. However, this means that they may become *runaway objects* that do not easily generate productive activities. The problem is visible in both ecosystems. Generally, both ecosystems have shared objectives – the mission for future ecosystem activity. Although the mission is well accepted, finding productive activities is difficult. When evaluated against the four prerequisites for objects to be benign (described in Section 2.2.3) – related to the first criterion of having properties beyond a profit – sustainability has some role in both ecosystems, holding some promise in this direction, but is not yet visible in the activities.

Case A was better according to criteria 2 (useful but incomplete intermediate products), with its first use-case solutions and the co-development process it used to initiate new cases. By contrast, case B performed better in relation to criteria 3 (visibility and accessibility), because the ecosystem has several building sites that reflect the objectives in a very concrete and approachable way. In both ecosystems, the final prerequisite was almost missing; the single-use-case solutions had feedback loops. However, the overall progress regarding the objectives for all (existing and potential) ecosystem actors was not visible. This situation limits the learning power of the ecosystem regarding the organisation of the activities – that is, the emergence of an activity system or systems required to achieve the mission. However, the need for something like this was already recognised in both cases (although for internal use in case B).

In conclusion, the future of these ecosystems is related to how they can support collaborative social processes of renewal while progressing towards materialising the value of the shared purpose. This means that a continuous dynamic process of *doing and getting done*, *belonging* and *becoming* exists to create observable practices that provide access and create paths to deepen participation and allow participants to leave and return

with the possibility of seeing their impacts on the objectives. To summarise the findings of the abductive process, we next concluded with the three characteristics of an ecosystem practice for an ecosystem to evolve towards industrial renewal.

5 Conceptual results: the three characteristics of an ecosystem practice for industrial renewal

The three recognised characteristics (Figure 3) describe the core features of the shared practice of integrating resources, feeding continuous processes of collaborative learning that are necessary for industrial renewal. These characteristics are required to pull actors together across the boundaries of industries and to allow different actors to participate in varying degrees, thus supporting the continuous coevolution of an ecosystem that possesses both business prospects and the power to renew industries.

First, collaboration in an ecosystem needs to result in a real *accomplishment* that demonstrates how improved value (reflecting the general vision or mission) can be materialised through the resource integration of these particular actors. This formulates the area of mastery in which one can earn and learn a legitimate role and, thus, the possibility of *belonging* to the community. The more unique the identity achieved by integrating complementarities, the stronger the ecosystem community.

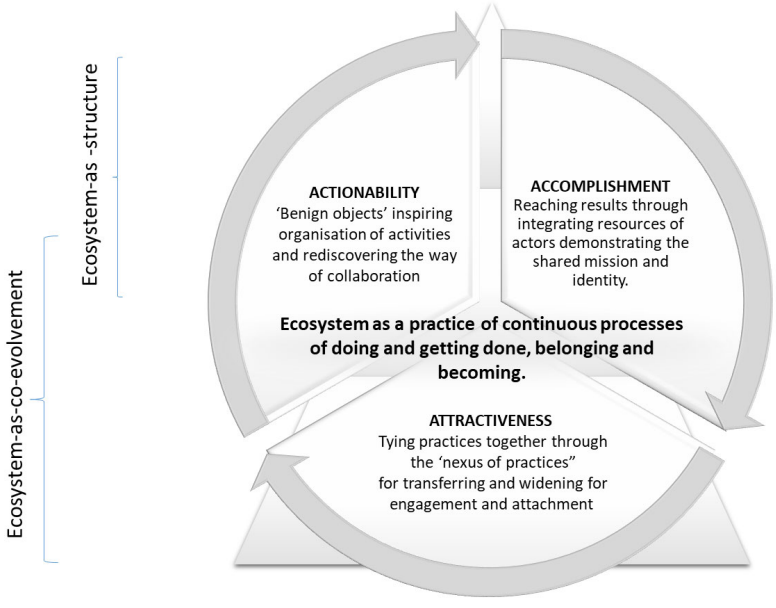
Furthermore, to grow and expand, an ecosystem should maintain openness and provide a nexus of practices that invite participation from new actors. The visibility and transparency of the rules and processes as discursive means (e.g., open communication tools) to interlink with new actors' practices influence the *attractiveness* of an ecosystem. In addition, the uniqueness of the ecosystems' mission (and the emerging area of mastery) as a promise of future opportunities and impacts generates new encounters. This feeds *the process of becoming* something as a unit – a continuously developing community worth getting attached to. In other words, the ecosystem operation must offer something sufficiently aligned with the new actors' objectives but offer a significant possibility to broaden the perspective uniquely and even co-specialise. As noted earlier, participants contribute knowledge for transfer and expansion through relationships and connections with resources and constraints in this socially interconnected context.

The defined shared practices create a sound basis. Still, they are insufficient to achieve the *actionability* of an evolving ecosystem – not only to get things done, but also to do things together. They enhance ease of collaboration, whereas continuity also requires dividing the general mission (runaway object) into *benign objects* that can be actual objects of activity (something to work on together to materialise the value proposition), boosting the integration of the resources required. The actual objects of activity change based on progress and the new partners who bring ways of collaborating with them that require the entire activity system to be reorganised.

By balancing accomplishment, attractiveness and actionability, the new ecosystem-specific logic of practice enables the ecosystem to function as a unit and actors to feel the flow of doing things and take pride in getting things done together. It also enables a feeling of belonging to the continuously developing ecosystem, thus offering possibilities to become something more by integrating resources for improved value and providing meaning and purpose for shared everyday activities. We believe these three characteristics are needed to provide ecosystem members with enough intensity and motivation to continue towards a shared mission and create the targeted

impact together. They also facilitate flexible participation by different actors within the ecosystem structure, in which the roles and depths of participation can vary.

Figure 3 Three characteristics of flourishing ecosystem practices with industrial renewal power



6 Discussion and conclusions

This study aimed to create a new understanding of integrating resources through shared practice for industrial renewal. It contributes to the growing body of knowledge on service ecosystems by providing a new, empirically and theoretically grounded opening for studying ecosystems as practice. Our study builds on Hou and Shi's (2021) insights by effectively integrating the structure view (Adner, 2016; Jacobides et al., 2018) with the coevolution view (Dattee et al., 2018) and bringing these together with the practice lens and an abductive approach. This synergistic approach enhances our understanding of ecosystem theory and practice and contributes to a more comprehensive perspective on ecosystem coevolution dynamics (Vargo and Akaka, 2012). The results highlight *three characteristics of an ecosystem practice* that enhance the resource integration of ecosystems to evolve – and exceed the actors' independent avenues of development. The three characteristics – *accomplishment*, *attractiveness* and *actionability* – describe the core features of an ecosystem practice as continuous processes of *doing and getting done*, *belonging* and *becoming*. Through two practical case examples, the study complements previous perceptions of *ecosystems-as-structures* (Adner, 2016) by describing how coevolution dynamics create new knowledge and business opportunities within industrial service ecosystems.

Based on an examination of two cases with distinct structures, we demonstrated the emergence of different co-evolving dynamics and practices. Instead of zooming out into

nested, overlapping service ecosystems and institutions (as suggested by Vargo and Lusch, 2011), we sought the power of change in the dynamics of collaborative resource integration using the new *ecosystem-as-practice* lens, building on the perspectives of practice and learning research (Kallio et al., 2017; Mele et al., 2017; Corradi et al., 2010). Through the adopted approaches, linking structure and coevolution is facilitated in terms of the past and present (knowing in practice), as well as in bridging different contexts (knowing in-between practices) and directing the activity forward (expansive learning) (cf. Kallio et al., 2017). The practice-based approach (Mele et al., 2017) enabled the study of the ecosystems from within (Gherardi, 2009) in a longitudinal setting, which provided a rare view of the dynamics of a service ecosystem's coevolution. Thus, this study provides new insights into the collaborative dynamics of service ecosystems by highlighting the interlinked dynamics of the structures and practices that enhance the resource integration of an ecosystem to evolve. Additionally, leveraging practice-based learning approaches (Kallio et al., 2017), this study offers a complementary perspective on institutional explanations, enriching our systemic understanding of the service ecosystem (Vargo and Akaka, 2012; Koskela-Huotari et al., 2016; Siltaloppi et al., 2016; Gummesson et al., 2018). It also provides an empirical example of the ecosystem as a novel condition for organising further challenges theorising in organisational studies (cf. Kuhn, 2021; Zhang et al., 2020).

The three characteristics – *accomplishment*, *attractiveness* and *actionability* – are needed to form the ecosystem practice, which pulls actors together to form an attachment. Thus, the formation of practice helps the ecosystem develop, and new value is created within the ecosystem. The rapid but modest business benefits of being part of an ecosystem may be achieved by (over)emphasising accomplishment (emphasising getting things done fast); however, the potential of the entire ecosystem is easily lost. The empirical findings presented here indicate that the emphasis needed for each characteristic changes according to the structure and phase of coevolution. The ecosystem can become capable of meeting its mission by *balancing between the three characteristics*, providing enough intensity and motivation to continue towards the shared mission for industrial renewal as a unit to identify with (cf. Lave and Wenger, 1991) and to include or interlink networks. Formulating a new practice is a continuous social process of knowing and learning that enables industrial renewal.

As a key *managerial implication*, regular reflection on development according to these three characteristics is recommended. Shared missions, jointly defined aims, and building and maintaining shared but adaptive practices that support co-defining and co-realising the value proposition are essential to proceed in institutional pluralism. Unclear rules, difficulties finding a common language, and misunderstandings are inevitable in cross-industry ecosystems. Coevolution within an ecosystem not only aims to develop the *practices of a community*, but also fights the established communities of each participating partner within the existing service ecosystems. Making an additional effort to foster open discourse for contemplating 'harmonies and dissonance, consonance and cacophony' [Gherardi and Nicolini, (2002), p.420] and reorganising collaboration to include new players facilitate the integration of knowledge and expertise, thereby enriching the ecosystem practice. Moreover, sustaining connections between the overarching mission and more specific objectives is essential. This linkage ensures the capability to foster growth and learning, facilitated by comparing the perspectives of all participants engaged in discourse practice.

While this study employed four tests to uphold the quality of social research, it was not immune to the inherent *limitations* associated with case studies. Nonetheless, applying these tests indicates that at least one suggested approach was used in each area [Yin, (2014), pp.45–49]. Reporting an abductive study is always difficult (cf. Mele et al., 2018), as is evident in this study. Additionally, our engagement as research practitioners in emerging ecosystem practices led to a nuanced approach. We adopted a dual perspective, examining practices from the inside as the subjective perspective of practitioners (cf. Gherardi, 2009; Gherardi and Nicolini, 2002) and from outside as observers, allowing for critical reflection using selected theoretical constructs, as proposed by Geiger (2009).

Although we reviewed the literature extensively as part of our analysis, we used only a small part of it, guided by the abductive process, and selected according to what emerged from the empirical analysis. This also affected our contribution, which is aimed at ecosystem research, by defining a new opening about ecosystems as practices. In addition, the primary motive behind this article was influenced by the necessity of shedding light on the ongoing evolution of the ecosystem with the help of relevant theoretical concepts, which also strongly influenced the methodological approach. Accordingly, the study's contribution to theory development is modest. However, it aims to eliminate possible blind spots in practice-based theorising (cf. Kuhn, 2021), thus opening a theoretically justified starting point for further research.

Nevertheless, the findings emphasise the richness that arises from the intersection of different theoretical fields and empirics. This study highlights that there is still much to explore in the convergence of different perspectives, and the synergistic use of these approaches will reveal valuable insights. Finally, the potential of the two studied ecosystems to lead to the necessary industrial renewal remains to be seen. The growing number of actors with experience in ecosystem collaboration gradually brings down institutional and daily obstacles hindering the needed change. The glue for commitment builds on belonging to something precious and inspiring when defining who we are and who we want to be – the uniqueness and value of ourselves as part of a meaningful shared process of becoming part of something better. Our study underlines the need to explore ecosystems on multiple levels with multiple perspectives to discover the essentials of their dynamic evolution. This also requires further conceptual development, in which our study proposes an opening: ecosystem-as-practice.

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