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The Role of Eco-industrial Parks in Promoting Regional Circular Economy: A Stakeholder Perspective

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Abstract
In this paper, we discuss an eco-industrial park (EIP) formation process and its role in promoting regional circular economy (CE) policy from a stakeholder perspective. This case study adds to the knowledge of stakeholder engagement and the role of intermediation in EIP formation and related urban–regional CE policies. By reviewing the case of the ECO3 bioeconomy and CE industrial park in Tampere Region, Finland, we analyze the role of a city-owned development company in the EIP development as an intermediary between public and private stakeholder interests. Intermediation proved to be fruitful in the EIP formation process, as the intermediator sufficiently catalyzed the alignment of stakeholder interests, and various stakeholders thus contributed resources (stakes) to the development process, which furthered the growth of the EIP. The case illustrates how a hybrid actor, such as a city-owned development company, may serve as an important catalyst in regional CE promotion.

Keywords Eco-industrial parks · Circular economy · Regional development · Stakeholders · Intermediation · Hybridity

Introduction

Because concerns over the environmental degradation of our planet have taken a political foothold [1], many overarching ideas have been developed to guide us in solving environmental problems. Sustainable development remains the most prominent of such policy

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ideas. However, over the years, other overarching ideas have emerged [1, 2]. One of these, which is currently topical, is the circular economy (CE) [3]. The underlying idea of the CE is to provide environmental and economic goods by eliminating linear thinking and adopt a circular approach by closing loops in the material flows of an economy [4]. The CE has spread as a policy objective to a multitude of institutions and organizations from the public, private, and voluntary sectors [5–7], which attempt to concretize the idea into practice [8, 9].

Although the earliest eco-industrial parks (EIPs) existed well before the emergence of the CE in public discourse, they are identified as a kind means of implementing the ideas of the CE in production [10–12]. According to Ruggieri and others [13], EIPs "are settings in which business organizations are concentrated on the basis of the possibilities to reuse resources among them in a circular way." This paper contributes to CE policy analysis with a case study of the formation of EIPs as a way for local governments to realize the CE [14, 15]. Our case study subject is the formation of the Kolmenkulma Eco-Industrial Park, also known as ECO3, in Nokia, Tampere Region, Finland. ECO3 has been seen as a flagship CE policy item in the region.

Our case study relies on stakeholder analysis. We first identified relevant stakeholders in the formation of ECO3. We interviewed them to understand their interest in the formation process and what kinds of actions they have taken to promote it. What stands out in our case analysis is how the intermediary actions of a city-owned development company led to a former landfill area becoming a nationally and even internationally renowned EIP. To obtain a detailed account of stakeholders' involvement and how they contributed to the urban–regional development of the CE through the formation of ECO3, we asked the following research questions:

- How do stakeholders' roles and interests influence the formation of an EIP?
- In what ways did the intermediator actor engage stakeholders in the EIP formation and development process?
- How did EIP formation become a vehicle for regional CE policy?

The interview data are our primary data, which are complemented by documents and previous research on the ECO3 park. Thus far, stakeholder roles have been under-researched vis-à-vis the analysis of CE promotion and the formation of EIPs [16–22]. Our key contribution to these bodies of research is the analysis of how a hybrid actor (the city-owned development company) who has knowledge, networks, and access to business and local policy arenas acted as an efficient facilitator between private and public interests in the park's formation. In addition, our research discusses how developing an EIP serves as a meaningful local policy intervention that combines CE and economic development goals for local governments and other public actors. In the following section, we introduce the methodological and theoretical foundations of our study.

Analytical Setting and Theoretical Framework

This research relies on a case study approach. According to Thomas and Myers [23], the research setting in case studies relies on the distinction between research subjects and research objects. The research subject refers to the contextualized and demarcated practi-

cal, historical unity that is under inquiry, while the research object refers to the theoretical framework through which explanations of the research problem are sought. Table 1 lists the key concepts used in this study; their analytical roles; and whether they contribute to building the research subject, object, or both. Figure 1 illustrates how these terms fit into the research setting.

Our study has two focal terms: CE and stakeholders. These contribute to the building of both the research subject and object. The CE is the political entity under inquiry, but it is also a topic for theoretical research and thus adds the research object. The stakeholders, in turn, represent actors who attempt to realize the CE locally through the formation of the EIP. However, most of our analytical terms are derived from stakeholder analysis; thus, stakeholders are an important part of our research object. In the following subsections, we introduce key literature on CE and EIP to provide a foundation for our research subject. We then introduce our analytical tools.

EIPs as Topics of CE Policy

As an idea for change, a CE operates at multiple levels: "At the macro level, there is the whole economy-wide idea of transforming the linear economy into the CE, and from there, the idea and its implications trickle down to single business models and practices" [8, p. 148]. In effect, CE transition concentrates on changing production and consumption prac-

Table 1 Nomenclature and separation of concepts according to their analytical purposes

Concept	Abbreviation	Analytical role	Research subject	Research object
The circular economy	CE	Focal term	X	X
Eco-industrial park	EIP	Key contextual term	X	
Industrial ecology	IE	Contextual term	X	
Industrial symbiosis	IS	Contextual term	X	
Local policy	-	Contextual term	X	
Regional development	-	Key contextual term	X	
Stakeholder	-	Focal term	X	X
Stakeholder's value-based motivation	-	Analytical term		X
Stakeholder's expectations	-	Analytical term		X
Stakeholder's stakes	-	Analytical term		X
Stakeholder's perceived challenge	-	Analytical term		X
Intermediation	-	Analytical term		X
Hybridity	-	Analytical term		X

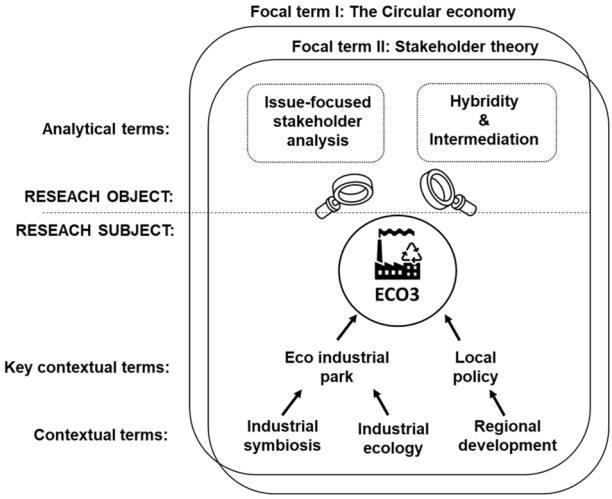

Fig. 1 Research setting

tices [14, 15], and it is supposed to contribute to the formation of a sustainable, inclusive, and resilient future [24]. An important aspect of promoting CE is the integration of the economic, social, political, technological, and ecological dimensions of a new economic model, even though the CE discourse has primarily focused on material flows and on seeking out maximum utility from material resources [25–30]. Consequently, the CE is a normative and ambiguous idea of change, and owing to these characteristics, actors and institutions first need to make sense of what a CE could mean for them and what kind of value it could provide. In essence, this process is about finding ways to put such ideas into practice, and more often than not, public policies play a significant role in achieving this [6, 8, 14, 15, 31].

The formation of EIPs has proved to be one of the ways in which local governments aim to realize the CE [14, 15]. Prior research has shown that local governments are important actors in a CE transition [32–36]. Perhaps the key reason is that the CE has risen as a strategic objective in local policy, and this implies that local policymakers need to find ways to fulfill objectives by somehow actualizing the idea of CE [36–38]. As primary land use planners, local governments have a focal role in the establishment of EIPs. Partly for these reasons, in Finland, the establishment of EIPs has proliferated over the past decade (e.g., Ekomo Eco-Industrial Centre in Helsinki; Topinpuisto Circular Economy Hub in Turku; and our research subject, the ECO3 in Nokia) [20].

The idea of EIPs being semi-bounded in terms of material flows connects them with the ideas and practices of industrial ecology (IE) and industrial symbiosis (IS) [20, 39]. In simple terms, IE is primarily about where resources come from and eventually end up [40]. IS, in turn, is a branch of IE that involves "the physical exchange of materials, energy, water and by-products among several organization" [40, p. 334]. Thus, at the core of IS lies the collective aim of optimizing resource use while providing social, economic, and environmental benefits to its stakeholders [11, 40, 41]. Similarly, as one of the aims of the CE is a high efficiency of resource flows, it is closely related to IS [42, p. 247].

Even if IS does not need to take place within a geographically bounded area, an EIP is nevertheless a concrete way of manifesting the ideas and values of IE and IS. The keys to the success of an EIP are trust and geographical proximity, which enable synergistic opportunities and collaboration between actors operating within it [12, 40]. For instance, the highly

developed industrial symbiosis of Kalundborg is often labeled as the exemplary model highlighting the benefits of an EIP that is designed with IS in mind [40, 41, 43].

The broader regional development perspective of EIPs is important because local governments are puzzled by questions such as how local and regional actors can support CE policies and how the reorganization of industrial districts according to the principles of CE can benefit local and regional economic development [44, 45]. Lately, CE discourse has given stronger political impetus to the formation of EIPs simply because they are seen as instrumental in the realization of a CE [13–15, 25, 44, 46–50]. This is evident in Finnish CE policy, wherein EIPs have been promoted through networking [51], development projects [51, 52], national policy strategies [53], and regional and city-level strategies [54].

To conclude, in this section, we have conceptualized the CE as a political entity, established its relationship with EIPs, and argued why EIPs are an interesting topic for local policymakers for the purposes of regional development. In the next section, we form our research object. We start with stakeholder conceptualization and then introduce our analytical terms (see Table 1).

Connecting Stakeholder Interests and Actions in EIP Formation

According to the conventional definition, a stakeholder is "any group or individual who can affect or is affected by the achievement of the firm's objectives" [55]. However, Roloff's [56] definition aligns more closely with our analysis, as it labels actors who are affected by *an issue* at hand as stakeholders. Adopting Roloff's definition, we follow an issue-focused stakeholder approach. The key proposition is that an issue concerning multiple stakeholders requires their active involvement. Stakeholders' involvement is largely informed by their interests [18, 56]. In our case, this translates into the different ways in which stakeholders are puzzled by the creation of value from the idea of a CE in an EIP setting and how differing stakeholder interests affect how this process evolves [57–59].

Marjamaa et al. [18] conceptualized three categories that provide an understanding of how stakeholder interests unfold in issue-focused situations: *value-based motivations*, which concern stakeholders' reasons for wanting to work on an issue; *expectations*, which represent the value creation that stakeholders envision from the process; and *stakes*, which refer to different types of contributions or resources that stakeholders can bring to or impose on a process to further it in a desired direction. We use these categories as our analytical tools, but we also see it necessary to add a fourth category: *perceived challenges*. We understand this as a necessary flip side of expectations because placing stakes is a future-oriented endeavor that may backfire owing to risks. Consequently, stakeholders have an inherent need to assess and manage the risks of their engagements (see, e.g., [21]).

There is a qualitative difference between stakes and the other three categories. Stakes represent actions, while other categories provide representation of the stakeholders' reasoning for placing the stakes. To better understand the actions and roles of stakeholders and their relationships in the formation of ECO3(cf. [60, 61]), we need to include two additional analytical terms: *hybridity* and *intermediation*.

Previous research has discussed the roles of different actors in establishing and maintaining EIP operations. Discussions have centered primarily on public and private actors [11, 22, 62]. In this paper, we introduce an additional category, *hybrid actors* [63], to gain a more in-depth understanding of stakeholder perspectives on urban–regional CE policymak-

ing. In this instance, *hybridity* refers to organizations and actors that do not purely represent public or private entities but, rather, fall somewhere in between. Hence, there can be mixed ownership, funding, and control of an organization, which implies that it may need to serve various, sometimes competing, institutional logics [63]. For example, a publicly owned company should make a profit, but it simultaneously serves a societal purpose that is expressed as its strategic objective. This implies that compared to non-hybrid actors, hybrid ones can more easily influence more than one arena (e.g., political and business).

In formation processes, such as with an EIP, *intermediary actors* are usually beneficial. Intermediary actors are often discussed in terms of hybridity, but the use of this term does not refer to the organizational structure of an intermediator [64–66]. Rather, it refers to the in-betweenness of phenomena. Intermediation involves actions that connect actors, levels, institutions, and processes. Through such connections, intermediary actions can cross different social boundaries (geographical, organizational, sectoral, cultural, etc.). Moreover, working in between serves a purpose, which may be fostering innovation, forwarding sociotechnical transitions, or promoting certain policies. An intermediator's toolbox usually includes organizational activities such as networking, managing, communications, advising, brokering, generating and circulating knowledge, lobbying, and visioning [37, 67]. Consequently, intermediation is important for a CE transition because it is driven by connections between actors, ideas, institutions, and processes [6, 66–69].

To conclude, we built our case research object from six analytical terms that aim to shed light on stakeholder interests in the formation of ECO3 as well as their roles and actions in this process (see Table 1; Fig. 1).

Data and Methods

We used interviews to acquire the primary data. We then used document data and earlier research on ECO3 [20, 39, 62] to contextualize the case and corroborate the interview data. Table 2 presents the interview data. Interviewees were chosen by screening relevant stakeholders based on public information about ECO3 and previous research. Additionally, we used the snowball sampling method, meaning that we did not find any more suggestions for relevant stakeholders to be interviewed. The interviews were conducted between March and October 2022, and their average length was 45 min.

The interview method followed the lines of semi-structured thematic interviews [70]. The themes remained the same in each interview, but the questions differed based on the interviewees' backgrounds and the institutions that they represented. The themes were (a) the formation of an EIP; (b) the rationale, functioning, and stumbling blocks of an EIP; (c) the interests and stakes of EIP stakeholders; and (d) EIPs' potential to scale up CE-related business and enhance regional CE (see Appendix 1). The interview data were transcribed before the qualitative content analysis was conducted.

Our research procedure was iterative, and we began our content analysis with categories of value-based motivations, expectations, and stakes from each interview (see "Connecting Stakeholder Interests and Actions in EIP Formation" section). However, while undertaking this work, we noticed how much the stakeholders discussed challenges in connection with interests. Thus, we added perceived challenges as an analytical category. In the next phase of the analysis, we extracted utterances of actor relationships and forms of collaboration from

Table 2 Interviewees' positions and affiliations

Organization	Interviewee's Title	Code	Purpose of the Organization in Relation to ECO3	Interview Length
Interviews with public organizations				
City of Nokia	Director of business development	INT1	This city administration is the operational actor in the land use planning and building of the infrastructure of the city and ECO3 area. The politically elected city council sets development aims, such as the mandate to develop the ECO3 area.	1 h 3 min
City of Nokia	Director of city development	INT2		0 h 44 min
Regional economic development agency (Business Tampere)	Project manager of circular economy	INT3	This organization is owned by eight neighboring municipalities: Tampere, Nokia, Ylöjärvi, Pirkkala, Kangasala, Lempäälä, Vesilahti, and Orivesi. The purpose of the organization is to accelerate regional development by offering free expertise for the companies within Tampere Region and by matchmaking companies and other actors.	0 h 53 min
Interviews with hybrid organizations				
Development company (Verte)	General manager	INT4	Verte is owned by the city of Nokia and was originally grounded in the purpose of developing the mental hospital area of Pitkäniemi. In 2014, the development project was completed, and Verte experienced a renaissance as it started the development of the Kolmenkulma CE area, known today as ECO3.	0 h 50 min
Regional waste management company	Chief executive officer	INT5	Owned by 17 neighboring municipalities in the Tampere city region, it takes care of regional waste management and develops technical solutions for recycling. It is one of five founding members of ECO3.	0 h 35 min
Local water supply and sewerage company	Chief executive officer	INT6	Fully owned by the city of Nokia, it takes care of Nokia's drinking water supply and sewage system and creates solutions for salvaging different kinds of materials from sewage water. It is one of five founding members of ECO3.	0 h 29 min
University	Professor	INT7	This university has over 20,000 students and more than 4,000 personnel. Many ECO3 network actors have versatile connections with the university's researchers.	0 h 31 min
University	Researcher	INT8		1 h 0 min
Interviews with private companies situated in the ECO3 area				
Bio-fertilizer company	Account and product manager	INT9	This company started operating in the ECO3 area in 2017. The company's plants in the ECO3 area produce granular ash that is used to build roads. ECO3 production plants also produce forest economy and agriculture fertilizers. All outputs are made of nonvirgin materials.	1 h 3 min
Recycling company	Company representative	INT10	This company started operating in the ECO3 area in 2017. It receives, for example, construction waste and organic waste, and it processes the former into modular concrete blocks and the latter into soil.	0 h 25 min
Recycling company	Company representative	INT11	It started operating in ECO3 in 2019 and receives, for example, construction waste.	0 h 37 min
Total Length: 8 h 10 min				

the data to analyze how stakeholders engage with one another in the various phases of EIP development (cf [57]). This process emphasized intermediation and hybridity as important factors in the formation of ECO3. Finally, we compiled stakeholder interests (value-based motivations, expectations, and perceived challenges), stakes, institutional roles (public, private, or hybrid), and intermediation inputs to explain how ECO3 has contributed to regional development. The strengths of our study lie in the rigorous case selection, extensive collection of qualitative data, review of relevant research, and various peer debriefings between the research team members.

Analysis

Background and Early Development of Eco3

The story of ECO3 began in 2014, when the city of Nokia (approximately 35,400 inhabitants) allocated a 120-hectare area near a former landfill site for the development of the EIP and mandated the city-owned development company Verte to run the operation. The ECO3 development model relied on Verte to act as an intermediary in the process. Another key stakeholder from the outset was the regional waste management company Pirkanmaan Jätehuolto, whose role was based on its strong presence in the area, having previously operated a controlled landfill there. From its viewpoint, initiating an EIP around the waste management company was relatively easy, as it was used to collect different material components and rejects (INT5). Other initial stakeholders included the water management company Nokian Vesi, the energy company Leppäkosken lämpö, and Tampere University. This group shared a common interest in enhancing CE markets and regional CE. As the development of the EIP progressed, Verte and Pirkanmaan Jätehuolto started actively promoting ECO3 as a bioeconomy and CE platform, which quickly received wider publicity (cf [39]). In 2017, the first private companies were located in the area. Since 2022, the ECO3 area has inhabited 38 private and publicly owned companies (see Fig. 2). An enticement factor for companies has been location—that is, it is in the vicinity of the urban growth center Tampere (approximately 250,000 inhabitants) and a nexus of highways [INT1; INT4; INT9-INT11]. Another key element of the area's rapid growth and maturation is the logic of its development, which is reliant on Verte to intermediate between public and private stakeholders and their interests related to the area [20]. More specifically, Verte has facilitated collaboration between ECO3 and other stakeholders and has actively enticed private companies to locate their operations in the area.

The idea of enhancing the CE has attracted various stakeholders' interests. An interest in the operating model of ECO3 proliferated owing to its use as an EIP paragon in 2020 in the national CE strategic program [53]. Moreover, the ECO3 model has gained publicity abroad, as indicated by the number of international visitors to the area [INT1; INT2; INT5; INT8; INT11].

Stakeholder Interests Associated with Eco3

Here, we extract and digest stakeholder interest associated with the formation of ECO3 with categories of value-based motivations, expectations, perceived challenges, and stakes.

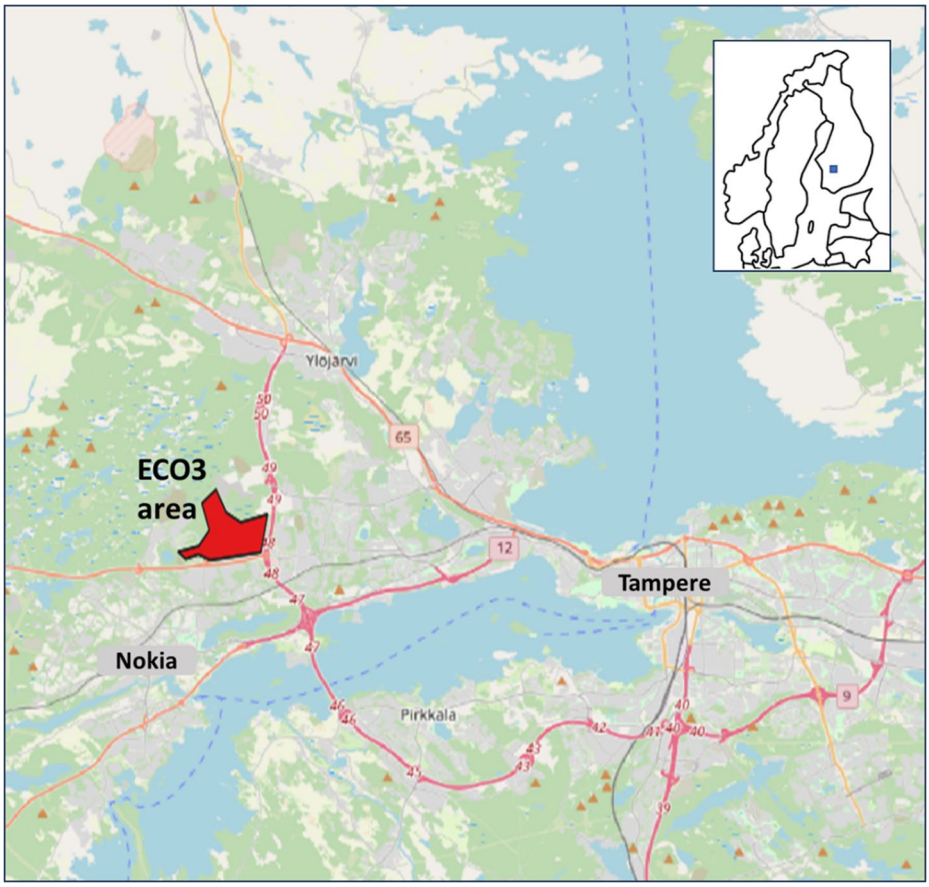

Fig. 2 The ECO3 area's location

Table 3 provides an overview of these categories. Stakeholders' value-based motivations for the formation of ECO3 derive from sustainability thinking and how stakeholders see value in promoting a CE. Their expectations, in turn, divert from a somewhat unified idea of value in the CE to different apprehensions of how this value is created. Differences in expectations and perceived risks are largely explained by the types of stakeholders in question. Stakes are further elaborated in our analysis of intermediation in the formation of ECO3 ("Forms of Intermediation in the Development of Eco3" section).

The initial ECO3 stakeholders were **hybrid companies**, excluding the university. These companies operate in markets but are publicly owned. The goal of hybrid companies in this case was not to maximize profit but to provide public services (water, waste management and energy) for reasonable fees. In terms of stakes and stakeholder collaboration, hybrid companies were vital to the formation of ECO3. This is because these companies are politically steered by boards comprising political representatives and can thus be used as instruments to promote public policies. A prime example of this is Verte, which is mandated to promote ECO3 [INT1; INT2; INT4]. Influence through boards also works another way, as the head of the waste management company attempted to influence policymaking. During

Table 3 Value-based motivations, expectations, perceived challenges, and stakes of the stakeholders involved in the development of ECO3

Stakeholders	Value-based motivations	Expectations	Perceived challenges	Stakes
Private companies	• Corporate social responsibility • Profitability • Sustainable development and CE	• Excellent location • CE focus of the area • Good reputation of the area	• Too similar actors within ECO3 • Transparency versus business secrets in collaboration • Environmental license-granting processes • CE market difficulties	• Material exchanges • ECO3 expansion through word of mouth • Investments in the area
Hybrid companies: waste and water management	• Sustainable development and CE	• ECO3 as productive CE platform	• Potentially conflicting institutional logics: CE enhancing versus distribution of dividends	• Operation as an anchor institution • Material exchanges • Research and pilot collaboration
Hybrid organization: Verte	• Sustainable development and CE	• Spatial expansion of ECO3 • Emergence of EIP networks • New business activities • Enhanced visibility of the ECO3 area	• Networking challenges between EIPs • Value creation for current and potential companies located in ECO3 is a continuous challenge	• Consortium meetings • Matchmaking • Aftercare • Marketing of the ECO3 area and model • Hosting of international visitors • Building of a network between EIPs
Public institution: Business Tampere	• Sustainable development and CE	• ECO3 as a crowd puller for CE companies • Public–private partnership	• Public sector caution regarding the use of CE products • Insufficient knowledge of CE product behavior	• Matchmaking • CE accelerator program • Financing and support for product development and internalization services
Public Institution: city	• Sustainable development and CE	• More companies, jobs, and tax revenue • Sustainability policymaking through the CE and bioeconomy	• Potential conflict between job creation and CE enhancement	• Land use planning • Plot management and sales • Infrastructure building • Owning and funding of Verte Ldt
University	• CE research and development	• Fruitful research platform	-	• Collaboration with ECO3 network actors • Knowledge dissemination

board discussions, he argued that profits should be reallocated to enhance companies' CE activities instead of merely being paid as dividends to owners (municipalities) [INT5].

> We think about social impacts and what our mission really is. And I think that social responsibility and social effectiveness derive from the fact that we do not pursue economic profit; instead, [we contribute to solving the] big issues of the moment [lack of circularity and climate actions]. [INT5]
> The current will or intention is starting to be quite favorable towards climate issues and issues related to the circular economy, kind of like political will in general. But

> then when it comes to concrete questions [on the political board of the regional waste management company], such as whether we should refrain from distributing dividends to you, for example, and instead use the funds for developing the circular economy, then there's some [questioning] that arises regarding whether this is really sensible like this. [INT5]

Attracting CE-minded **private companies** to the area is the key objective of the public and hybrid stakeholders that promote the ECO3 project [INT1; INT3-INT5]. This means that the expectations and perceived challenges of private companies are issues for the other involved stakeholders that we identified (Table 3). Thus, they need to contribute to solving these perceived challenges and maintaining positive expectations of investing in the area, and they did this in the following ways: Through zoning, the city provided demolition companies with outdoor storage with conditions of fencing or building tarpaulin halls for material piles, as some materials did not have utilization opportunities in line [INT1; INT11].

Private companies were concerned that too many similar companies might become located in the ECO3 area [INT12]. Thus, potential overcrowding could lead to a price war that causes profitability issues for the companies. The other challenge concerns drawing a line between openness and business secrets. To advance companies' common projects of carving out market opportunities for a CE, openness and collaboration are essential, but occasionally, some matters appear as business secrets, creating hurdles in B2B communication [INT13]. The issue between openness and business secrets is addressed by the development company Verte, whose intermediation work fosters trust and collaboration, moving away from a business-as-usual approach within the ECO3 ecosystem. This intermediation work is further analyzed in "Forms of Intermediation in the Development of Eco3" section.

Public procurements as public actors' means of furthering the CE came up multiple times in the interviews [INT3; INT4; INT11]. Involved stakeholders felt that procuring CE products would not only provide sales to the companies but also act as references for the suitability and usefulness of CE products. Public procurement could facilitate the use of CE products and thus enhance regional CE.

> Public sector actors should be braver and test and utilize [the CE products] more widely. And they should consider [the CE products] in the procurement criteria or similarly. The public sector is still [a powerful player] if you think about infrastructure and building projects; those projects could utilize material components being diverted from construction demolition sites. (INT3)

Development company Verte's expectations and stakes reflect its role as an intermediary between various stakeholders (more in "Forms of Intermediation in the Development of Eco3" section). Verte aims to increase the number of companies in ECO3, expand the EIP area spatially, and enhance regional and nationwide networks of EIPs [INT4]. The latter is a challenging task because of the different maturities of Finnish EIPs, indicating that the benefits of networks are not obvious [INT4].

> The challenge with networks is that there are different, conflicting interests. And now someone needs to take ownership of developing the network in such a way that these conflicting interests can be reconciled into a vision where the network participants

> can justify and establish regional economic benefits for themselves. These benefits involve factors like euros, working hours, and inputs. Currently, our challenge is that we haven't created a single functioning [national EIP] network that reconciles interests. This is because many of these network participants… are at very different stages. Some are learning and contemplating, while others, like us, are already operating… It's important to understand that if there's a common interest or the same level of maturity in this matter, collaboration becomes much easier. [INT4]

The earlier literature points out that intra- and interregional networks enhance innovation, learning, and knowledge diffusion [12]. However, the development company points out that enhancing regional cooperation between EIPs is more sensible than building a national network, as finding a common point of interest is easier [INT4]. In the case of the Tampere urban region, multiple nearby municipalities have taken a strategic approach to establishing EIPs with different focuses in terms of the materials used and exchanged (e.g., the municipality of Vesilahti focuses on agroecological symbiosis). However, these formation processes are in the early stages.

For **local government**, expectations regarding ECO3 centered on economic benefits—businesses, jobs, and tax revenue [INT1; INT2]—and a nexus for sustainability and CE policymaking [71]. ECO3 holds a significant number of jobs and tax-paying companies, but it also creates indirect jobs through value chains connected to the area. At the same time, the city government is aware of traditional industrial companies' ability to provide more jobs and thus tax income compared to CE businesses. This disparity between enhancing CE and creating jobs is a politically sensitive matter.

> Concerning the number of jobs—you know, what the company creates—[CE business] is not as efficient in terms of land use if we think about [the fact] that there would be a metal works company, and it would need a hectare-sized plot, and there would be 50 workers in the company compared to this [ECO3 and CE business]. So, this is a little bit of a balancing act on what the city wants. Of course, we want to promote the CE and so forth, but somebody always poses a question about how many jobs [the CE business] creates. [INT1]

From the perspective of stakes, the city government's role is essential. The city of Nokia handles land use planning, the building of municipal infrastructure, and the assignment of plots to ECO3. It also owns the development company Verte and mandated it for the formation of the park. Regarding the city's stakes with ECO3, there was an interesting discrepancy between the well-perceived image of ECO3 and the material realities of CE business conducted in the area. CE business is described as noisy, dusty, smelly, and not esthetic [INT1; INT11; INT13]. As such, it is expected to establish operations far enough from residential areas [INT11]. Furthermore, the city is cautious about what the façade of ECO3 looks like from the nearby highway.

> We prefer to situate the CE here, a bit out of sight, because the CE is not necessarily that pretty. And we think about the highways, which pass here. If one drives past from here… then one can notice that [the façade] has finer-looking companies compared to company piles of some waste components… [INT1].

The interviewee from the **regional development agency** represented a regional stakeholder who worked closely with the formation of ECO3 along with a waste management company. The regional development agency perceived ECO3 as successful and as the most significant regional EIP; thus, it is thought to act as a magnet for sustainability-oriented companies nationally and internationally. The agency's hope is that the success of ECO3 will accelerate the regional expansion of CE markets. [INT3]

The regional development agency's stakes consist of various support services for CE businesses. For instance, together with Verte, the regional development agency launched an accelerator program to develop CE companies and CE markets. This program included a platform that offered empirical knowledge of how, for instance, construction procurement processes may be implemented cost-effectively, taking CE considerations into account [INT4]. In addition, the agency provides matchmaking whenever a company needs a partner to help solve some of its business challenges [INT3]. Finally, the agency offers services regarding the internationalization of companies and support for product development [INT3].

Finally, **the university** has been a stakeholder in the development of ECO3 from the outset. Some Tampere University researchers were engaged in intense collaboration with ECO3 actors. They expected the EIP to be a fruitful research platform with mutual benefits, for example, in the form of product development for private companies [INT7; INT8].

Forms of Intermediation in the Development of Eco3

ECO3 is a case of an EIP formation that demonstrates how a hybrid intermediary actor (Verte) at the center of the process can effectively facilitate it:

> It has been a planned decision that Verte will conduct the operative work. That is, it is specifically implemented in a corporative form [Verte as a city-owned development company] so that there would be this sort of agile actor between the municipal organization and… the corporate world. [INT2]

Various stakeholders described and even praised Verte's role in forming ECO3, stating that it is a solid yet agile development-oriented organization between the public and private sectors [INT1-INT11]. This description is derived from Verte's role in enticing companies to ECO3 and tending to their needs. Verte called the latter "aftercare" [72]. With aftercare, Verte attempts to deliver prospects to companies in ECO3 to grow and develop their businesses. An example of aftercare is the accelerator program discussed in the previous section. Other important forms of intermediation include consortium meetings, promoting the ECO3 area and its EIP model nationally and internationally, and collaborating with research institutions.

The Eco3 Consortium

The ECO3 consortium is a "loose network" [INT2] that consists of companies located in the area and other stakeholders that are interested in ECO3's development, such as local governments, regional development agencies, research institutes, and regional councils. In this consortium, which is led by Verte, all members participate equally, with the shared goal of

enhancing ECO3's CE practices and viability. Voluntary consortium meetings are organized three to four times per year. The participants discuss various topical matters, such as new ECO3 companies and current development projects [INT1-INT11].

Consortium meetings play an essential role in the development of ECO3. They allow actors to get to know one another, thus fostering new collaborative relationships and strengthening old ones that may be related to material exchanges or using one another's networks to overcome challenges or find new customers [INT1-INT9; INT11]. Few companies perceive consortium meetings as pointless and thus do not participate in them (INT10). Additionally, Verte and local government representatives use the meetings as an instrument to map out the needs of ECO3 companies [INT1; INT4]. Verte also maintains informal relationships with ECO3 actors through face-to-face discussions or phone calls to remain aware of the companies' needs and recent activities [INT4; INT10; INT11].

Promoting Eco3

Attracting investments and companies to ECO3 is not based solely on B2B discussions; rather, as key stakeholders, the regional waste management company and Verte have engaged in reputation building and marketing activities in the promotion of ECO3 [INT4-INT6; INT9]. They have actively presented the ECO3 model both internationally, by participating in international seminars, and nationally. This has increased awareness of ECO3 and, more importantly, spawned numerous visits to the site [INT1; INT2; INT5; INT8; INT11]. These visitors include high-ranking individuals, such as ministers and executives of international companies. Verte and local governments hope that such visits will lower the threshold for international companies to establish operations in ECO3.

Public and hybrid stakeholders deem international visitors and ECO3's role as a paragon of an EIP in the proposition of a strategic CE program by the Finnish government [53] as evidence of the positive reception of the ECO3 model. In addition to drawing more private companies to invest in the area, public and private stakeholders see ECO3's reputation as having political leverage, which helps hybrid companies demonstrate the effectiveness of their CE development work for the political boards and thus enables them to gain trust and mandates to continue their regional CE promotion [INT4-INT6].

ECO3's reputation has not been particularly meaningful for private companies as such, but ECO3 gained new companies through word-of-mouth recommendations from those already located in the area [INT1]. Moreover, as companies establish and grow their business operations, this will eventually enhance the development of the EIP and CE in general, even though growth and collaboration bring risks to private companies (see Table 3).

Voicing plans for the area development is one method that key stakeholders use to keep ECO3 at the forefront of sustainable business park development and in broader environmental and economic policy discussions [INT3-INT5]. The plans that came up in the interviews included improvements in the area's self-sufficiency and the construction of a solar power plant [INT4; INT5]. Additionally, prospects for a hydrogen economy were discussed [INT4; INT5]. These topics are key components of the anticipated green transition [73–75], which has been a common subject of public discourse in the last few years.

Collaboration with Research Institutions

The ECO3 network and consortium meetings enable broad collaboration between ECO3 actors and research institutions. ECO3 actors and Finnish universities have undertaken product development projects and applied for funding from the European Regional Development Fund [INT4; INT6-INT9]. In addition, some researchers at Tampere University participated in the ECO3 model development and attended workshops on disseminating the model internationally [INT7; INT8]. ECO3 companies and Tampere University "live in symbiosis as universities gain up-to-date information and companies gain inexpensive research and product development" [INT9]. In addition to research universities, hybrid companies in ECO3 occasionally offer collaborative development projects to private companies. For instance, a local water management company has been involved in pilot projects regarding the utilization of sensor technology [INT6].

Embedding Eco3 in Local and Regional Development Policy

As a publicly owned intermediator, Verte had a primary role in creating an ecosystem of relevant stakeholders with a considerable impact on the emphases on local and regional economic development policy. The city of Nokia empowered Verte to generate value through ECO3, which eventually created multilevel relationalities at the local, regional, national, and international levels. The policy implications of the development around ECO3 are manifold. First, ECO3 became a branded, small-scale anchor institution that facilitates personal and network relations between key stakeholders. Most notably, informal consortium meetings provide an important structure for collaboration between local governments, economic development agencies, universities, and private companies in the region [INT1; INT3]. Second, ECO3 feeds the regional perspective on and intensifies regional collaborative relations regarding economic development, which is seen in its openness to business ideas and site selections in various parts of the Tampere urban region [INT3; INT4]. Moreover, the region benefits from the emergence of business and industrial parks with different profiles, as this contributes to economic diversification [INT3]. Third, the concept development and hands-on experiences gained through ECO3 provide opportunities to scale up, which can be realized through the interregional and national collaboration between EIPs and their host municipalities [INT2; INT3]. Finally, ECO3 is a prime example of a local policy intervention that combines economic development goals with broader sustainable development ones. Local stakeholders believe that this makes place promotion easier owing to the ECO3's impact on the progressive image of the city of Nokia and of the wider Tampere urban region [INT1].

In summary, ECO3 became an impetus for urban–regional synergies that benefit local and regional economic development. Its drivers revolve around various stakeholder interests, which expand from an interorganizational dyadic relationship between the city government and municipal development company to a broader set of relationships in a multi-sector setting, as described in the previous sections. This setting is illustrated in Fig. 3.

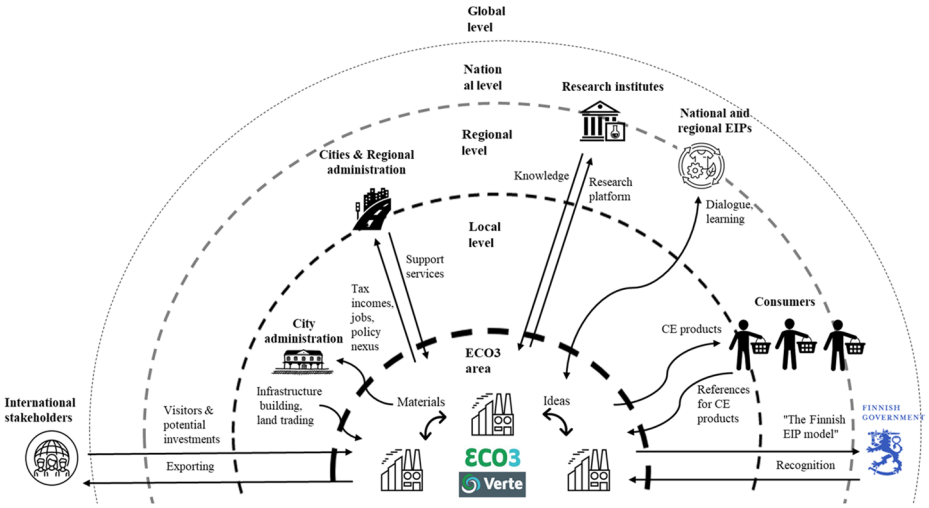

Fig. 3 Illustration of stakeholder benefits created through the establishment of the ECO3 EIP

Discussion and Conclusion

In essence, a CE transition is driven by actors and institutions that are attempting to concretize the idea of CE and its change propositions into practice and generate value through them [8, 76]. One of the most popular meso-level realizations of CE is EIP [15]. This paper's purpose was to contribute to the understanding of the relationship between regional CE policymaking and EIP formation from a stakeholder perspective. We focused on stakeholders' roles and interests, combined with an intermediation perspective, to shed light on how various stakeholders' interests align with the formation of the EIP.

According to Ehrenfeld and Chertow [40, p. 346], well-established EIPs can be used as best practice models to promote economically, socially, and ecologically sustainable manufacturing, in which the core logic is based on collaboration, synergies, and trust instead of "business as usual." The representation of the benefits that the stakeholders gained from their involvement in the ECO3 EIP formation process in Fig. 3 seems to corroborate Ehrenfeld's and Chertow's view. However, our case analysis underlines that the viability of an EIP requires some major hurdles to be overcome. The private companies of ECO3, and the CE markets more broadly, suffer from uncertain permitting procedures, strict regulatory obligations, complex profit-making schemes, space requirements, and restrictions. This shows that market infrastructure, which enables the efficient exchange of products and services, is still in the making [77]. In addition, the political will among local decision-makers might not be unconditionally in favor of EIP. If one were to assess this type of endeavor simply from an economic point of view, the list of hurdles would probably make the formation of ECO3 quite risky for potential stakeholders.

Our results underline that placing a city-owned development company (Verte) as the head of park formation enabled quite rapid growth and institutionalization of the ECO3. We found three key factors for this. (1) Verte's intermediation actions were designed to address the needs of private companies in the area and enhance perception of the park. These intermediation actions included organizing events that facilitated collaboration between the

companies and other actors in ECO3. (2) The hybrid companies that were involved in the formation had access to and the ability to act in public and private decision-making arenas. In particular, Verte and the regional waste management company were active in getting political support for the park formation in board meetings and other meetings with decision-makers. Simultaneously, the hybrid companies connected with the realities of the private companies by understanding the operating environment better than city officials or providing needed services for them (e.g., the management of waste components that were unsuitable for utilization). (3) Finally, EIP formation benefited the popularity of the CE and consequent policy actions. This shows how the CE has become a policy item at the national and local levels and how EIPs are one of the key topics related to this policy [8, 15].

Reflecting on the extant literature, our study makes three contributions to the research of EIPs and regional CE. (1) To date, focused analysis of the roles of intermediator and hybrid actors has not been conducted in EIP research. Uusikartano et al. [39] saw hybridity as a perspective that is beneficial to EIP formation analysis. Intermediation has been a topic of IS research [78], but to our knowledge, analyses have failed to unpack the intermediary actions in EIP formation by Verte-type development companies. Our results show that an intermediator is in a crucial position vis-à-vis the development of an EIP, as its intermediation work facilitates trust building and collaboration within the EIP and other relevant organizations, such as research institutes. This kind of intermediation is a focal task in creating symbiotic relations with ecological, social, and economic benefits [40]. (2) Our research setup adds to the literature on EIPs and regional CE policy. By analyzing EIP formation as a subject of regional CE policy from the stakeholder perspective, we added a detailed understanding of how and why different stakeholders are mobilized in the formation process, how they contribute to it, and what kind of values are created. The stakeholder analysis also makes various risks and challenges associated with EIP formation visible. (3) This study is a welcome addition to CE stakeholder analyses, which are still quite low in number [16–19]. According to the literature review by Arsova et al. [79], the understanding of regional CE policy and implementation is fragmented. Thus, future research on this topic is needed.

The policy implications of our research are manifold. The most important among them is the catalytic effect of publicly owned intermediaries, which are able to operate between public and private stakeholders. Relevant stakeholders are brought together with minimized friction owing to the intermediaries' hybrid structure and their ability to serve as "translators" between the public and private sectors. Another implication is that at the outset, local governments must utilize the multi-sector and multilayered nature of the relationality associated with EIP ecosystem development. This starts by avoiding a narrow local focus and being open to regional collaboration irrespective of its immediate economic benefit to the host locality. Finally, the EIP appears to be an efficient and catalytic method of bringing the principles of circularity into urban and regional economic development, even though it must also be noted that the success of such operations is affected by not only political support but also the conditions of the CE market.

Regarding the limitations of this research, single-case studies are criticized for shortcomings of generalization. King et al. stated, "We always do better (or, in the extreme, no worse) with more observation as the basis of our generalization" [80, p. 212]. Hence, drawing conclusions based on a single case must be done in particular sensitivity. However, it is important to note that despite these generalization challenges, the strength of a single-case study is that it provides an opportunity for detailed, in-depth, context-sensitive analysis.

Thus, single-case studies are beneficial to a broader understanding of various topics and phenomena. In addition, the study and its interpretations could have benefited from more quantitative data, such as rates circularity in and out of the EIP and how this has changed since the establishment of the park. However, this weakness was difficult to rectify, as such data were not attainable.

Appendix 1. An Example Template of an Interview for a Public and Hybrid Organization

(a) The formation of ECO3

- How did the ECO3 come into being?
- How were you and your organization involved in the creation of the area?
- Were companies easily attracted to participate in ECO3's activities from the beginning, and what have been the biggest challenges for ECO3 in this regard?
- On what basis was ECO3 located in its current location? (Accessibility, distance from major cities, transportation connections, availability of land, political factors, etc.)

(b) the rationale, functioning and stumbling blocks of an EIP

- What activities take place ECO3? What materials and energy circulate within ECO3? Between which operators do these exchanges and cycles occur?
- What is your organization's current role in the operations of ECO3?
- How often do organizations involved in ECO3 meet? For what purposes? Who participates in these meetings?
- Is your organization part of the ECO3 consortium? What is its role there?
- What factors have contributed to the development and growth of ECO3 operations?
- What has specifically slowed down or hindered the development of ECO3?

(c) the interests and stakes of EIP stakeholders

- What is the role of the city's development company in developing ECO3?
- What kind of collaboration do organizations in ECO3 engage in with each other?
- What kind of collaboration does your organization have with the development company?
- What kind of collaboration do you have with the businesses of ECO3?
- How does your organization benefit from ECO3, and how do ECO3 companies benefit from your organization?
- In what other ways does your organization support the operations of ECO3?
- How would you describe the role of the public sector, particularly the local government, in the context of ECO3?
- What is the role of universities and research institutions, and how are they integrated into ECO3's activities?

- Is there collaboration between different EIPs in Finland? What kind of collaboration?

(d) EIPs' potential in scaling up CE-related business and enhancing regional CE

- Why does your organization want to be actively involved in the operations of ECO3? What are your organization's goals regarding ECO3?
- Does your organization aim to promote the circular economy regionally in Pirkanmaa or more broadly in society? In what ways?
- Have any of ECO3's activities been successfully established more broadly beyond ECO3 itself? Have sustainable practices been successfully scaled up?
- What have been the regional and particularly the local economic impacts of the circular economy park?
- What potential does ECO3 have for embedding circular economy activities in the long term in Tampere, Pirkanmaa, and society more broadly?
- What is ECO3's long-term goal? What is your vision?

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