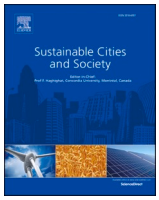
Sustainable Cities and Society 79 (2022) 103697

Contents lists available at ScienceDirect

Sustainable Cities and Society

journal homepage: www.elsevier.com/locate/scs



How do time-bound practices initiate local sustainability pathways?

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ARTICLE INFO

Keywords:
Sustainability pathways
ULL
temporality
reconfiguration
local transition
urban place

ABSTRACT

This paper examines the micro-scale ignition of sustainability pathways in multi-actor collaboration in an urban living lab in Tampere, Finland, and aims to capture the reconfigurations that lead to urban sustainability. The conventional model of sustainability focusing on economic, environmental and social pillars does not correspond to the dynamic nature of urban sustainability. Thus, we utilise a sustainability framework that is more sensitive to urban conditions and compatible with a temporal typology of practices carried out by diverse actors in the living lab. The results show, first, that the emerging sustainability pathways are based on the coexistence of diverse actors and resources, develop through interconnected temporal phases of practices and are differently sensitised to place depending on the temporal phase. The sustainability pathways reach permanence when the actions of catalysing and revamping take the mode of routinisation. Second, we locate the generative moments of reconfigurations and address the cumulative nature of sustainability. In conclusion, this helps to recognise the incipient forms of sustainability pathways and their potential for local sustainability transitions.

1. Introduction

As a metaphor, the sustainability pathway is used to address the dynamics of sustainable development, and tracing paths serves to unpack circulations and interactions in a wider process of systemic change for sustainability (von Wirth et al., 2019). Many recent studies on urban sustainability, sustainability transitions and urban living lab (ULL) research have dealt with the initial stage of transformative change leading to sustainability pathways (e.g. Frantzeskaki et al., 2016; Köhler et al., 2019). However, they have largely neglected the spontaneous emergence of sustainability pathways through a complex mess of multi-actor interactions taking place on the scale of ULL. Multi-actor interactions, where several actors or stakeholders collaborate, are omnipresent for local activities, and the types of collaboration can vary extensively according to size, membership and activities (Fadeeva, 2005). Strambach and Pflitsch (2018) address an important point regarding the emergence of local and regional transition pathways: The paths cannot be fully explained with niche–regime categories since they are essentially plastic and flexible, not least in the case of sustainability innovations. In addition, there are few studies that have taken a critical approach to the analysis of ULL, seeking to investigate the emergence of sustainability pathways within broader experimental logics of urban development (Bulkeley et al., 2016). To contribute to this research gap, we develop a research approach that starts from an alternative framing for sustainable development, helps to capture the reconfigurative dynamics of urban sustainable development and then examines temporal phases of sustainability pathways in multi-actor collaboration. Concerning reconfiguration, we refer to the need for changes in different domains, resulting in a new combination of old and new elements (Laakso et al., 2021).

The classic definition of *sustainability* as 'meeting the needs of the present without compromising the ability of future generations to meet their own needs' (WCED, 1987, p. 43) – based on the pillars of economy, environment and society – does not correspond to the dynamic nature of urban sustainability. Despite the popularity of the three-pillar model, the concrete content of sustainable development has remained ultimately disputed (e.g. George, 2007; Voinov, 2017; Feleki et al., 2018). The concept has been criticised, for instance due to ignoring political agency, sustaining the assumption of the inherent conflict of satisfying human needs with environmental constraints and basing the conceptual framework on anthropocentrism (Meadowcroft, 2007; Seghezzo, 2009). Notably, there are ultimately no absolute boundaries between the ecological, economic and social dimensions, nor are there social rules on how these dimensions should be weighed relative to each other (e.g. Littig and Grießler, 2005; Vallance et al., 2011; Hiedanpää et al., 2012). Overall, the huge sustainability literature is filled with numerous definitions of sustainability, covering diverse issues and addressing tensions between sustainability aspects (e.g. Liu, 2009; Giovannoni and Fabietti,

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https://doi.org/10.1016/j.scs.2022.103697
Received 8 June 2021; Received in revised form 6 January 2022; Accepted 13 January 2022
Available online 17 January 2022

2013; Rosén, 2018). Instead of sustainability in general, we target *urban sustainability*, whose approaches also diverge from their conceptual origins and emphasis (Kremer et al., 2019).

Sustainability is a dynamic concept that changes over time in a place (e.g. Dempsey et al., 2011). Along with the shift of sustainability thinking from long-term global solutions to improvements on a local or regional scale, cities have been identified as important actors in enhancing sustainable practices (Nevens et al., 2013; Wolfram and Frantzeskaki, 2016). In recent years, urban sustainability plans to reduce resource use, pollution and waste have started to merge with climate action planning. Sustainability solutions have become more immediate (Pincetl, 2017; Grandin and Sareen, 2020; c.f. Yang and Zhang, 2017). This new framing of urban sustainability emphasises participation and engagement and has opened ways for more contextualised and local solutions and experimentation (von Wirth et al., 2019). Seyfang and Smith (2007) have recognised innovation and community action as important strands for sustainability, which highlights the central role of individuals in generating, sustaining and overthrowing everyday practices (cf. Shove and Walker, 2010). The collaborative approach has become a principal approach to environmental sustainability (e.g. Fadeeva, 2005). However, due to the theoretical orientation of sustainability governance research, which aims to generalise and classify sustainability pathways, the roles of local actors and contexts have often stayed hidden at some level. Moreover, despite the time bounding of sustainability processes, the concept of time has seldom been interrogated at the local level (yet, see, e.g. Barnes et al., 2018). Local sustainability innovations are often experimental, iterative and impermanent (Castán Broto and Bulkeley, 2013; Feola and Nunes, 2014). Thus, we examine how urban sustainability pathways emerge in a dynamic relationship between *ephemerality* and *permanence*.

Within the changed forms of *sustainability innovations* – referring to practices, objectives and initiatives (Korjonen-Kuusipuro et al., 2017) and supporting socially inclusive and environmentally desirable value creation in cities (Fratini et al., 2019) – the platforms of local innovations are also changing. Urban living labs are a prominent example of testing and developing innovations. They refer to a public space or places where a local government engages citizens in developing sustainability activities and solutions in conjunction with other actors, such as businesses and research institutes (e.g. Voytenko et al., 2016; Nesti, 2018; Ansell and Miura, 2019). Hence, ULLs have features of open innovation (e.g. Leminen et al. 2017; McCrory et al., 2020) and a 'quadruple' helix model of experimentation that brings science, policy, business and civil society together (Bulkeley et al., 2016; Nesti, 2018). A ULL is both a platform and a modus operandi that promotes urban sustainability through the co-production of knowledge (e.g. Bulkeley and Castán Broto, 2013; Evans et al., 2015; Kronell and Mukhtar-Landgren, 2018). Seeing ULL as experimentation and part of a broader shift in the ways how cities respond to urban sustainability challenges supports the approach that sustainability is emergent rather than pre-given (Bulkeley et al., 2016; McCrory et al., 2020). Urban living labs offer us the scope to address local sustainability transitions when a locality becomes defined by the birthplace of innovations.

The purpose of this paper is to examine the micro-scale emergence of sustainability pathways and to capture the reconfigurative dynamics of urban sustainable development. We study how diverse actors, including private enterprises and social and cultural actors, advance local sustainability transitions in Hiedanranta Urban Living Lab in Tampere, Finland. Analysing the Hiedanranta ULL offers us a suitable platform to contribute to the research gap: Besides a ULL, Hiedanranta is also a developing city district originating from an industrial brownfield. Thus, it covers not only the multi-actor collaboration but also the logics of urban development. To respond to our research questions, we apply temporal analysis. We combine a temporal typology (Grandin and Sareen, 2020) with an alternative framework for sustainability (Seghezzo, 2009), which we see as promising to address urban sustainability. The first question is empirical in nature and connects to the specific Finnish case, while the second is more interpretative and aims to place findings in a broader context:

How do local actors in the ULL support urban sustainability?

What are the incipient forms of sustainability pathways, and what kinds of potential do they have for local sustainability transitions?

Following the introduction, the paper proceeds as follows: We continue by presenting the research literature and theoretical concepts applied in this study. The literature search methodology was issue-based and selective. Then we move to the case study approach, data and analysis. The results section encapsulates the main findings. The last section concludes the results, with some recommendations and limitations of this study.

2. Theoretical Background

2.1. Reconfiguration: Dynamics of change

The concept of reconfiguration helps to understand the dynamics of the development of sustainability pathways. Despite the popularity of the concept in recent sustainability transitions studies, reconfiguration lacks strict definitions (Laakso et al., 2021). We apply the definition given by Geels et al. (2015) and developed by Laakso et al. (2021), who have applied reconfiguration to further dialogue between transition and practice theories. According to their definition, *reconfiguration* suggests that several institutions, actors and practices are expected to change in sustainability transition, resulting in a new combination of old and new elements (Laakso et al., 2021). It indicates the need for change in the domains like mobility, housing, heating, food production and consumption and acknowledges that transitions do not happen only through technologies, markets and institutional frameworks, but also through the cultural meanings and everyday life practices that must be exposed to change. Laakso et al. (ibid.) emphasise that research applying social practice theory is less hierarchical than the multi-level approach to transitions and finds reconfiguration taking place in the organisation of a practice or in relationships between practices (Shove, 2014). Overall, reconfiguration seems to be a flexible concept in transitions research. We utilise this flexibility to adopt a horizontal view of reconfigurations in the multi-actor development of local sustainability transitions.

While the multi-level perspective has dominated sustainability transitions research, many current lines of research focusing on urban sustainability emphasise horizontal views on transition dynamics or use a mix of horizontal and vertical approaches. These perspectives, although often leaving the term *reconfiguration* without explication, enrich our understanding of reconfiguration in urban sustainability transitions. For instance, when Frantzeskaki et al. (2016) explore the dynamics and opportunities of sustainability transitions in cities, we recognise that they speak about reconfiguration as a necessary condition of transition. These conditions are related to several place-specific features intrinsic to cities, such as proximity and interdependencies enabling the simultaneous co-existence of real-world contexts, multi-actor processes and the alignment of resources and actor constellations between multiple sectors.

Such features are distinctly urban and therefore particular to ULL development. To study the emergence of sustainability pathways in ULL, sustainability research must move towards an assessment of how ULL serves to adjust socio-material conditions and mobilise agency and resources (Bulkeley et al., 2016). This approach involves attending to the capabilities of organisations and institutions, but also examining how ULLs can reconfigure the capacities, resources and agency of actors, intermediaries and materialities in a particular urban context. It also involves paying attention to the consequent effects of reconfiguration. Thus, the transition potential of ULL is not only a matter of the institutions and actors involved, but how their (re)configuration or design realises new kinds of capacities and capabilities.

While the term *reconfiguration* is closely linked to the transition to sustainability, we take this relationship further by creating a link between reconfiguration and urban sustainability. Since the basic conceptualisation of sustainability carries severe limitations in addressing contemporary urban sustainability issues, stronger conceptual frameworks are needed. Interestingly, Seghezzo (2009) has developed alternative concepts for sustainability research and outlined a framework for more inclusive and plural sustainability policies. By replacing the conventional three-pillar model with the terms *place, permanence* and *persons*, Seghezzo (ibid.) pins sustainability to territorial, temporal and personal aspects of development, which have been largely neglected by the standard definitions of sustainability (Voinov, 2017). We consider this conceptualisation by Seghezzo promising in addressing urban sustainability transitions, and it forms the basis of our approach to sustainability.

Place, permanence and persons are not far from the distinct urban features we presented above. First, *persons* is an aspect of agency, and it is important to recognise the active roles and shifts of roles of single urban actors. For Seghezzo (2009), the relationship between nature and society is personal and involves feelings. We agree with his claim that change can be achieved only by individuals with different morals, values, rights and identities (Seyfang and Smith, 2007; Baccarne et al., 2014; von Wirth et al., 2019). Therefore, beyond material 'outputs', focus should also be paid to the 'inner life of the being that produces those outputs' (Seghezzo, 2009, p. 550). However, we see that agency is not limited to a single actor or a group of actors and their personal characteristics. Instead, it is the interaction and coexistence of different actors that makes a transition happen (Ornetzeder and Rohracher, 2013; Korjonen-Kuusipuro et al., 2017). Second, *place* is a shared sense of belonging, identity and culture. Place is also a source of facts that is important for networking (Seghezzo, 2009). Thus, the concept of place cannot be overemphasised when analysing urban sustainability transitions. The sense of place is often related to things that occur at different, sometimes distant moments and is attached to a certain temporal component (ibid.). Third, we agree with Seghezzo that *permanence* is not only a realm of intergenerational equity and maintenance of present conditions but also includes changes and improvements. In urban conditions, permanence is not an obvious achievement in many cases. For instance, experiments regarding urban sustainability are often ephemeral and require continuous external input, but this input may create a process that causes further reconfigurations beyond the experiment (Castán Broto and Bulkeley, 2013; von Wirth et al., 2019).

Place, permanence and persons serve as sustainability dimensions of our research approach, focusing on the micro-scale emergence of urban sustainability pathways in ULLs. Simultaneously, they help us keep our touch on key reconfigurations, which occur with respect to both systems and practices, and manifest themselves as heterogeneous configurations with co-evolving elements (Laakso et al., 2021).

2.2. Typology of temporal dimensions

In temporal analysis, permanence offers an interesting viewpoint for the path breaking of sustainability innovations. Unlike place and people, which are associated with visible and tangible assets, permanence is a more 'ideal', abstract and subjective projection of events into the future, and for that reason, its pertinence within the environmental debate has been largely underestimated (Adam, 1998; Seghezzo, 2009). The attraction of permanence is its ability to address changes (Seghezzo, 2009). As Giddens (1984) has articulated, 'Time is not a mere background for action and interaction, but it is inseparably correlated with space, social institutions and individual persons'. Thus, studying permanence seems pertinent to understanding local but also far-reaching implications of sustainability innovations.

We see that unpacking permanence is important to understanding how local transitions emerge and unfold. Grandin and Sareen (2020) propose a typology of temporal dimensions to help in assessing the dynamics between ephemerality and permanence in local transitions and how ephemeral initiatives relate to their long-term effects. By mapping sustainability transitions with a review of 150 recent research papers, Grandin and Sareen (2020) found that ephemerality is ubiquitous in local initiatives. This leads to a re-evaluation of permanence as an essential aspect of sustainability (cf. Seghezzo, 2009). In this paper, we address permanence as a structured sequence of events and performed repetition, which realigns depending on the initiative's specific characteristics and its positions in the sequence of other events (Madanipour, 2017; Grandin & Sareen, 2020).

Following Sareen and Haarstad (2018), Grandin and Sareen (2020) recognise that transitions comprise structural, relational and material changes. These types of changes play another analytical dimension in their temporal typology. However, we see that the novelty of typology, which we found particularly inspiring, is the development of temporal phases and their interconnections. In this study, we decided to apply only the temporal dimensions of the typology, since the empirical analysis is based on data from a single case. Temporal phases, presented in Table 1, serve us as an analytical tool. Despite focusing on temporalities, we do not leave out the nature of sustainability innovations. By adding another analytical strain, an alternative framework for sustainability (Seghezzo, 2009), we aim to address the particularities of *urban* sustainability. This framework emphasising place, permanence and persons is compatible with McCrory et al. (2020), who found that sustainability in real-world labs develops through a process defined by space, process and ways of organising.

Catalyse describes initiatives that contribute to conditions for change. These initiatives disrupt prevalent norms and practices to open new transition paths and to activate transformative change. Catalytic strategies vary from questioning and criticising unsustainable practices to demonstrating more sustainable alternatives (Grandin and Sareen, 2020). Actors can also reframe governance arrangements, networks and open spaces for new ideas and modes of local and collective action (Korjonen-Kuusipuro et al., 2017; Wolfram, 2018), engender new perspectives and mobilise inspiration from successful initiatives elsewhere (Johannessen and Hahn, 2013). Catalysing initiatives are often ephemeral, ad hoc or pop-up. As a temporary setting, ULLs can enable actors to innovate and implement their ideas quite freely (Grandin and Sareen, 2020).

Revamp describes driving local innovations and experimentation. Its power is tied to reconfiguration and influences future change trajectories (Grandin and Sareen, 2020). Reorienting transition paths can happen, for example by improving initiatives that have fallen into disuse (ibid.), adapting to changes and seizing opportunities, self-organising to foster innovation and new partnerships and reflecting shared aims and values (Hatzl et al., 2016). Revamping innovations is supported by openness and social learning, which enables the exploration of unusual ideas (Korjonen-Kuusipuro et al., 2017). This can happen through everyday practices, which steer sustainability innovation and support more sustainable practices.

Routinise describes searching for durability to overcome the fragmentation and ephemerality of local innovations. Routinisation can happen through institutionalising, such as creating new institutions or realigning the goals and structures of existing ones (Barnes et al., 2018). Other important means are standardising, normalising, networking and

Table 1
Typology of temporal dimensions applied in this study.

Temporal dimensions	Catalyse	Revamp	Routinise
	Open a space for new ideas and modes of local action.	Innovate to reconfigure, reinforce or reorient transition pathways.	Secure the longevity of activities and overcome the fragmented and fleeting nature of initiatives.

Source: Grandin and Sareen (2020, p. 77), modified by the authors.

commercialising. These are based on local learning and shared visions that actors cultivate (Grandin and Sareen, 2020).

The categorisation of three temporal phases enables us to assess the substantive, enduring and transformative impact of local and ephemeral sustainability innovations. The phases are connected, as sustainability initiatives can develop from catalysing innovations to revamping and realigning, and in some cases, they can have the capability to routinise transitions. Thus, the phases concern processes that amalgamate in a semblance of continuity (Grandin & Sareen, 2020.) Nonetheless, the phases do not follow linear processes. Instead, they display characteristics for change and the potential for sustainable transitions.

The typology emphasises that in the field of sustainability transitions, there is a great deal happening that does not endure but serves other functions. Therefore, despite ephemerality, local sustainability innovations can help sustainability pathways emerge and thus accelerate local transitions. Catalysing and revamping have the potential to align and create agency, but unless they are stabilised into routines, they risk disappearing. However, the durability of initiatives is not the inherent measure for sustainability, as temporal dimensions do not describe the inherent properties of sustainability innovations. For example, by creating temporary settings for experimentations, actors not only catalyse change, but they can also ground the revamping and reconfiguring of transition paths (Grandin and Sareen, 2020). Routinisation as a more durable phase is rarely an objective of the activities but is rather an outcome emerging from other dimensions that are transitory and cumulative. However, once achieved, routinisation needs to be maintained, for example, through repetitions (ibid.).

3. Methods

3.1. Case study: The Hiedanranta urban living lab

To study the emergence of sustainability pathways, we rely on the case study approach. This approach is suited to the creation of concrete, context-dependent knowledge, as it provides for an analysis of the interdependencies between actors and processes within their social settings (e.g. Harrison et al., 2017). Case studies also aim to understand the complexity and uniqueness of projects or systems in their real-life context (Thomas, 2011). When the objective is to achieve strong data on a given problem or phenomenon, a representative case or a random sample may not be the most appropriate strategy because typical or average cases are supposedly not the richest in information. In contrast, an information-oriented case selection aims to maximise the utility of information from small samples and single cases (Flyvbjerg, 2006; Ruddin, 2006). Besides the information richness, strategic case selection can increase the generalisability of case studies. Of the four basic strategies for information-oriented selection, we have applied the critical case method (ibid.) by choosing a case with strategic importance to our research task. We carried out a qualitative analysis of a Finnish ULL called Hiedanranta. As regards size, organisation and diversity, this ULL allows space for dynamic sustainability processes (McCrory et al., 2020) and exhibits the main collaborative innovation modes found in cities and neighbourhoods in Finland (Leminen et al., 2017). Hence, if our research demonstration is not valid for this ULL, it is hardly valid for any other cases in Finland.

Hiedanranta is a former industrial area located in Tampere, the third largest and rapidly growing city in Finland with 235,000 inhabitants in 2018. The Hiedanranta district is four kilometres from the city centre, on the gulf of Lake Näsijärvi. The city procured the area in 2014 to start a brownfield project for a new city district of 25,000 residents and 10,000 workplaces. Currently, there is no housing in the area. The next year, after establishing the Hiedanranta development programme in 2015 (City of Tampere, 2018), the city opened the area to the public. The idea was to use an open and collaborative approach that follows the principles of a circular economy to coordinate activities and generate ideas for the new urban district. Old industrial buildings were taken into use, and Hiedanranta became a platform for culture, research and development, start-ups and co-creation.

Defining the exact number of actors in the Hiedanranta ULL is difficult due to the ongoing development phase of the area, with some actors leaving and others moving to the area. The ULL has hosted about 40 R & D projects and experiments that promote smart technology, sustainability and circular economy solutions (City of Tampere, 2020; Särkilahti et al., 2021). Around five to 10 innovative enterprises have also settled down in Hiedanranta. Their expertise varies from sustainable food production to alternative sanitation and heating systems. There are also a few social enterprises that organise, for example, social rehabilitation and rehabilitative on-the-job training for their clients.

Hiedanranta gathers various cultural actors and artisans. There are three main groups promoting culture: the circus, skateboarding and visual arts associations. In addition, a dozen groups and individuals organise festivals and other sorts of events in the area. Cultural actors advance sustainability in several ways, and many are interested in participating in the development of the future residential district. The artisan community in the Paja building hosts more than 20 artists and artisans whose domains vary from visual arts to music and film making and handicrafts. The artisans work in partly shared workrooms, which support daily interaction. Many artisans draw inspiration from circular economy ideas, for example by using waste material on their products.

Due to the development phase of Hiedanranta, all the current activities risk being temporary, and the area is experiencing huge changes transforming into a residential district. Currently (2020−21), the Hiedanranta ULL is in an intermediary stage during which the city is taking steps in formal master planning and detailed planning and is preparing to start the first building projects in the area. Housing construction is expected to continue until 2045 (City of Tampere, 2020).

Hiedanranta is primarily a ULL type (Bulkeley et al., 2019), in which the city takes the lead and works with universities and local companies to transfer research into demonstration, achieve the first-mover advantage and take measures towards innovation, economic development and sustainable infrastructures. Simultaneously, Hiedanranta has distinct features of organic ULL, in which civic movements, cultural actors and other bottom-up activities provide an important resource for urban development (Alatalo et al., 2017; Turku et al., 2021). We considered both these ULL sides in the selection of case informants and data.

3.2. Data collection and qualitative case analysis

The main research data consists of 10 thematic interviews with 14 actors working in Hiedanranta. The interviewees were chosen based on ULL key actors that are recognised in the research literature and the particularities of the specific case study. The interviews were conducted between November 2019 and July 2020, and they mostly took place at the workplaces of the interviewees in Hiedanranta. The interviewees were local entrepreneurs working on green, technological innovations, associations that promote culture and community building, and artisans who aim to reduce waste streams by offering reparation services or using recycled materials in their products. The interviews covered the diversity of actors operating in the ULL, but research projects and teams were not included in the data due to their temporary nature. The main themes discussed in all the interviews were 1) motivations for and development of interviewees' innovation activity in Hiedanranta; 2) arrival to Hiedanranta and impressions and expectation of working there; 3) Hiedanranta as an operational environment, interaction and collaboration with other actors; and 4) changes in the ULL and shifting from temporary to more permanent. The interviews were supported by the planning documents of Hiedanranta and by two supplementary interviews conducted with the employees of the City of Tampere. With the supplementary data, we built a picture of Hiedanranta between the years 2015−2020. Table 2 introduces interviewees based on their innovation activity.

The interviews were semi-structured, and the role of the

Table 2
The list and number of interviewees categorised by their innovation activity.

Entrepreneurs for green, technological innovations		
Carbofex Oy	2	The company converts biomass into biochar with pyrolysis technology and CO2 negative biochar production.
Digi Toilet Systems Oy (DTS)	1	The company operates on alternative, dry toilet experiments, and nutrient recycling.
Polar Night Energy Oy (PNE)	2	Innovator of energy-sufficient heat storage for housing and industrial applications.
Associations for community building and culture		
Sopimusvuori ry	2	Social enterprise organizes work try-outs as rehabilitation activities for their clients.
Pirkanmaan Kaarikoirat ry	2	Association supports skateboarding by maintaining a skate hall, organizing training and events, and building skateparks.
SWÄG ry	1	Association promotes visual arts and electronic music, organises events and maintains cultural space Kuivaamo.
Sirkus Faktori ry	1	Group organizes weekly circus trainings, which are open for everybody.
Artisans for sustainable consumption		
Blacksmith	1	City smith offers reparation services works on his own products and teaches the profession.
Upholsterer	1	Upholsterer gives old pieces of furniture a new life.
Sewer	1	Sewer manufactures small bags and purses from recycled leather.
Supplementary interviews		
Employees of the city of Tampere	2	The interviewees have worked closely with social and cultural associations and artisans in Hiedanranta.
	n = 16 interviewees	

researcher−interviewer was to ensure that the same themes were discussed with all interviewees (Brinkmann, 2018). This let the participants pore over their ideas and bring in the issues they found relevant concerning the themes discussed. The interviews varied between 1−2.5 hours and were recorded and transcribed. The transcriptions were coded and analysed with an online tagging tool for thematic analysis (TA). TA has been labelled a 'cornerstone of qualitative data analysis', which is particularly suitable for analysing experiences, perceptions and understandings in context-specific settings (Riger and Sigurvinsdottir, 2016; Herzog et al., 2019). We analysed the interview talk in two rounds. The first round aimed to draw an image of the possible sustainability pathways from the narratives of interviewees. Attention was paid to the development of innovations, supporting and challenging factors, interviewees' arrival to Hiedanranta and expectations for the future. The second round was conducted to recognise the path-breaking events. Overall, the analysis combined elements of content-driven thematic analysis and theory-driven thematic analysis: The meaningful events for the development of sustainability paths were first drawn from the data, after which they were categorised according to the typology of temporal dimensions (Grandin and Sareen, 2020).

4. Analysis

4.1. Catalysing new beginnings

Entrepreneurs in the Hiedanranta ULL have developed their innovations to the point of commercial take-off, which has catalysed new sustainability pathways. Innovations have been implemented into the infrastructure of the developing city district, as exemplified by the sanitation system of the area. The enterprise Digi Toilet System (DTS) has generated a large-scale dry toilet experiment in the Kuivaamo cultural space and created a patented microthermal method for the safe recovery of nutrients. A local enterprise, Carbofex, operates a district heating plant in Hiedanranta, which is connected to the pilot of a heat storage system invented by another local company, Polar Night Energy (PNE). By implementing innovations in temporary infrastructure, the enterprises have gained experience, and they have also been able to invite people to test their innovations in a real-life setting. The possibility of this kind of testing is rare for small enterprises and their customers. Thus, it has attracted people to visit Hiedanranta and familiarise themselves with the innovations, as well as supported the emergence of new partnerships. Meanwhile, other actors working in the ULL operate as a test group. In the case of the dry toilet experiment, they have also become co-developers of the innovation.

Demonstrating alternatives promotes sustainable practices. By selling customer experiences, entrepreneurs attempt to change conventional thinking and encourage openness towards sustainable solutions. The citation below between two engineers of PNE describes the aim to open space for more sustainable alternatives in Finnish sauna culture. When discussing alternative sauna stoves, they end up generating ideas for community saunas operating on their heat storage technology. Thus, technological innovation expands from an ecologically sustainable alternative to social innovation and community building. Social and cultural actors had various expectations and attitudes towards the experiment: Some saw it as a good incentive to do repair work in the sauna while testing another stove, while others were sceptical whether it is possible to find a challenger to a traditional sauna stove. In general, the experiment was welcomed with much interest, and local actors participated in a test group of a new stove.

- *…if there are more public than private saunas, energy use would be more environmentally friendly. (…) Everybody turning on their saunas at 7 PM is a big burden for the power grid.*
- *I have talked, this kind of joke, about fooling people that this is a wood-burning sauna. (…) I agree that burning wood in a sauna stove gives good steam ('löyly'), because it has more energy than an electric stove. It is easy to breathe and steams well. And dammit, it smells good. I think it is all these aspects and a visual side of burning wood that makes a good sauna. But all this can be emulated without burning wood.*
- *From an engineer's point of view, I think we should change the idea in sauna culture that a non-wooden stove can also offer a good sauna experience.*

When PNE entrepreneurs contacted the city, their original idea of installing solar panels on a sound barrier in one neighbourhood developed to pilot their heat storage system, as some city officials saw its potential and offered a place for a pilot plant in Hiedanranta. Later, Hiedanranta influenced the scale of the pilot, when it became connected to the district heating network. The sustainability aims of the Hiedanranta ULL have also catalysed completely new sustainability pathways. The company DTS ended up extending its innovation activity from alternative toilet systems to toilet waste disposal to better promote the nutrition cycle, which is one of the main themes of the Hiedanranta ULL.

Cultural actors arrived in Hiedanranta mainly due to an attraction to the area. They were inspired by the idea of vacant factory buildings and the incompleteness of the area, enabling 'endless possibilities', as an organiser of a street art festival put it. Inspiration was nourished by the creative places all over the world that the cultural actors visited. Cultural actors saw the same kind of potential in Hiedanranta. The citation below illustrates the creative ideas the interviewee wanted to import and recreate in Hiedanranta and the comparisons between places.

- In 2014, I visited an art district in Peking, which has similarities with Hiedanranta. It is a huge industrial zone with lots of public art and paintings on streets, diverse actors, shops, not sure about dwellings, what is planned in Hiedanranta, too. Also, I was inspired by the Darwin area in Bordeaux. … Again, it is a bit like Hiedanranta, but the buildings are lower.

Civil society actors in Hiedanranta promote mainly cultural activities, but some of their objectives also support social sustainability. First, the skateboard association, Kaarikoirat, aims to change its work culture to be more open, inclusive and free of hierarchies. By creating practices that support these aims, the association demonstrates an alternative work culture to its members. Operating in Hiedanranta has enabled skateboarders to practise their skills in organising recreational activities, community work and building skateparks. This has increased trust in the association and resulted in new projects and funding. Second, the social enterprise, Sopimusvuori, aims to bring their knowledge on community building to the heart of the developing city district. Sopimusvuori organises rehabilitative on-the-job training in Hiedanranta, based on recognised local needs. With ad hoc activities, the enterprise has been able to offer their clients meaningful work experiences, from cafe work to gardening and the maintenance of old buildings. Ad hoc activities are reactive and thereby enable wide networking and spreading experience on community work to new domains.

The interviewed artisans contested disposal culture by providing products or services where waste is reduced by using recycling materials or restoring and repairing things. They criticised prevailing consumption practices and offered sustainable alternatives to replace them. During the years of entrepreneurship, ecological aims had become a part of the everyday life of artisans and were no longer actively brought up. However, sustainability as a value affected the work of artisans behind their habits.

The analysis of the catalysis of innovation paths in the Hiedanranta ULL reveals the importance of the City of Tampere in governing innovations. The openness to and tolerance of new ideas and the determination to promote sustainability, innovation activity, culture and community have enabled a diversity of actors and innovations. This demonstrates that the ways in which ULLs are conducted are central to the possibilities for transformative processes (Bulkeley et al., 2016). Thus, more than designing a platform or an arena to address particular sustainable challenges, the city has supported the emergence of sustainable innovations and, at least in some cases, steered innovations to new paths.

4.2. Revamp innovations and develop further

Entrepreneurs in Hiedanranta have reoriented and revamped their innovations by creating networks and combining their expertise. Cooperation has resulted in new applications of innovations or shifting to a whole new domain. As an example, DTS has started to cooperate with researchers studying the wooden industrial waste called zero fibre, helping to co-create solutions for this environmental problem. Zero fibre sedimented on the lake bottom during the area's industrial history. In this case, the realignment of innovation activity stems directly from cooperation with another actor in Hiedanranta who is solving a local problem. Despite the experimental character, the DTS entrepreneur saw cooperation with zero fibre researchers as a promising development path.

The community sauna project in which PNE took part exemplifies experimental cooperation between an enterprise, academia and civil society actors. In this project, the innovation of a heat storage system attained new uses and meanings when brought to new surroundings. The sauna project illustrates the transformative potential of further development, which in this case stems from cooperation and recognised needs for innovation. In addition, Carbofex has embarked on diverse projects in Hiedanranta. Some of them are oriented towards developing new technological innovations by combining expertise with other innovative entrepreneurs and research in the area, whereas others are based on everyday sharing and community support. Through experimental cooperation with diverse actors, the enterprise has explored new applications for their products and by-products.

Local culture actors and artisans are united to support the continuity of arts, culture and community activities in Hiedanranta. The Kaarikoirat skateboarding association cooperates with research projects and educational institutions to better articulate their value to city administrators. Networking with academic institutions provides skaters with knowledge that is not explicitly available to them, and it also enables linkages with formal institutional processes (cf. VanHoose and Savini, 2017). By networking, skaters aim to maximise the internal resources of the group and keep the focus on promoting skateboarding, community building and employment.

We found several examples of how employment provided social resources in the ULL. For Kaarikoirat, employment was consciously used to create a safety network for their members, to spread the alternative work culture and to equip members for their future work life. Transforming social networks and power relationships in a work environment affects members of the association, and through members, the larger community. Instead, Sopimusvuori uses employment to empower their clients and cultivate openness. The clients of Sopimusvuori are mainly the long-term unemployed with difficulties in managing their daily life or with limitations in finding employment or education. Thus, rehabilitative on-the-job training is used to encourage participation and destabilise the ways that outcast people are seen in society. The conversation between two employees of Sopimusvuori describes how meaningful work and a role in society are important for social sustainability and community building:

- *… the aim of the on-the-job training is that our clients who come here are not objects, but subjects.*
- *Yes, and it is important that they have work roles here. … They have workwear, and they do…*
- *Our clients come here to work, not to rehabilitate. They say that they come here to work. On a work shift, they take a photo of themselves in front of a mansion (place for training in Hiedanranta) and send it to their children. This is Dad's workplace; this is Mom's workplace.*

The diversity of actors working in Hiedanranta supports the exchange of services, and cooperation creates new uses for skills. For example, the smith had found ways to cooperate with almost every actor in the area. The cooperation and new clientele demonstrate the utility of "the city smith" in fixing everyday products from door handles to snow shovels. Because of the service's easy accessibility, it encourages repair instead of buying new things. Coworking has also enabled learning from other people. Working in the artisans' community, Paja, has enabled actors to learn about entrepreneurship from others and thus obtain new perspectives on their work. Sharing a workspace motivated and supported the exchange of ideas and experiences and has resulted in the further development and amelioration of some products.

Analysing the ways that local actors have revamped their innovations revealed multiple examples of cooperation and interaction at different levels. Unexpected collaborations were created between actors who operated in different domains and had little in common at first sight (see also Turku et al., 2021). However, collaborations also brought challenges: Due to everybody's priorities to advance their own interests and objectives, the resources to cooperate were sometimes very limited. This has led to inequity among actors, as some actors put more effort into community and cooperation than others. Especially in recent years, the competition for resources and the support from the City of Tampere have become more tense, causing conflicts among actors. Many actors depend on city support, and they compete for investments and renovations that the city, as the owner of the area, makes in industrial buildings. Renovations can be essential for the continuity and amelioration of innovation activities.

4. 3. Routinise for a secure future

Enterprises have attempted to routinise innovations through productisation and commercialisation. Carbofex has started to sell the energy they produce even though it is more like a by-product of the

company. However, the trade of heat energy secures its cash flow and, thus, supports the permanence of innovations. Successful productisation also enables the development of other innovations. For Carbofex and other enterprises in Hiedanranta, commercialisation has been an important tool for value creation, finding partners and financing. The following quotation describes how Carbofex works to prove the value of their innovations and to routinise cooperation:

> *- When working in the commercial sector, the aim is that someone sees the value of our products and wants to cooperate. Of course, we want to tell people that we do this and how they could benefit from this. We hope that the city (of Tampere) sees our value to them and would like to keep that (in Hiedanranta). The developing area would also be a suitable partner, so in that sense, it would be pretty nice to stay here.*

Moreover, the artists and culture and community groups have applied marketing and value creation to support permanence. The value of their work relies on public opinion and acknowledgement of their innovations among citizens. To build community support, culture actors and artists have attempted to get as many citizens as possible to visit and experience Hiedanranta. They have also presented their innovations in several news articles and 'open door' events.

To routinise culture and community innovations in the developing area, local actors have also aligned their initiatives by creating organisations and strategies for funding. The artisans have formed an organisation to help in advertising their expertise and to make their services accessible to customers. A cultural coordinator of Hiedanranta has led some initiatives to organise diverse actors. The coordinator has gathered people to plan the notion of art and culture for the master plan of the area. The actors have also collaborated to plan a strategy for the future funding of culture activities in Hiedanranta. These examples of strategies for organising and funding are based on cultural actors' shared visions and future objectives.

The groups of cultural actors have also strengthened their self-organising activities. Kaarikoirat started as a non-profit skateboarding association, but recently they have decided to form a cooperative to the side of the association. Skate schools and activities of supported employment continue to be arranged under an existing non-profit association. However, multiple skatepark building projects will be transferred to a new cooperative. The separation of activities is essential for the continuation of the skatepark as a municipal place for sports and leisure, whereas the cooperative enables commercial activity and supports the development of the association and the employment of its members.

To enhance the continuity of their sustainability work, Sopimusvuori aims to ensure that all their clients find a study or workplace after finishing their training in Hiedanranta. Such trail building is supported by cooperation with educational institutions, and the training in Hiedanranta thus opens possibilities to continue studies elsewhere. Creating paths not only supports the individual development of participants, but also translates community and social innovations into new environments. This shows how social sustainability is transferred outside the primary operational zone of the organisation.

The group of circus actors managed to routinise some cultural activities in Hiedanranta through openness for everybody to translate their ideas. The Sirkus Faktori association launched several cultural events in the area that brought local people together and encouraged networking. The events were supported by the community in Hiedanranta. Later, new actors developed them further. The community events started to live their own lives when some new actors stepped in to organise them and others opted out, leaving space for new ideas and makers. This illustrates how openness and setting an example can support continuity.

When Hiedanranta develops as a mixed-use residential area, changes in the current activities of the ULL are inevitable. Due to the temporarity, local actors try to accelerate their innovation processes and make efforts to prove their value for the future city district. However, while several interviewees are in a critical phase to expand their innovations, they see that the City of Tampere is no longer agile enough for fast decision making or investments to support local activities. This brings us to the debate addressed by Bulkeley et al. (2016) on how and why institutions govern innovations and orchestrate ULL to produce outcomes, as well as foreclosing on others. Generally, interviewees saw the city's changed attitude towards supporting innovations because of the end of an in-between stage of development (Stevens and Dovey, 2019). The shift from temporary uses to the construction phase of a new residential area forced several actors to consider moving elsewhere, which poses a risk for the continuity of some sustainability innovations. Yet, none of the interviewees wanted to leave the Hiedanranta ULL.

5. Results and Discussion

5.1. Emerging pathways

Our analysis of the ignition of sustainability pathways and the reconfiguration for transition was based on two strands. The first strand – the temporal axis between ephemerality and durability – is demonstrated through the typology *catalyse, revamp and routinise* (Grandin and Sareen, 2020). The second strand illustrates sustainability through the dimensions of *persons, place and permanence*, which form an alternative framework for urban sustainability (Seghezzo, 2009). Based on our empirical case study, we present the Hiedanranta ULL (*Place)* as a

Table 3
The incipient forms for sustainability pathways in the Hiedanranta ULL.

	Place: The Hiedanranta ULL		
Permanence: Temporalities / **Persons**: Actors	Catalyse	Revamp	Routinise
Entrepreneurs for green, technological innovations	Implement innovations in temporary infra, scale innovations Learn from elsewhere, translate and further develop existing ideas Respond local needs Disrupt prevailing practices and demonstrate alternatives	Cocreate and explore unusual ideas through coworking Realign functions	Commercialize and productize innovations
Associations for community building and culture	Plan activities ad hoc basis Become inspired by the place Demonstrate alternative work culture Import creative ideas from visits abroad	Find new partners Share values and objectives Empower people and build safety networks through employment Cultivate openness	Form organizations and strategies for funding Assure trail building Translate successful ideas
Artisans for sustainable consumption	Criticize prevailing consumption practices and offer alternatives Network locally to acquire new clients	Learn from fellow actors Share visions	Club together and get organized

connective element that brings together different actors *(Persons)* and interlinked temporal phases, creating continuity *(Permanence)*. Understanding permanence as realigning sequence of events and as performed repetition allows it to merge with temporal phases of typology. Table 3 combines these two strands and summarises the main findings on how local actors in the Hiedanranta ULL support urban sustainability.

Analysing the emergence of local sustainability pathways guided our focus on practices supporting sustainability. Table 3 presents the incipient forms for sustainability pathways through activities. While some forms point to objectives and initiatives of activity, others relate more directly to the active doing of things (c.f. Korjonen-Kuusipuro et al., 2017). By illustrating sustainability innovations through verbs, we emphasise the agency of local actors and their innovative ways to cooperate. Once the activities presented in rows in Table 3 are connected from left to right, they present the development of initial forms of sustainability pathways. For example, concerning the first row, the company DTS started in Hiedanranta by developing an alternative toilet system to the needs of local cultural space. Later, this innovation and revamping activity was interrupted by researchers in Hiedanranta who asked DTS to participate in a collaborative project seeking new uses for zero fibre. Hence, two potential sustainability pathways emerged for DTS before the stage of routinisation, one related to circular use of zero fibre and the other focusing on alternative toilets for the promotion of urban nutrient circulation.

In the previous section, the analysis was structured on temporal phases presented by Grandin and Sareen (2020). About the sustainability framework of Seghezzo (2009), we interpreted these phases as sequences of permanence. To emphasise the interconnectedness of the two strands cross-analysed in Table 3, we will next summarise the key findings for the emergence of sustainability paths from the aspects of persons and place, the two remaining dimensions of the sustainability framework.

Persons are connected to all temporal phases through agency. In Hiedanranta, the action is relatively small scale, and experiences and activities are based on individuals and their motivations and interests for sustainability. The division of actors in Table 3 shows the diversity of actors and sustainability innovations and demonstrates that agency is not limited to entrepreneurs, as civil society actors also have an important role in advancing urban sustainability (Turku Turku et al., 2021). Besides promoting culture and the arts, local civil society actors develop social practices that support openness, participation and equality. Our findings are in line with research on grassroots innovations for sustainability, emphasising the importance of civil society actors as a source of innovative diversity (e.g. Seyfang and Smith 2007; Smith et al., 2014). Following Seghezzo (2009), the sustainability dimension of persons illustrates how ecology as a value affects the work of artisans and how interviewed actors have become part of the Hiedanranta ULL with their personal sustainability identities.

Despite the differing motivations and domains, the spatial proximity of actors has generated many forms of cooperation. Thus, we found that the innovation potential of the Hiedanranta ULL builds on the place that gathers diverse people and practices. According to studies (Ornetzeder and Rohracher, 2013; Korjonen-Kuusipuro et al., 2017), grassroots civil society innovations are often deeply embedded in local communities and places. Our case study verifies this and emphasises the agency of entrepreneurs. Individuals depend on surrounding networks of actors – such as external resources for product improvement and sources of new ideas – which underscores the importance of shared resources in open innovation systems (Korjonen-Kuusipuro et al., 2017) and the 'quadruple' helix model (Bulkeley et al., 2016; Nesti, 2018). Thus, coexistence is crucial for emerging forms of sustainability pathways. Nevertheless, we see that actions in varying development phases are differently sensitised to place: Catalysing requires a protective space, revamping entails a multi-dimensional exchange of opportunities, and routinising deepens the employment of the resources of the place. In the Hiedanranta ULL, place inspires actors but also enables sustainability initiatives in the catalysing phase. Revamping, conversely, happens through sharing and learning from other actors of the ULL. Finally, when routinising sustainability paths, the achievements gained in ULL support transmitting sustainability innovations, and the community of the ULL works as a resource to consolidate continuity across temporal phases. Consequently, sustainability develops as an emergent normative property of the Hiedanranta ULL (Bulkeley et al., 2016; McCrory et al., 2020) and takes several paths.

5.2. Reconfiguration through incipient forms of sustainability paths

As our second research question was interpretative and conceptual in nature, the latter part of the results is also that and places findings in a broader context of local sustainability transitions. With the typology of temporal phases, we have provided a more detailed understanding of the emergence of sustainability paths. Nonetheless, the boundaries of such temporal phases are not strict, and the same activity can present elements of several temporal phases. The connectivity of dimensions is explained by the progressive and cumulative development of sustainability. The horizontal axis in Table 3 demonstrates how catalysing can self-reinforce paths, trigger revamping and in some cases lead to routinisation. The example of artisans is illustrative: Networking with other local actors has enabled artisans to find like-minded people with whom they share values and visions. The shared objectives have been used to support the durability of activities when artisans have formed an organisation, joint projects and common strategies for the future. The above example of the DTS company is another indication of the initial formation of sustainability paths. The cumulative nature of sustainability also explains why Table 3 has more content on its left side: Not all catalysing initiatives become processed up to routinisation. While some wither, others find ways to transmit sustainability potential, instead of gaining permanence, as such (Seyfang and Smith, 2007; von Wirth et al., 2019). The schematic arrow in Fig. 1 presents this temporal development, showing that the relative proportion of emerging sustainability paths decreases as the paths become more permanent.

We found that reconfiguration happens through temporal phases: to understand the emergence of sustainability pathways, the focus must be on all three phases and their interconnectedness. All the phases are touched by the dynamics of ephemerality and durability, and the tensional relationship generates the path breaking. Thus, catalyse, revamp and routinise are active parts of a reconfiguration, where co-evolving elements reorganise for transition (Laakso et al., 2021). We have traced the critical moment of path breaking in revamping, which we see as a strategic turning point: After catalysing has triggered innovations to revamping, development may take many directions. Some lead to the emergence of sustainability pathways and routinisation. Revamping can also disperse a catalysed impact when innovations do not continue to refine into pathways. Drawing attention to revamping facilitates recognising sustainability pathways before they emerge, which helps to support the path breaking of the most promising sustainability innovations and reinforce them towards routinisation.

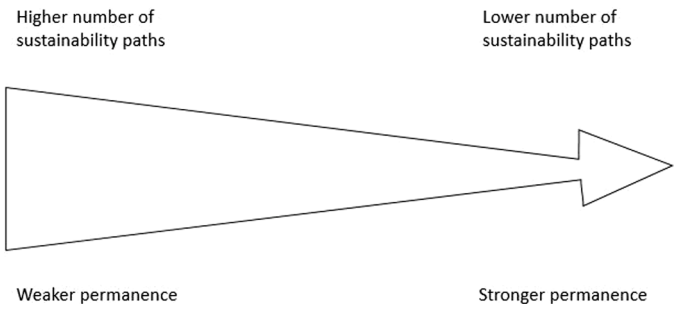

Fig. 1. The arrow of temporalities depicts the possibility of sustainability transition.

Interrelations of temporal phases illustrate how permanence is not an inherent measure of innovations, but it can be established in many ways. For some innovations, permanence is the desired state as such, and it can thus support the withdrawing of the innovation from its initial context. In the studied case, the actors illustrated this by the commercialisation of innovations, which they perceived as a tool for value creation, finding partners and financing. Our analytic emphasis on the relationship between permanence and place helped us to find the diverse ways the ULL can generate urban sustainability innovations and secure continuous reconfiguration for the emerging sustainability paths. The aspect of permanence resonates with transgenerational sustainability, but the specification of this relationship remained outside our research scope.

6. Conclusion

In this paper, we have studied the emergence and potential of incipient forms of sustainability pathways and the agency of local actors promoting sustainability transitions. The combination of two analytical strands enabled us to study the micro-scale emergence of urban sustainability pathways in a local context. The sustainability dimensions by Seghezzo (2009) helped us to examine the temporalities of emerging sustainability pathways at close range as they offered benchmarks that are beyond processual analysis (Grandin and Sareen, 2020). They also helped explore key reconfigurations occurring at levels of systems and practices (Laakso et al., 2021). As our research questions combined empirical and interpretive approaches, the contributions of this paper are both empirical and conceptual.

First, our empirical contributions demonstrate a vast array of innovations by which local actors in the ULL promote urban sustainability. These include social and cultural practices, consumption, everyday life and social learning as well as ecological improvements through technological innovations. An important result is that the agency is not limited to entrepreneurs, but also artisans and local associations, whose activities for culture and community-building generate sustainable innovations. The innovations are developed not only by individuals but also collaborations. Hence, our micro-analysis of an early-stage transition uncovers relationships and continuities, i.e. initial forms of sustainability pathways, that may remain invisible for general level studies. We suggest that analyses of actor groups together should gain more attention in sustainability transitions research, especially due to the importance of a shared place and interactions supporting path breaking.

Second, our conceptual contributions are built on temporal dimensions. Grandin and Sareen (2020) encouraged researchers to apply and test their typology with empirical cases and data, and we took up the challenge. As expected, some practices for sustainability easily found their place in the typology, but others were more challenging: the category of revamping was the most indefinite of the three dimensions and resulted in difficulty classifying findings. Although we followed the typology, the relationships of temporal dimensions were clarified further, due to the needs of empirical work. By *catalyse*, we refer to temporal beginnings and openings for sustainability pathways, whereas *routinise* as a more permanent phase relates to supporting the continuity and durability of already emerged paths. Between them, *revamp* has the intermediary role, and we define it as reorienting already catalysed innovations. It is thus a turning point towards routinisation and the phase when *reconfiguration* is at its strongest. With these clarifications, we emphasise the unique roles of the phases and, meanwhile, their interconnections.

The three time-bound practices – catalysing, revamping and routinising – were helpful in the analysis because they proved (1) to be distinguishable forms of organising, (2) to create a characteristic pattern to be studied as a possible contribution to emerging sustainability pathways, (3) their sequential order provides information about temporalities and shifts ranging from strong ephemerality to routinisation, (4) each of them can be related to Seghezzian dimensions of place, persons and permanence to examine reconfigurations that are probably most relevant to sustainability and (5) in this cross-demonstration, routinising and permanence can be paired for the specific purpose of finding connections between short-term options and long-term horizons of sustainability pathways, based on the assumption that routinisation entails a process that creates the capacity for path creation and institutionalisation.

We have applied the case study approach and chosen a single case. Generalisability, when understood as a claim "what is the case in one place or time, will be so elsewhere or in another time" (Payne and Williams, 2005), is evidently a challenge for the single case study approach. As described in the Methods section, we have utilised the critical case method (Flyvbjerg, 2006) and studied the case chosen, i.e. the Hiedanranta ULL, for its strategic importance with the aim to strengthen the validity of the study. Another challenge for the case study approach might be addressed in terms of reproducibility and replicability. Since the replication of qualitative fieldwork is necessarily limited, in qualitative research reproducibility and replicability are replaced by the transparency of the research process (Jacobs et al., 2021). Regarding the reliability of our study, we have thus described in the Methods section the main process of data collection (i.e. 'production transparency') and the main process of data preparation and analysis (i.e. 'analytic transparency'). A further challenge of this research was how to distinguish sustainable innovations from other daily activities carried out in Hiedanranta, as all activities fostering positive change cannot be considered sustainability innovations. In addition, when the scale and scope of innovations vary, the transition potential is not easily estimated regarding local and transferable innovations.

With this paper, we cannot draw lessons from the continuity of pathways or from the transition potential of a ULL. However, based on our findings, the studied ULL seems to be a promising type to advance various sorts of sustainability. By adopting a horizontal view of reconfiguration, we were able to direct the starting points for local sustainability transitions. The findings based on temporal development of micro-practices as an entry point to the emergence of initial sustainability paths form our major contribution to the research of urban sustainability transitions. Opportunities to recognise early signs of transition potential of ULL activities help researchers, practitioners, decision-makers and other stakeholders develop ULL based sustainability governance in cities. For further studies on local sustainability transitions, we suggest that the analysis of 'temporal logic' aligning a sequence of events should be stretched to further stages of developing sustainability pathways. Overall, more attention should be paid to persons and a place related to temporal phases.

Funding

This work was supported by the Strategic Research Council at the Academy of Finland (Grant number 320206, project CICAT2025).

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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