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SPECIAL FEATURE: ORIGINAL ARTICLE

Agriculture (re-)territorialisation: Balancing the Promotion of Local Products and International Trade in Europe

Socio-techno-ecological transition dynamics in the re-territorialization of food production: the case of wild berries in Sweden

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Abstract

Recent geopolitical and economic crises underline the need for a European transition towards a more sustainable food system. Scholars and policymakers have called for a re-territorialization of food production to strike a better balance between local, regional and global value chains. This paper explores the role of re-territorialization through an analysis of the emergence, development and current transformation of the Swedish wild berry value chain. The analysis combines the multi-level perspective on sustainability transitions with a socio-techno-ecological system approach and draws on interviews, informal conversations, participant observations and a range of secondary sources. The resulting case narrative shows how processes of de-territorialization may result in regimes that fail to address sustainability potential and problems. It also highlights that processes of re-territorialization challenge established regimes by promoting niches that represent different, albeit complementary, value chain configurations. Apart from a rich empirical narrative that brings useful knowledge to stakeholders to the Swedish wild berry value chain, the paper contributes to the theoretical understanding re-territorialization, shows how the ecological dimension can be accounted for with the multi-level perspective on sustainability transitions and presents a number of general policy implications.

Keywords Sustainability transitions · Multi-level perspective · Socio-techno-ecological systems · Re-territorialization · Food systems · Swedish wild berries

Introduction

Recent geopolitical and economic crises underline the need for a European transition towards a more sustainable food system (Toffolutti et al. 2020; Vittuari et al. 2021; Behnassi and el Haiba 2022; Nchasi et al. 2022). This involves trade-offs between a range of values that appear on different geographical scales, including self-sufficiency and resilience, economic development, wellbeing of agricultural workers, supply of affordable and nutritious products, and low environmental impacts (Khoury et al. 2020; Mausch et al. 2020; Vågsholm et al. 2020; Antle and Valdivia 2021). An important aspect that influences the realization of these values is the geographical configuration of food value chains. After several decades of increasingly globalized structures and growing international trade with food products, scholars, policymakers and even incumbent firms call for a better balance between local, regional and global configurations (Smith et al. 2016; European Commission 2020; SAPEA 2020; Wood et al. 2023). An example of recent policy developments in this direction is the EU's 'Farm to Fork Strategy', which emphasizes the importance of connecting sites of production and consumption (European Commission 2020). While this is mainly highlighted from a food security perspective, it also aligns with the need to cut transport-related carbon emissions and maintain social and environmental product standards. In addition, distance within food

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value chains is framed as a justice issue, referring to the outsourcing of environmental and social harms to producer countries on the one hand, and the precarity of migrant workers in Europe on the other, problems to which the just food transitions movement tries to respond (Tribaldos and Kortetmäki 2022).

In this paper, we adopt the notion of "re-territorialization" as we approach the transition towards a more sustainable food system. Re-territorialization has previously been used as an umbrella concept to encompass the construction of niche products linked to local "terroirs", strategies used by farms to the capture "non-food-related value", alternative food networks built around reflexive localism, and institutional arrangements such as Protected Designation of Origins (Jarosz 2008; Schneider et al. 2016; Berti 2020). The essence of re-territorialization can thus be seen as a food system transformation that occurs in response to fractures with nature, producers and consumers. While this could also be understood in terms of localization and regionalization, these concepts are not only vaguely used, but also contested (Kneafsey 2010). What we see as promising with the notion of re-territorialization is that it, apart from referring to processes that re-connect food production and consumption to local and regional scales, also semantically denotes re-establishing a connection between food and nature. To fully understand the prospects of re-territorialization, however, it should be discussed against a backdrop of de-territorialization, which refers to the severing of connections established through original territorialization processes. In line with Raffestin and Butler (2012), we, therefore, approach de- and re-territorialization as interlinked processes.

We also argue that inquiries into the dynamics of de- and re-territorialization should draw on the sustainability transition literature and its insights about transformative change in societal modes of production and consumption (Markard et al. 2012; Köhler et al. 2019; Savin and van den Bergh 2021). In particular, the multi-level perspective on socio-technical transitions, which highlights tensions and dynamics between developments at landscape, regime and niche levels, constitutes a useful theoretical lens (Rip and Kemp 1998; Geels 2002, 2005). When applied to the food sector, however, the socio-technical system perspective which underlies the MLP (Geels 2004) should be broadened to a socio-techno-ecological system approach that except for the social and the technical also accounts for ecological dimensions (Ahlborg et al. 2019; el Bilali 2020; Tribaldos and Kortetmäki 2022).

An interesting empirical domain to explore in this context is non-timber forest products (NTFP), such as wild berries, mushrooms and game, whose biological properties, exchange value and cultural significance are intertwined with their geographical origin (de Beer and McDermott 1996; Olofsson et al. 2022). While most social science research on NTFPs has focused on subsistence foraging by households in low-income countries, recent studies have also looked at commercial value chains that serve international markets (Jensen 2009). However, a link to the re-territorialization of global food systems is yet to be established, and the literature generally adopts socio-economic (Shackleton et al. 2011; Sisak et al. 2016) and socio-ecological (Lopes et al. 2019) perspectives that fail to fully capture the role of technology (an exception is Adam et al. (2013)).

Against this background, we present an analysis of the emergence and current development of the Swedish wild berry value chain. This case departs from natural ecosystems that each year produce up to a million tons of bilberries (*Vaccinium myrtillus*), lingonberries (*Vaccinium vitis-idaea*) and cloudberries (*Rubus chamaemorus*) (SLU 2022). With their deep blue, red and golden colors, these berries put a characteristic mark on forests, mires and mountains throughout Sweden. Indeed, berries have become important culturally as local delicacies, or simply as nutritious food, that link urban society to the natural environment. As a domestically available food source that is not associated with environmental impacts related to agriculture (e.g. land-use, irrigation and fertilization), they may also play an important role in a more sustainable, future food system.

Although berries are localized in a geographical, biological and cultural sense, the Swedish value chain has undergone several historical transitions characterized by increasing de-territorialization. The current regime is associated with low domestic value-added and extensive international trade as well as a near complete reliance on migrant berry pickers from low-income countries (Uddstål 2014; Casimir et al. 2018). Meanwhile, only a few percent of the available berries are collected and used for human purposes. This situation has for years been problematized and debated from different perspectives (Livsmedelsföretagen 2013; Wingborg 2011, 2013; Uddstål 2014; Axelsson and Hedberg 2018; Casimir et al. 2018; Carmo and Hedberg 2019). Some argue that there is potential to increase the collection of berries and thereby realize more of their associated benefits. Others highlight that exporting berries as a raw material that has undergone little to no processing represents a lost opportunity in terms of tax revenue and job creation. Yet others focus on the situation of migrant workers, who are not only empowered by their earnings, but also exposed to precarious work and even human trafficking. These issues are addressed by recent niche initiatives that aim to transform the regime through social and technical innovation (RISE 2022; Umeå University 2022). After decades of de-territorialization, there is accordingly a countermovement that strives for re-territorialization.

The Swedish wild berry value chain is a relevant case to explore to learn more about the role of re-territorialization in the transition towards a more sustainable food system,

particularly since longitudinal research from a broad system perspective is largely lacking. When analyzing the case, our empirical aim is to identify the dynamics which govern de- and re-territorialization in the emergence, development and current transformation of the value chain. We combine the MLP framework with a socio-techno-ecological system approach and use a wide range of data sources, including interviews, informal conversations and participant observations. While our analysis is mainly qualitative, we also draw support from quantitative data about trade, patents, publications and berry yields. In the end, the paper provides a rich empirical narrative, contributes to the theoretical understanding of re-territorialization, shows how the ecological dimension can be accounted for with the MLP framework, and presents a number of policy implications.

Theoretical framework and methodology

The theoretical framework used in this paper departs from the notion of re-territorialization, which, as discussed in the introduction, has been applied in research on sustainable food systems (Berti 2020). However, the concept is rarely linked to its theoretical heritage in Deleuze and Guattari's (1987) discussion of investments of energy in different practices (territorialization), withdrawing such investments (de-territorialization), and re-investing the energy elsewhere (re-territorialization). Examples span from the de-territorializing effects of capitalism and the re-territorialization of financial streams by the capitalist state to the de-territorialization of a tune in jazz music. This more-than-geographical understanding is in line with Deleuze and Guattari's (1996) idea that philosophy was about the creation of new concepts, which could further new thinking and practices. Geographers and political theorists have, however, used de- and re-territorialization to denote practices of forming, severing, and re-establishing connections to a particular geographical place, often highlighting how the underlying notion of territory is much more social and relational than the land that it is commonly conceived as (Raffestin and Butler 2012; Elden 2018). Further inspiration can be found in Latour's (2018) argument that the understandings of the global and the local are too narrowly understood; the global as representing a single vision, rather than taking into account a multiplicity of beings, cultures, and phenomena, and the local as either not modern enough or as promoting tradition and identity within national and ethnic borders. Instead, Latour argues that there is a need for a third attractor, namely the terrestrial, to bring discussions about politics "down to earth".

Our application of de- and re-territorialization thus aims to describe and contrast processes that connect food systems to local, regional and national territories in all of their multiplicity (re-territorialization), with processes that sever links to local cultures and places and thus pave the way for global configurations (de-territorialization). In contrast to notions of localization and regionalization, these concepts highlight that food systems, just like the plants around which they are built, have roots that embed them in specific territories in a much more profound way than other technological and sectoral systems. These roots are stretched or even severed through de-territorialization, and possibly restored or reinvented through re-territorialization.

To further conceptualize this dynamic, we look to the sustainability transition literature and its broad theorizing about how socio-technical systems of production and consumption change over time (Markard et al. 2012; Köhler et al. 2019). Inspired by evolutionary economics (Nelson and Winter 1977; Dosi 1982) and sociological perspectives on technology (Hughes 1987; Pinch and Bijker 1987), this research domain highlights how heterogenous system elements, such as policy, culture, organizations, markets and technology, are forming stable regimes (Rip and Kemp 1998; Geels 2002; Markard et al. 2012). These not only embed the established systems that any novelty must compete with, but also guide actors involved in innovation processes. This results in path dependencies that favor the current regime and hinders the transformative change represented by de- and re-territorialization. However, if novelties are allowed to develop in niches, where learning and institutional adaptation can unfold without being exposed to competition and negative pressure from the regime, new configurations may eventually replace entrenched regimes (Kemp 1994; Kemp et al. 1998). Indeed, transformative change is often, if not always, contingent on such protective spaces where new social and technological innovations are brought from early prototypes to viable and competitive alternatives.

The interplay of socio-technical regimes, innovative niches and exogenous landscape developments is captured by the multi-level perspective (MLP) (Geels 2002, 2004, 2005). This analytical framework is based on the idea that established regimes are stable and difficult to change, but that landscape developments, such as climate change, geopolitical shifts and the emergence of new platform technologies, may create windows of opportunity that enable innovative niches to gain momentum and either challenge and eventually replace the old regime or exert sufficient pressure to force an endogenous reconfiguration of existing structures (Geels and Schot 2007). This also highlights that individual actors associated with the established regime, such as incumbent firms, will not always resist transformative change. On the contrary, they may act as important promoters of radical alternatives and also control resources that may be decisive for re-territorialization to unfold.

Although the socio-technical system perspective which underlies the MLP serves to illuminate many important features of sustainability transitions, scholars have recently

Table 1 List of interviews with experts and stakeholders

No	Interviewee role	Mode	Duration	Date	Interviewer
1	Food retailer	Video call	60 min	2021-02-18	TL, PP
2	Industry association	Video call	60 min	2021-03-30	PP, TL
3	Food retailer	Video call	60 min	2021-05-06	PP, TL
4	Regional policymaker	Video call	60 min	2021-05-18	TL, PP
5	Berry company	Video call	60 min	2021-05-28	TL, PP
6	Food producer	Video call	60 min	2021-10-21	JA, PP
7	Researcher	Video call	60 min	2021-11-09	PP, JA
8	Industry association	Video call	60 min	2021-11-11	PP, JA
9	Industry expert	Video call	90 min	2021-11-16	JA, PP
10	Berry company	Video call	60 min	2021-11-19	PP, TL
11	Berry company	In person	120 min	2021-11-23	JA, TL
12	Researcher	Video call	60 min	2021-12-13	JA, PP
13	Researcher	Video call	60 min	2022-01-28	PP, JA
14	Food retailer	Video call	60 min	2022-02-04	TL, JA, PP
15	Researcher	Video call	60 min	2022-02-09	PP, JA
16	Berry company	Voice call	60 min	2022-02-10	TL, PP
17	Food producer	Video call	60 min	2022-02-16	TL, PP

All interviews were made on the condition of anonymity, based on an open-ended interview guide, and recorded and transcribed to facilitate further analysis

highlighted that there is a need to better account for the role of nature (Smith and Stirling 2010; Patterson et al. 2017; Ahlborg et al. 2019; Yap and Truffer 2021), particularly when dealing with food systems that are strongly intertwined with ecosystems (Pigford et al. 2018; el Bilali 2019; Vermunt et al. 2020). It has also been suggested that broader socio-techno-ecological system perspectives, which also point to elements and dynamics associated with the natural environment (Markolf et al. 2018; Pitt et al. 2020; Chang et al. 2021; Selin and Selin 2022), may be better suited to guide investigations into sustainability transitions (Ahlborg et al. 2019). In this paper, we follow this line of thought as we include ecology as an additional regime dimension and aim to identify socio-techno-ecological rather than socio-technical dynamics.

Our analysis is based on a broad empirical study. We gathered primary data through 17 semi-structured interviews with experts and stakeholders (Table 1), informal conversations with 17 berry traders and wholesalers, and participant observations in collaborative research projects.[1] We also conducted extensive reviews of secondary data, including scientific publications, project reports, official statistics, patent data, and media articles. Combining and triangulating this qualitative and quantitative data with support from the MLP framework enabled us to create a narrative that describes the historical emergence and current transformation of the Swedish wild berry value chain. In turn, this allowed us to shine light on how de- and re-territorialization are fundamentally about the restructuring of socio-techno-ecological regimes as well as to discuss implications for policymaking that aims to achieve sustainability transitions in the food sector.

The emergence, development and current transformation of the Swedish wild berry value chain

In this section, we begin with a review of the historical emergence of the socio-techno-ecological regime that governs the Swedish value chain for wild berries. The narrative is divided into four periods, and main developments are summarized in Fig. 1. In the end, we then turn to an analysis of recent niche-level efforts to transform the regime in response to various sustainability challenges.

Period 1: pre-industrial foraging (before 1900)

Wild berries have for centuries been foraged for by local Swedes (Svanberg 2012). Although numerous edible berries can be found, bilberries, lingonberries and cloudberries have been, and still are, the dominating species. They are found on low-growing shrubs on forest floors, mountain sides and mires, and ripen in the late summer. As sources of sugars, fibers, vitamins and other nutrients, both the plants

[1] Since both interviews and informal conversations were made on the condition of anonymity, we refrain from offering in-text references in Sect. 3.

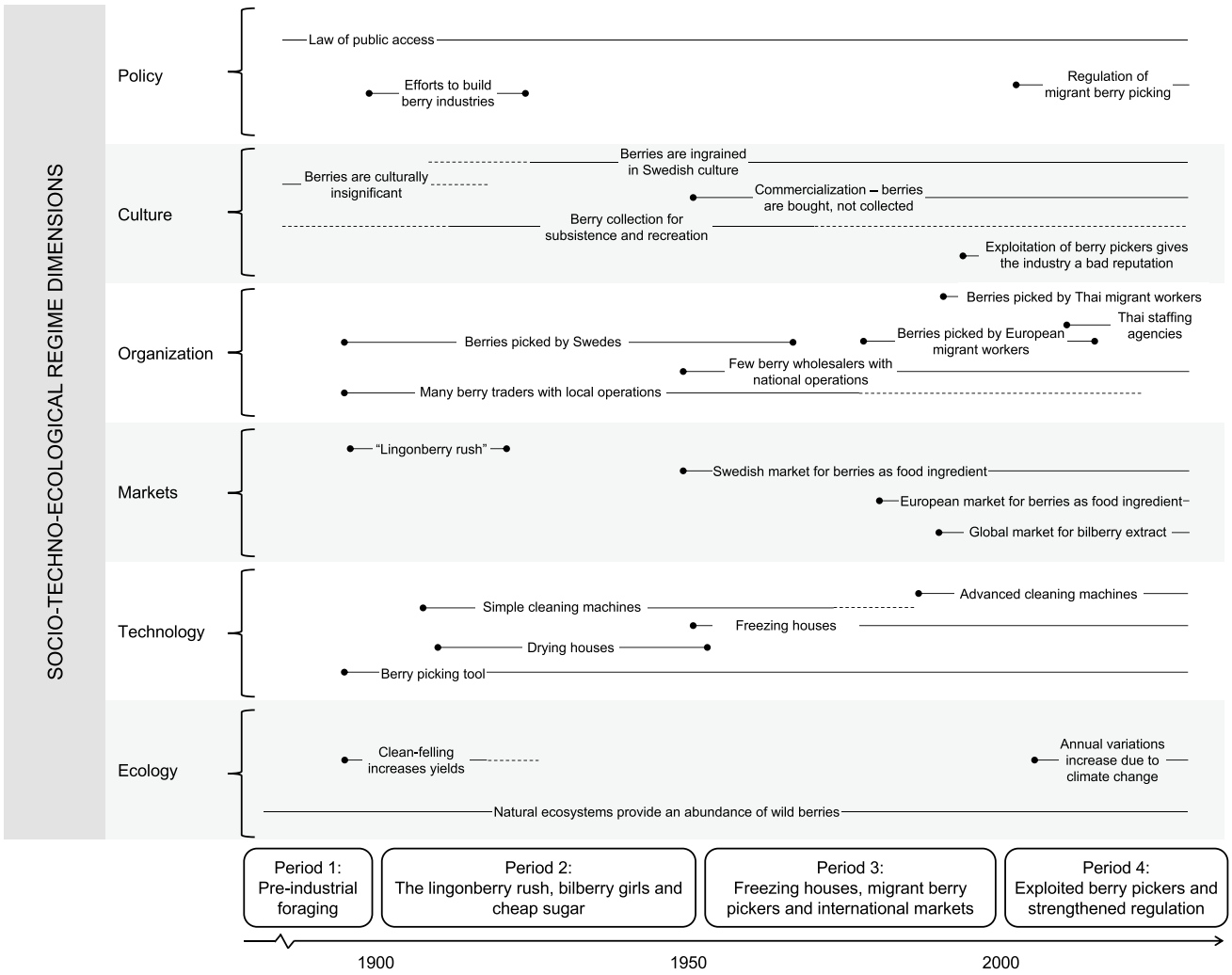

Fig. 1 A summary of main developments in the emergence of the socio-techno-ecological regime that governs the Swedish wild berry value chain

and their berries are also important for animals such as bears and moose (Sjörs 1989; Atlegrim and Sjiiberg 1996; Hertel et al. 2018).[2] In fact, bilberry and lingonberry are among the most common plants in Sweden, covering almost one fifth of the productive forest area (Sjörs 1989; SLU 2022). The average production of bilberries and lingonberries is around 800,000 tons per year (SLU 2017, 2022), most of which is found in the northern half of the country (Fig. 2). There is a lack of similar statistics for cloudberry, but estimates suggest an annual production of around 80,000 tons (Jonsson and Uddstål 2002). However, berry production is subject to very large annual variations (Fig. 3), which are mainly due to the local weather. In particular, the plants are sensitive to exceptionally warm temperatures in the late winter as well as to frost during the flowering period in the spring (Jonsson and Uddstål 2002).

Swedish wild berries are available for anyone to collect and consume. The right to access public and private land and forage for certain resources, such as berries and mushrooms, has since ancient times been granted by the 'law of public access', a longstanding custom that with time became reflected in several laws and regulations (Sténs and Sandström 2014). Pre-industrial human foraging mainly focused on lingonberries, which are not particularly fragile and also contain a natural preservative that makes them withstand longer periods of unrefrigerated storage, and to some extent cloudberries, which have similar properties but are more fragile. Bilberries were less sought after since

[2] Wild berry plants tend to recover quickly from human foraging. While berries that are left on the plant may play some role in the ecosystem by recirculating nutrients, they are not crucial for plant reproduction since they mainly spread through their root systems (Sjörs 1989).

[thousand tons]	Bilberry	Lingonberry	Cloudberry
Northern Norrland	180	130	-
Southern Norrland	120	120	-
Svealand	80	90	-
Gotaland	40	30	-
Sweden (total)	420	380	80

Fig. 2 Average annual production of wild berries in different parts of Sweden. Data for bilberry and lingonberry are based on official Swedish forest statistics (SLU 2017, 2022), averaged over the period 2011–2020. Data for cloudberry is based on an estimate by Jonsson and Uddstål (2002)

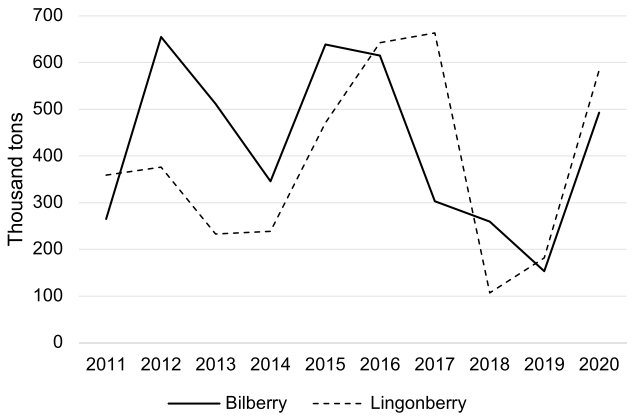

Fig. 3 Annual production of bilberry and lingonberry in Sweden during 2011–2020. Based on official Swedish forest statistics (SLU 2017, 2022)

they are both fragile and sensitive to mold, spontaneous fermentation and water-loss (Jonsson and Uddstål 2002). However, the historical importance of berries as a source of energy and nutrients should not be exaggerated. On the contrary, it has been argued that berries played a minor role due to the time and labor required to collect them and the difficulty in preserving them without using expensive sugar (Svanberg 2012; la Mela 2014). Instead, berry collection for non-food purposes may have been more important. Bilberries have since ancient times been known to treat various ailments, while lingonberries contain acids that can be used to preserve other foodstuffs (Dunn 1968; Grieve 1971). Archaeologists have even found evidence that lingonberries were used in Bronze Age alcoholic beverages or 'Nordic grog' (McGovern et al. 2013).

In pre-industrial times, the entire Swedish wild berry value chain was accordingly embedded in local ecosystems. Berries were to some extent collected and consumed by local communities, but rarely refined, transported and traded. This early regime can be seen as highly territorialized and mainly constituted by a socio-ecological interplay since technology was yet to separate berries from their local context.

Period 2: the lingonberry rush, bilberry girls and cheap sugar (1900–1950)

In the mid-nineteenth century, technological and industrial change at the landscape level enabled a dramatic expansion of the wild berry value chain, which can be tied to processes of de-territorialization on various geographical scales. A wave of industrialization had brought rail infrastructure that opened up previously inaccessible landscapes to trade, and an expanding forestry sector had resulted in vast clean-felled areas (Andersson 2019). Although intensive forestry generally has detrimental effects for berry shrubs (Sjörs 1989; Atlegrim and Sjiiberg 1996; Kardell and Eriksson 2011; Granath and Strengbom 2017; Granath et al. 2018), lingonberry thrives on clean-felled land and yields were, therefore, exceptional. This attracted German merchants who came by train to buy lingonberries that had been collected by local people to supplement their incomes (la Mela 2014). The trade developed into a substantial export, which in the beginning of the 1900s amounted to as much as 10,000 tons of lingonberries per year (Sténs and Sandström 2014). Historical accounts describe the period as a 'lingonberry rush', where entire villages were occupied picking the lucrative berries in the late summer (la Mela 2014; Andersson 2019). However, the large-scale trade decreased drastically in the late 1900s, as a period of low lingonberry yields in Sweden, resulting

in high prices, made the German market turn to fruits and berries that could be cultivated domestically.

The growing interest in wild berries resulted in an intense political debate about the law of public access (la Mela 2014; Sténs and Sandström 2014). There were attempts to strengthen the position of landowners by including berries in their property rights, but in the end, the status of berries as freely available goods was maintained (Sténs and Sandström 2014). Swedish officials and industrialists also found it problematic that berries were exported as a low-value commodity to Germany, particularly since some of the harvest was later reimported as jam and other food products. To counter this early de-territorialization, public and private actors collaborated to establish domestic industries that would process berries, both for domestic consumption and higher value exports (la Mela 2014). However, these niche initiatives failed to meet their high expectations, partly since they coincided with the decline of lingonberry exports. Efforts were also made to increase the collection of bilberries, which had been traded in much lower volumes since they were more difficult to preserve during transportation (Sténs and Sandström 2014). Bilberry drying houses were built throughout Sweden and thousands of women, so called "bilberry girls", were sent to pick berries in northern forests, thus providing an example of de-territorialization at regional and national scales.

Another important landscape development in the early twentieth century was the plummeting price of sugar (Rönnbäck 2007), which made it possible to preserve berries by producing jam and lemonade. This not only facilitated commercial trade, but also paved the way for increased berry collection for subsistence. Over time, this practice developed into a recreational activity and became ingrained in Swedish culture, particularly through bilberry and lingonberry jam which are essential companions to staple dishes such as pancakes and meatballs.

The increased commercial and non-commercial berry collection also co-evolved with technological innovations that were quickly adopted by the regime. The simple rake commonly referred to as the 'berry picker', which is used widely to this day, was first patented in 1888 (Andersson 1888). Although this tool made berry picking more efficient and soon became widespread, there were at first major concerns about its effects on berry plants. This even prompted a research project, which eventually showed that negative effects were marginal (Jonsson and Uddstål 2002). Other innovations focused on the cleaning process. At first, technology was limited to simple tools, such as trays with openings that allow leaves and other residues to fall through, but eventually mechanical cleaning machines were developed (Jonsson and Uddstål 2002). While these certainly made the cleaning process more efficient, they still required a lot of manual labor.

Throughout the first half of the twentieth century, the Swedish wild berry value chain was accordingly dominated by people of different ages and occupations who picked berries close to their homes. What was not consumed in the household was sold to local traders, who in turn supplied food producers in Sweden and abroad. The regime thus remained largely territorialized in the upstream collection and processing of berries (even though de-territorialization at regional and national scales was present), while de-territorialization was clearly transforming downstream markets. In addition, technology and infrastructure had begun mediating and expanding socio-ecological interactions.

Period 3: freezing houses, migrant berry pickers and international markets (1950–2000)

In the mid-twentieth century, the introduction of large-scale freezing houses made it possible to store berries frozen, and then bring them out for cleaning, distribution and further processing at a later point in time (Jonsson and Uddstål 2002). This landscape development restructured the regime and propelled two large berry wholesalers to central positions in the value chain. Quite strategically, perhaps, and to cover distinct markets, one was localized in the very north and one in the very south of Sweden. Since frozen berries are less fragile, it also paved the way for automated production lines that clean berries through mechanical processes. This technology was introduced during the 1990s and has since then been refined continuously, for example, through the addition of more advanced optical sorting steps and the integration of machines that package (still frozen) berries.

In contrast, berry picking remained dependent on hard physical labor, involving long periods of trekking through hills, forests and mires with heavy loads of harvested berries in simple plastic crates,[3] while technological support was limited to the simple nineteenth century rake. Still, the wholesale price was low, and with the more attractive opportunities brought by a growing economy and expanding welfare state, the interest among Swedes to pick and sell berries diminished. Surveys performed in 1977 and 1997 also indicate that berry picking for household use decreased dramatically—from 40,000 tons to 13,000 tons (Jonsson and Uddstål 2002).

Meanwhile, the demand for berries increased as downstream parts of the value chain were increasingly subject to de-territorialization. On the one hand, this resulted from a regime transformation where Swedish consumers began buying jam and other berry products, rather than producing

[3] The only occasional exception is cloudberries, which are sometimes transported by helicopter since they command a particularly high price and often grow on remote mires.

them at home from berries they had picked themselves. On the other hand, it was driven by the discovery that bilberries contain high concentrations of anthocyanins with antioxidant properties. In fact, it was found that the anthocyanin content increases with the latitude at which bilberries grow (Åkerström 2010), which created a high demand for harvests from northern European countries such as Sweden. As the global, and particularly East Asian, market for dietary supplements and cosmetics with bilberry extract took off in the 1990s, bio-extraction companies in Italy and later China began buying an increasing share of Swedish bilberries (Paassilta et al. 2009).[4] This also raised the economic importance of bilberry, which had been overshadowed by lingonberry since pre-industrial times.

The diminishing interest among Swedes to collect berries, together with an increasing market demand, created opportunities for migrant workers who were willing to work hard to earn an extra income (Eriksson and Tollefsen 2013; Hedberg 2013). Already in the 1980s, berry pickers from Eastern Europe began arriving on tourist visas. In the 1990s, they were increasingly joined by people from Thailand, who were invited by relatives that had settled in Sweden, often after partnering with Swedish men (Hedberg 2016). The Thai berry pickers also arrived on tourist visas and had no formal Swedish employer, but were nevertheless organized from an early stage. In particular, a number of Thai women, who lived in Sweden and thus knew the local landscape and culture, became informal entrepreneurs that organized travel and accommodation for growing numbers of berry pickers from northeastern Thailand (Hedberg 2016).

From a strict market perspective, the match between Swedish berries and Thai workers was perfect. Swedish berry companies could receive berries in larger volumes, from workers who demanded less payment and who were linked to the area through social networks based on partnerships between Swedish men and Thai women (Hedberg 2016). Coming from a region dominated by rice farming, the Thai berry pickers were also used to hard physical labor and eager to supplement their meager incomes, which lowered their demands for work environment practices in Sweden and became a basis for accepting precarious work (Hedberg 2021). In addition, the Swedish berry season coincides with a period of less work on Thai rice fields, which is why workers could travel without compromising their domestic duties. However, the arrangement has also been heavily criticized. The lack of regulation allowed Swedish actors (including Thai women living in Sweden) to exploit berry pickers by offering poor working conditions, low wages and accommodation far below Swedish standards (Hedberg 2013; Eriksson and Tollefsen 2018). It also implied that berry pickers could largely avoid paying taxes, and that market risks and failures were imposed on the workers (Wingborg 2014; Hedberg 2022). In addition, the increasing presence of migrant berry pickers in Swedish forests, together with concerns about damage to private land, fueled an ongoing debate about whether the law of public access should allow commercial berry collection (Sténs and Sandström 2014).

In the second half of the twentieth century, the trade with Swedish berries thus became increasingly industrialized as a result of technological innovation, economic development and the concurrent use of migrant workers. New opportunities to freeze berries at scale resulted in the emergence of a few powerful wholesalers that not only supplied traditional food industries throughout the year, but also exploited the growing demand from international bio-extraction industries. At the same time, a changing Swedish society, together with increasing market demand, opened up for what came to be the beginning of a major import of migrant berry pickers. The regime was accordingly subject to increasing deterritorialization in both up- and downstream parts of the value chain.

Period 4: exploited berry pickers and strengthened regulation (2000 and onwards)

At the turn of the century, there were mounting concerns about the precarious work of migrant berry pickers. Meanwhile, berry traders had identified a business opportunity in inviting their own workers, rather than buying berries from the Thai women entrepreneurs who acted as intermediaries (Jonsson and Uddstål 2002; Hedberg 2016). To promote their own interests, the berry traders came together in the industry association SBIF and worked with Swedish authorities to strengthen the regulation of migrant berry pickers, while safeguarding their business interests (Jonsson and Uddstål 2002; Hedberg and Olofsson 2022). This resulted in a new institutional arrangement where non-European berry pickers had to apply for work permits, which in turn required an invitation from a Swedish berry trader that was approved by the SBIF. Since the Thai women that had previously organized workers were not seen as berry traders by the authorities, they could only continue their operations at a small scale. In particular, they served as brokers and sub-contractors, offering food, accommodation and interpretation services to Swedish companies, but some also kept inviting small numbers of relatives on tourist visas (Hedberg 2016).

Simultaneously, Swedish berry traders stopped employing migrant berry pickers directly and instead begun hiring their services from recruitment agencies based in Thailand.

[4] These is no conclusive evidence that bilberry extract has positive health effects, even though some research points in this direction and also highlights other potential pharmaceutical properties.

This new arrangement was adopted to circumvent new tax regulations, something that was in fact both suggested and encouraged by Swedish authorities (Axelsson and Hedberg 2018). However, it also made berry pickers more vulnerable, since they ended up somewhere in between the regulatory regimes of Sweden and Thailand. In turn, this resulted in a lack of lack of transparency, for instance regarding taxation and the actual payment of earnings. Unscrupulous actors in both countries exploited the situation for their own profit, with grave consequences for the many workers who had to return home indebted or with substantially less earnings than expected.

In 2010, after a number of high-profile scandals and an intensifying public debate, the trade union confederation LO and the Swedish Migration Agency took initiatives to guarantee migrant berry pickers a minimum wage and acceptable working conditions. In addition, the berry wholesalers began implementing social codes, often in collaboration with their large and powerful customers in the food industry (Wingborg 2014). Today, most actors agree that the situation has improved. Nevertheless, there are repeated reports of migrant berry pickers being mistreated and exploited, transparency is still missing, and in many cases the industry remains associated with unscrupulous business practices.

As this process of regulation and institutionalization unfolded, berry pickers kept arriving from Eastern Europe. This was facilitated by the expansion of the EU in 2004, which also implied that European berry pickers remained largely unregulated. Although statistics about the share of berry pickers from Europe are lacking, it is estimated that they were at least as many as the Thai berry pickers in 2014 (Wingborg 2014; Hedberg and Olofsson 2022). In recent years, however, the share of European berry pickers has decreased to less than ten percent. This is partly because Thai berry pickers are highly effective due to their collective accumulated experience,[5] but also since the standard of living and wage expectations has increased in many Eastern European countries. Another reason is the difference in organization and infrastructure between Thai and European workers. Whereas the arrangement with Thai berry pickers has been institutionalized, the lack of organization and regulation among European workers makes it difficult for berry traders to adhere to social codes enacted by berry wholesalers and their customers, as well as to offer the traceability required for organic certification. In addition, some berry traders argue that recent regulations around cash payments have made it virtually impossible to buy berries from individual migrant workers.

The changing composition and regulation of berry pickers had consequences for the regime structure. From a quite straight-forward arrangement—where more or less organized workers sold berries to traders, who supplied wholesalers, who in turn supplied domestic and international markets—intricate networks of recruitment agencies, migrant berry pickers, berry traders and berry wholesalers emerged (Axelsson and Hedberg 2018). As a part of this transformation, the number of traders that purchase berries from unorganized pickers decreased dramatically, while large berry traders and wholesalers (that often have very close relationships and sometimes are a part of the same organization) strengthened their positions. Indeed, the increased reliance on Thai berry pickers has contributed to making small-scale operations less viable.

Meanwhile, international trade with Swedish berries continued. In the early 2000s, Swedish traders begun exporting fresh berries to wholesalers in other European countries, mainly in the Baltic region where firms had begun acquiring modern cleaning and freezing technology. This trade was often based on close networks, and in some cases foreign wholesalers even established purchasing organizations as Swedish subsidiaries.[6] However, most exports were made by Swedish wholesalers that sold cleaned, frozen and bulk-packaged berries to international customers. Swedish wholesalers also brought fresh berries from Finland to Swedish facilities for cleaning and freezing, while importing frozen berries from across the world to supplement the domestically available harvest.

Along with the increasing international demand for Swedish bilberries, domestic food producers had also begun importing large amounts of cultivated American highbush blueberries, which is a different species native to North America (Sjörs 1989). Blueberries are cheaper and less nutritious than wild bilberries, but at the same time sufficiently similar in taste and texture to be used as a complement or supplement. In Sweden in particular, blueberries and wild bilberries are often confused, since they are both referred to as 'blåbär' in Swedish. However, as blueberry imports took off, the lack of transparent product declaration made it difficult for consumers to know whether they bought wild or cultivated berries, and if wild berries originated from local forests, another region in Sweden or somewhere else in Northern Europe.

In recent years, the effects of climate change have also become apparent. Although causal evidence is difficult to present, many experts and industry actors link the large

[5] Thai berry pickers know where to find berries and how to modify and use equipment to pick them efficiently.

[6] Foreign wholesalers also purchased berries directly from unregulated berry pickers (i.e. through operations based on large trucks with cool storage). With the shifting composition among migrant berry pickers, however, this gradually became less common.

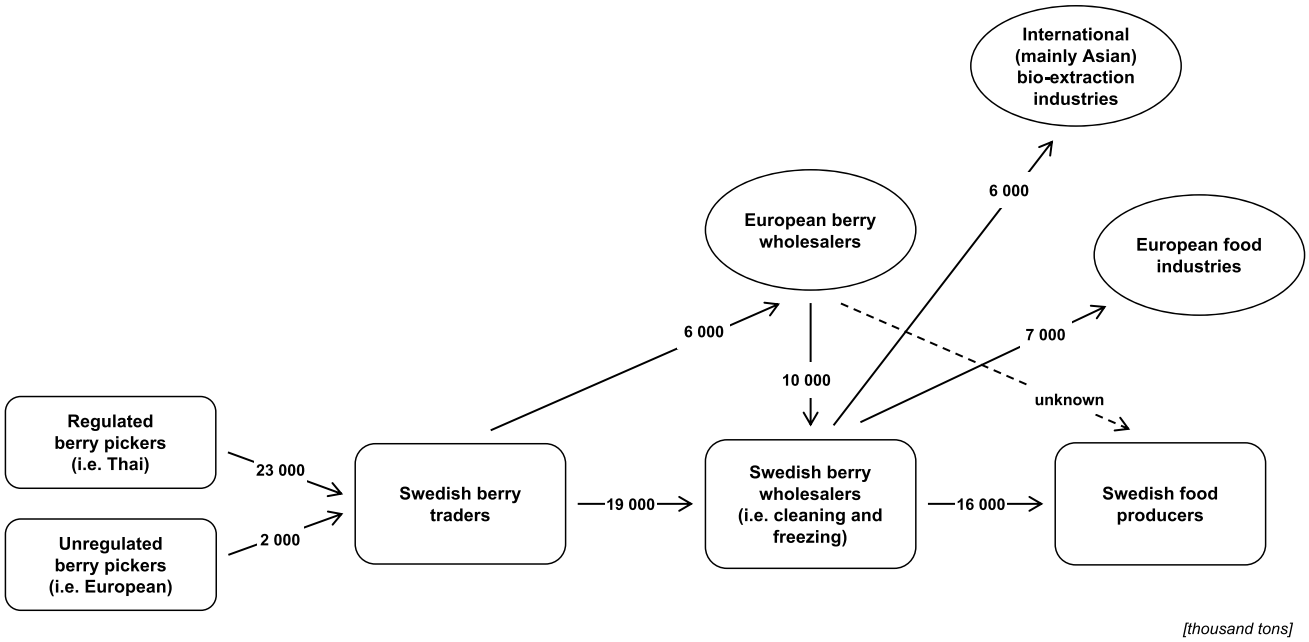

Fig. 4 Estimated flows in the Swedish wild berry value chain. The ratio between bilberry and lingonberry is generally 60/40, while cloudberry makes up a few percent. However, all exports to bio-extraction industries are bilberry, while lingonberry dominates exports to European food industries. Based on information obtained from Swedish berry traders and wholesalers

variations in berry yields over the last decade (Fig. 3) to weather patterns that are expected from a warmer climate.[7] The variations result in a challenging business environment and also adds to the importance of scale, as a means to handle and survive years with poor yields.

Since the turn of the century, the Swedish wild berry value chain has accordingly transformed further. Thai berry pickers have largely displaced European berry pickers, small-scale berry traders have struggled to keep up with large-scale traders and wholesalers, and international trade now involves not only frozen but also fresh berries. About a quarter of the total berry harvest in Sweden is exported fresh to wholesalers in the Baltic region (Fig. 4). The rest is cleaned, frozen and packaged by Swedish wholesalers, some of which also import berries from other countries for further processing and/or distribution. In the end, around half of the berries handled by Swedish wholesalers are supplied to domestic food industries, one quarter to food industries in other European countries, and one quarter to international bio-extraction industries. De-territorialization has thus continued in both up- and downstream parts of the value chain, and also become institutionalized through the development of regulations intended to facilitate the arrangement with Thai berry pickers.

Recent niche developments

As described already in the introduction, the Swedish wild berry value chain is associated with both potential and problems from a sustainability perspective. This has not only led to debate, but also efforts to promote transformative change. At the center of this development is a publicly owned Swedish research institute with broad activities related to a wide range of industries, which since the turn of the century has initiated and led a series of innovation projects (Uddstål 2014; Casimir et al. 2018).[8] These efforts have with time become increasingly framed in terms of sustainability, rather than business development and economic growth. There are currently three ongoing research and innovation projects (Umeå University 2022; Fairchain 2023; RISE 2023), as well as a variety of regional development activities

[7] Research has shown that extreme weather patterns brought by climate change may increase annual variability and reduce overall berry production (Taulavuori et al. 1997).

[8] Drawing mainly on the EU structural funds for regional development, with additions from regional and local governments in northern Sweden, these projects supported competence and business development, developed new products and spread information about the benefits of wild berries, with a view to engage firms and other stakeholders in collaborative innovation activities. While the result was some business creation and investment, the regime structure remained largely intact.

(MMFV 2023), which aim to promote a more sustainable wild berry value chain. Among these niche-level initiatives, it is possible to discern two development trajectories that are associated with alternative visions of the future value chain. Although innovation activities in line with these trajectories are dispersed and yet to result in cohesive socio-techno-ecological configurations, we will here refer to them as two alternative niches.

The first niche aims to establish industries that refine berries and supply a broader variety of products to food and pharmaceutical industries in Sweden and abroad (Berry Lab 2023; RISE 2023). These new industries would be based on modern technologies that take advantage of the whole berry in resource-efficient processes. It is, for example, possible to combine the extraction of bioactive compounds with the production of juice and so-called press cake.[9] The niche is legitimized through a longstanding narrative that portrays the current value chain as limited to the supply of a low-value raw material to global markets. This is, however, a notable exaggeration as around half of the total berry harvest is refined by domestic food industries (Fig. 4). In addition, actors highlight that there is a substantial potential to create jobs and increase tax revenues, particularly in northern Sweden where most commercial berry collection occurs, and even argue that it would be easier to raise wages and improve conditions for migrant berry pickers if a larger share of berries were refined in Sweden. These arguments have mobilized researchers, firms and other actors to networks that promote the niche through various innovation activities (RISE 2022). In turn, this has generated learning and strengthened the underlying narrative, resulting in a reinforcing dynamic. However, the berry wholesalers that dominate the current regime are largely absent and seemingly lack the incentive and capacity to participate in the commercialization of new berry refining technologies. Simultaneously, the mobilization of external entrepreneurs and investors is hampered by a volatile and risky business environment as well as a lack of domestic competence. It is therefore not clear which actors should commercialize results from research and experimentation, giving rise to an inhibiting dynamic.

In contrast, the second niche seeks to establish localized wild berry value chains. It is associated with a cluster of research, innovation and regional development initiatives, centered in the Västerbotten region of northern Sweden (Umeå University 2022; Fairchain 2023; MMFV 2023). A shared aim is to create new business opportunities, or to acknowledge alternative economic initiatives, in rural and sparsely populated areas, and this is often framed in terms of promoting regional development.[10][11] Localized value chains are also seen as a way to promote social equity and cohesion, which could be said to evoke the community-driven berry trade of the early twentieth century and the "law of public access" which facilitated it. Efforts to promote the niche include research on alternative and diverse economies of entrepreneurship and work, particularly among marginalized groups and with a view to empower migrant workers (WiBS) (Umeå University 2022). Other initiatives link business model innovation to the idea of intermediate value chains, where small-scale local firms pick, clean and refine berries, and thereby reduce the distance between production and consumption (Fairchain 2023). Here, technological solutions, such as mobile applications guiding users to picking areas and potentially even robot berry pickers, are seen as important enablers that may also attract a younger generation. Indeed, a common emphasis among actors that promote the niche is to facilitate entrepreneurship among local actors. This may involve mobilizing firms and other actors to the wild berry value chain, but also reimagining the roles of existing stakeholders such as migrant berry pickers or land owners. Examples of activities in this direction include training courses for berry processing, school programs, business coaching sessions, and public events such as a berry festival and a food hackathon (MMFV 2023). These community-focused mobilization efforts align with regional policy goals and increased interest in local food, which creates an enabling dynamic (Nicolosi et al. 2019; Länsstyrelsen Västerbotten 2023). However, future business cases, as well as their social and environmental benefits, remain loosely defined. The niche is also misaligned with the current regime, which is characterized by incumbents with strong positions, business models based on large-scale export of berries, transnational infrastructure that promotes large-scale labor migration, and competition from products that use imported and cultivated berries. Together with landscape factors that favor global value chains, this creates an inhibiting dynamic.

It should be noted, finally, that although we present the two niches as distinct, the developments they capture are not mutually exclusive and may indeed be complementary. What makes the niches different, however, is that they represent different types of re-territorialization: one that maintains the idea of a long value chain that supplies global markets, but brings more, and possibly new, value-adding processes to

[9] This stands in contrast to the more wasteful processes used in the (foreign) bio-extraction industry, which discard most of the berry.

[10] A parallel can here be drawn with the bio extraction niche in terms of reclaiming value creation, but in this case the supporting narrative is regionally rather than internationally motivated.

[11] Similar initiatives have also existed elsewhere, such as in the neighboring region of Norrbotten, where a local berry processing company producing premium products was launched as the result of a collaborative public–private innovation project (Glommersbär 2023).

Sweden; and another that promotes shorter value chains that reduce the distance between the growth, collection, processing and consumption of wild berries.

Discussion and concluding remarks

This paper sets out to analyze the emergence, development and current transformation of the Swedish wild berry value chain. We have presented a rich historical narrative which highlights the interesting particularities of this case. This constitutes an empirical contribution to previous research on wild berries in Sweden (Hedberg 2013, 2016; la Mela 2014; Axelsson and Hedberg 2018; Eriksson and Tollefsen 2018; Carmo and Hedberg 2019; Hamunen et al. 2019), which by offering an updated and expanded account can be informative for ongoing and future efforts to promote innovation towards more sustainable configurations.

Moreover, and from a theoretical perspective, our study serves as an exploration of de- and re-territorialization. In the pre-industrial period, we conceive the Swedish wild berry value chain as territorialized—foraging was a means through which people related to, connected with and utilized the local territory, with sites of production and consumption closely connected spatially and socially. The twentieth century then saw the emergence of international markets, technological innovation and the mobilization of migrant workers from far-away places. We associate these developments with processes of de-territorialization, as connections to the territory were altered and globalized in various ways. For example, while exports and labor migration reconfigured spatial and social connections, freezing houses and bio-extraction established new forms of temporal and cultural distance between production and consumption. Lastly, recent years have seen increasing efforts to transform the value chain in ways that we associate with re-territorialization and a re-thinking of connections and distances. The distance between international bio-extraction industries and northern Sweden is targeted by niche developments that aim to establish domestic berry refineries based on modern technologies. Other niche initiatives promote shorter value chains, by supporting the development of infrastructure and supportive technology for small-scale local firms as well as by highlighting business potential and encouraging entrepreneurship. This addresses a broader set of distances within the current value chain, including the geographical and regulatory distance between the homes and employments of Thai berry pickers and the forests in which they work, as well as the spatial separation of berry ecosystems, industries and markets (Axelsson and Hedberg 2018; Carmo and Hedberg 2019). Accordingly, the process is not only about the globalization and localization of an industry, but also about spatial reorganization that alters connections and distances between places.

These observations highlight important characteristics of de- and re-territorialization, which are likely to be valid beyond the empirical context of this study. Although the two processes are interlinked, as argued already at the outset of the paper, re-territorialization is not necessarily about inverting de-territorialization to recreate an earlier state of territorialization. It is rather about promoting value chains that evoke natural territorial connections by balancing local, regional and global configurations. Indeed, re-territorialization processes may incorporate some of the global connections that characterize the de-territorialized configurations they respond to, either because these connections bring benefits that are difficult to recreate through local and regional configurations or due to path dependencies associated with the current regime. For example, migrant workers could be a part of more sustainable configurations as long as they work under equitable conditions. In turn, this likely requires that employment relations are regulated in Sweden rather than Thailand, which in fact corresponds to re-territorialization, albeit in an institutional rather than human or material sense.

Our study offers an additional theoretical contribution by showing how discussions of territoriality within food systems (Wezel et al. 2016; Gyimóthy 2017; Berti 2020; Felici and Mazzocchi 2022) may enter a generative dialogue with the sustainability transition literature (Markard et al. 2012; Köhler et al. 2019). We have established links between the MLP framework (Geels 2002) and the notion of re-territorialization, by approaching the latter as a process of transformative system change, characterized by tensions between stable regime structures, innovative niche developments and macro-level landscape factors. We have also strived to understand these dynamics in relation to different socio-techno-ecological dimensions (i.e. policy, culture, organization, markets, technology and ecology), parts of the value chain, and geographical scales of observation (i.e. local, regional and global). This combined theoretical perspective may be useful in future research on transitions to more sustainable food systems since it has the potential to reveal important insights about the historical and concurrent dynamics of transformative change. Future research should also validate and develop our approach further, particularly through a closer integration with literature on the geography of transitions (Murphy 2015; Truffer et al. 2015; Hansen and Coenen 2015), just transitions (Tribaldos and Kortetmäki 2022) and agro-food transitions (Hebinck et al. 2021).

The dynamics and plurality highlighted throughout this paper have implications for policymakers and other actors that promote strategies linked to re-territorialization as a means to achieve more sustainable food system configurations (Marsden et al. 2018; Berti 2020). Perhaps most importantly, our analysis highlights that re-territorialization is neither a well-defined

policy direction that can effortlessly be translated into concrete action, nor a silver bullet which inevitably heals fractures with nature, producers and consumers. Rather, different forms of re-territorialization come with different potential positive and negative consequences in relation to the vision of a robust, resilient and just food system. Acknowledging the intricate connections between de- and re-territorialization, it is key to design policies in relation to the historical emergence and current structuration of existing regimes. A deep understanding of historical pathways can give important insights into the possibilities of transformation of particular regimes through re-territorialization. We see this longitudinal groundwork as often missing from policy discussions about the future.

Finally, as has been apparent throughout this paper, and emphasized through our socio-techno-ecological approach, technology can be seen both as a facilitator for de-territorialization and as a source of new potentials for re-territorialization. This echoes longstanding insights about the dual role of technology for sustainable development (Simon 1973; Foray and Grübler 1996). Given the important role of technologies in the re-territorialized and more sustainable value chains of the future, it becomes a key issue to evaluate how dependent we are and should be on promises of new technological developments, without throwing out the baby with the bathwater, and reverting to a territorialized imaginary. Similarly, we must avoid falling into the 'local trap' (Purcell 2006) and assume that localized modes of production and consumption are always preferable to regional and global configurations. Instead, re-territorialization might concern how relations between the global and the local are renegotiated. In the end, efforts to promote re-territorialization are essentially about shaping socio-techno-ecological dynamics in a way that enables niche-level initiatives to replace or reconfigure current regime structures. Importantly, however, new regime structures that result from re-territorialization processes may be associated with different sustainability values (e.g. self-sufficiency, economic benefits, resilience, environmental impacts, etc.). This highlights the importance of policymaking that promotes broad problem framings and inclusive decision-making, to manage inevitable trade-offs in a way that maintains both near-term legitimacy and long-term sustainability objectives.

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