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Addressing Climate Change Through Social Innovation Initiatives

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ABSTRACT

While social innovation has traditionally emphasised social sustainability, it also presents potential for the mitigation of climate change by influencing social practices. This study explores how social innovation initiatives address social practices to mitigate climate change. Our qualitative study in an affluent setting, a Swedish municipality with high emissions, led to the identification of four dimensions relevant for climate mitigation: SIIs' social motives, inspiration of others, beneficiary participation, and use of artefacts. Social motives for climate relevant social ends focused on altering the meaning of practices while SIIs' had social means focused on changing meaning, competences, and materials of emission-intensive practices.

KEYWORDS

Social innovation; climate change; social innovation initiatives

Introduction

Climate change is a pressing societal challenge that negatively impacts society (IPCC 2023; UNEP (United Nations Environment Programme) 2023; WWF 2022). To ensure that Earth can continue providing its vital functions for current and future generations, greenhouse gas emissions must be drastically reduced (Rockström et al. 2017; UNEP (United Nations Environment Programme) 2023). These emissions relate to both consumption and production practices, but also to affluence levels (Hickel 2021; Hickel and Kallis 2020; Nyberg and Wright 2022). In response, governing bodies like the European Union, in alliance with the business sector, push green growth strategies that have largely become synonymous with technologically based solutions, like new energy systems and electric cars (European Commission 2022; Hickel 2021; Hickel and Kallis 2020; OECD 2022; Parrique et al. 2019). While this approach aligns with the optimistic development paradigms of ecological modernisation and so-called weak sustainability (Bonnedahl, Heikkurinen, and Paavola 2022; Hopwood, Mellor, and O'Brien 2005), social innovation initiatives (SIIs) may offer alternative climate mitigation solutions that focus more on the behavioural causes of increasing emissions: social practices (Angelidou and Psaltoglou 2017; Schartinger et al. 2017; Wittmayer et al. 2019).

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SIIs are intentional attempts to address societal challenges such as climate change (cf. Angelidou and Psaltoglou 2017; Caroli et al. 2018; Suitner, Haider, and Krisch 2024; von Jacobi and Chiappero-Martinetti 2017; von Jacobi, Nicholls, and Chiappero-Martinetti 2017). SIIs enable social innovation, defined as changes in social practice (Domanski, Howaldt, and Kaletka 2020; Howaldt et al. 2017; Wittmayer et al. 2019). Thus, SIIs are activity-focused alternatives for addressing major challenges (Avelino et al. 2020; Murray, Caulier-Grice, and Mulgan 2010; Olsson et al. 2017; Tjornbo and Westley 2012). A key way to unpack SIIs is by discussing two core dimensions, namely their social ends and social means (Grimm et al. 2013; Hoppe and de Vries 2018; Mulgan 2019). While social ends correspond to societal challenges or unmet social needs (Mulgan 2019), social means are the processes and tools used to achieve these ends, i.e. spreading new social practices through, e.g. empowerment, social learning, or collaboration (Murray, Caulier-Grice, and Mulgan 2010; Schartinger et al. 2017; Tjornbo and Westley 2012).

Primarily, social innovation research has focused on challenges related to social sustainability (i.e. Edwards-Schachter and Wallace 2017; Haskell, Bonnedahl, and Stål 2021; Olsson et al. 2017; Ziegler et al. 2022). Also, the more limited literature which directly deals with social innovation and climate change has tended to focus on adapting to climate change, investigating its' social side effects like social exclusion (i.e. Rodima-Taylor 2012; Scott-Cato and Hillier 2010), or on social innovation's role in diffusing technological innovations (i.e. Hoppe and de Vries 2018; Wehn et al. 2021). Instead, with the ambition to more directly target causes behind climate change in terms of activities and behaviours, an examination of how social practices can be altered to mitigate climate change becomes important (Batle, Orfila-Sintes, and Moon 2018; Haskell, Bonnedahl, and Stål 2021; Ziegler et al. 2022). We know that bricolage, the involvement of social actors, collaboration, empowerment, social learning, and involving beneficiaries are common means (Howaldt et al. 2017; Murray, Caulier-Grice, and Mulgan 2010), but the relevance of different social means in the particular case of climate change mitigation remains unclear. This includes how they are used by SIIs to mitigate climate change (i.e. Angelidou and Psaltoglou 2017). As activity-focused climate mitigation becomes increasingly necessary, a deeper understanding of SIIs' social means can help explore their potential for mitigating climate change (Matos et al. 2022; Olsson et al. 2017; Ziegler et al. 2022).

Subsequently, our purpose is to explore SIIs' potential for mitigating climate change. To fulfil this purpose, we aspire to answer the following question: How do SIIs attempt to alter social practices through their social ends and means to be relevant for mitigating climate change? Thereby, we aim to contribute to the literature on social innovation and the environment and provide a conceptual basis for evaluating the climate mitigation potential of SIIs.

Since social practices must be observed and understood where they take place (Deserti and Rizzo 2020; Domanski, Howaldt, and Kaletka 2020; Rabadjieva and Butzin 2020; Shove 2010; von Jacobi and Chiappero-Martinetti 2017), we apply a qualitative study of SIIs within one high-emitting setting, a Swedish municipality. This article continues with a review of the social innovation literature, focusing on SIIs, their social ends and means, and their theoretical potential for mitigating climate change. Then, we present the research setting, focusing on emission-intensive activities and

SII-relevant features, followed by the methods used to collect and analyse data. The findings are followed by implications for social innovation and climate change research.

Theoretical Background

Social Innovation Initiatives

Social innovation has become increasingly popular in research, practice, and policy over the last decade (Angelidou and Psaltoglou 2017; Caroli et al. 2018; Edwards-Schachter and Wallace 2017; Schartinger et al. 2020; van der Have and Rubalcaba 2016). However, as a growing research field, social innovation has been criticised for being fragmented, focusing on, e.g. creativity, societal challenges, local/regional development, community psychology (van der Have and Rubalcaba 2016), social change processes, sustainable development, and the service sector (Edwards-Schachter and Wallace 2017). Nonetheless, we understand social innovation as an intangible form of innovation (Angelidou and Psaltoglou 2017; Cunha and Benneworth 2020; von Jacobi and Chiappero-Martinetti 2017) that refers to innovation in social practices, which includes the recombination and reconfiguration of existing practices (Domanski, Howaldt, and Kaletka 2020; Howaldt et al. 2017). Enacting a social practice involves three integrated elements: materials, competences, and meanings (Shove, Pantzar, and Watson 2012). Materials include physical artefacts, implying that technology often has a role in social innovation (Bergman et al. 2010; Ziegler et al. 2022). Competences describe the know-how involved in performing a practice, while meaning refers to its symbolic significance and relates to a practice's purpose and motivation (of the person performing the practice) (Shove, Pantzar, and Watson 2012). Practices change when a connection between two elements changes, for example, consider the meaning of biking in the practices exercising and commuting. A bike is a material element that can be used in both practices, but as the purpose changes, so does the practice. Alternatively, the practice of commuting changes if the material, e.g. driving a car, is replaced by biking.

Further, social practices differ depending on the context and can appear differently depending on location, culture, and regulation (Hargreaves 2011; Shove 2010; Shove, Pantzar, and Watson 2012; Warde 2005), e.g. rural versus urban farming. Culture denotes how a set of beliefs, values, and preferences can affect practices within some subset of society (Mulgan 2019). Accordingly, culture contributes to what is considered normal behaviour in a setting (Shove, Pantzar, and Watson 2012), and influences the materials, competences and meanings associated with a specific practice. The influence of culture over practices can, e.g. be displayed in the materials used for transportation, like cars or bikes, or the food consumed, like vegetarian or meat based. Also, regulations and policies differ between settings, and they can have strong influence on (changes in) social practices (Shove, Pantzar, and Watson 2012). Subsequently, since SIIs address social practices, which may differ between contexts, context also shapes SIIs (cf. Cunha and Benneworth 2020; Deserti and Rizzo 2020; Domanski, Howaldt, and Kaletka 2020; Rabadjieva and Butzin 2020).

Moreover, SIIs can be grouped into practice fields for altering similar social practices or having similar social ends, e.g. mobility, alternative food consumption, and reuse

and repair (Howaldt et al. 2017; Schartinger et al. 2017). According to Dawson and Daniel (2010), SIIs' social ends shall correspond to the creation of social value, unlike market-driven and profit-maximising solutions (Caroli et al. 2018; Giesecke and Schartinger 2024). Social value is created when important challenges or unmet social needs are addressed and individuals' well-being or happiness increases (Grimm et al. 2013; Hiteva and Sovacool 2017; Mulgan 2019; Murray, Caulier-Grice, and Mulgan 2010).

To achieve this, SIIs use social means (Bergman et al. 2010; Grimm et al. 2013; Hoppe and de Vries 2018; Mulgan 2019). As a first example from the literature, social means can involve bricolage to develop new solutions, where existing elements are recombined in new ways (Olsson et al. 2017). A second social means is the involvement of a variety of actors, oftentimes from civil society or the public sector (Angelidou and Psaltoglou 2017; Howaldt et al. 2017). This variety can include grassroots movements, municipal organisations, but also social enterprises (Caroli et al. 2018; Schartinger et al. 2020). While more than one actor can form an SII, it normally has one or a few inner core actors, initiating and/or operating the SII (Caroli et al. 2018; Terstriep et al. 2015). Third, and related to the variety of actors, previous research has denoted the importance of the creation of new relationships and collaborations (Grimm et al. 2013; Pel et al. 2020), which are often cross-sectoral (Hiteva and Sovacool 2017; Murray, Caulier-Grice, and Mulgan 2010).

Fourth, extant social innovation research also refers to the involvement of the beneficiaries of innovations in their emerging solutions (Cunha and Benneworth 2020; Jaeger-Erben, Rückert-John, and Schäfer 2015; von Jacobi and Chiappero-Martinetti 2017). While major beneficiaries of mitigation activities may not be directly present in the innovation context, i.e. future humans or endangered animals, there are also those who could have qualitatively different roles compared to that of an ordinary entrepreneurial venture's customers (cf. Angelidou and Psaltoglou 2017; Caroli et al. 2018). An example is when a beneficiary (user) of energy is given a role as owner and producer in alternative energy systems (Hiteva and Sovacool 2017; Hoppe and de Vries 2018; Wittmayer et al. 2019). Involving beneficiaries can be linked to empowerment, a fifth aspect of SIIs' social means. Empowerment can be described as making the beneficiary think and feel that they can enact change (Angelidou and Psaltoglou 2017; Avelino et al. 2020). Such empowerment can emerge by encouraging participation but also through a sixth social means aspect, namely social learning, denoting how new practices can spread to make them understandable within a social setting (Giesecke and Schartinger 2024; Howaldt et al. 2017; von Jacobi and Chiappero-Martinetti 2017). A similarity between empowerment and social learning in relation to potentially altering a social practice is that they can affect the competences and meanings connected to a practice (Antadze and Westley 2012; Reckwitz 2002; Shove, Pantzar, and Watson 2012).

SIIs and Climate Change

The extant sustainability research field's stark focus on technological solutions increases the need to study SIIs with social means relevant for climate mitigation. The reliance on green growth solutions (Nyberg and Wright 2022; Parrique et al. 2019) has aligned with the (weak) sustainable development discourse which declares that social,

economic, and environmental sustainability are equally important (Hopwood, Mellor, and O'Brien 2005). This puts the onus on how different solutions prioritise between various ends. Our position follows that of strong sustainability (Bonnedahl, Heikkurinen, and Paavola 2022; Ekins et al. 2003; Hopwood, Mellor, and O'Brien 2005), and means that the natural environment ensures a habitable planet, which serves as the basis for a functioning society and economy.

Thus, the theoretical climate mitigation potential of SIIs begins with them having ends which recognise this reliance on nature for all human activities. This means that SIIs' could set the reduction of emissions as their primary end (cf. Bergman et al. 2010). Alternatively, SIIs may have social ends without an environmental focus, but operate with respect for the biophysical basis of a specific activity. Such SIIs can have an indirect mitigation potential by promoting practices with low environmental impact, that compete with high-impact practices (e.g. local recreational activities versus long-distance leisure travel (c.f., Hickel 2021; Nyberg and Wright 2022)). In contrast, commercial firms, even highly climate-oriented ones, have economic ends, with the primary goal to make profits and cater to customer demands. Although such firms can influence practice change, i.e. firms selling imitation meat products, economic expansionist goals do not promote the necessary decreases in overall environmental impact. Climate-oriented efforts of commercial firms can also cause systemic impacts, but often merely add, not replace, extant consumption and production (Parrique et al. 2019). For such reasons, profit-driven responses for mitigating climate change have repeatedly proven to be of limited value (Nyberg and Wright 2022).

When we combine readings on the social innovation and sustainability literatures, we deduce that certain social means hold theoretical potential for mitigating climate change. First, through bricolage, the introduction of innovative combinations, e.g. of information and technology, can alter problematic activities that cause greenhouse gas emissions (Geels et al. 2017; Olsson et al. 2017). Second, as a variety of actors are involved, with at least one core SII actor being driven by social ends, the risk that social concerns would be traded-off for in favour of economic ones could diminish (cf. Lindberg et al. 2022; Schartinger et al. 2020). Environmental concerns may still be subordinated under more direct stakeholder concerns (related to, e.g. employment or equality), but a focus on long-term societal improvements can harmonise with climate mitigation (von Jacobi, Nicholls, and Chiappero-Martinetti 2017).

Third, and related to actors involved, SIIs have potential by using collaboration to mitigate climate change (Murray, Caulier-Grice, and Mulgan 2010). Collaboration seems advantageous, given the complex and multifaceted nature of climate mitigation. Insight comes from research which has explored both top-down collaborative efforts to conserve nature (Biggs, Westley, and Carpenter 2010) and collective bottom-up grassroots initiatives to lower carbon emissions (Bergman et al. 2010). Also, cross-sectoral collaborations can be advantageous, as indicated by Tjornbo and Westley (2012) who studied a government collaboration with civil society funding climate initiatives.

Fourth, involving beneficiaries also plays a key role in altering social practices to mitigate climate change (Ziegler et al. 2022). Beneficiaries may have direct or indirect roles in such efforts (Angelidou and Psaltoglou 2017; Schartinger et al. 2017; Ziegler et al. 2022). For example, a direct beneficiary would purchase and use second-hand clothes, while an indirect beneficiary would be a citizen drawing environmental gains

from a recycling initiative. The latter shows that important beneficiaries may neither be present in the decision-making contexts nor in the social practices that SIIs target. As climate change affects all humans, including those yet to be born, in addition to nature itself, such beneficiaries are important for an initiative's social ends.

Regarding directly involved beneficiaries, extant social innovation research indicates that this can increase both empowerment and social learning; the fifth and sixth dimensions of social means described in the previous section (Avelino et al. 2020; Cunha and Benneworth 2020; Schartinger et al. 2017). Empowerment's potential as a means for mitigating climate change, where consumption is a key driver of emissions (Hickel and Kallis 2020; Nyberg and Wright 2022), relates to consumption practices (Jaeger-Erben, Rückert-John, and Schäfer 2015; Quilley 2012). If empowerment efforts actually lead to increased autonomy (cf. Avelino et al. 2020), the participation of beneficiaries in alternative practices such as sharing may be further enabled. Likewise, social learning would imply capability building of beneficiary groups, increasing knowledge about the climate impact of different practices (cf. Howaldt et al. 2017).

In summary, we deduce a theoretical potential of SIIs climate mitigation potential (see Table 1), to provide a much-needed alternative to mainstream solutions proposed within the dominant weak sustainable development discourse (Olsson et al. 2017; Schartinger et al. 2017). However, we do not know how this potential is actualised. More precisely, we do not know how SIIs attempt to alter social practices through their social ends and means to mitigate climate change.

Empirical Context and Methodology

Research Design

Considering that climate change is a global phenomenon, our emphasis on SIIs, with their context-specific characteristics, led us to spatially demarcate our research to focus on one location; a municipality (cf. Deserti and Rizzo 2020; Domanski, Howaldt, and Kaletka 2020; Rabadjieva and Butzin 2020). We used a qualitative research design which is preferable when the relationship between a phenomenon and context is important and complex (Yilmaz 2013), as is the case when studying how SIIs attempt to alter social practices through social ends and means.

Qualitative primary data was collected through interviews with the initiators or operating individuals of SIIs within our local qualitative study. Interviews allowed us to ask open questions that could uncover details and provide a rich understanding of initiatives and how they relate to emission-intensive activities and climate change (cf. Yilmaz 2013). To inform ourselves broadly about SIIs' ends in relation to climate change, we asked informants to describe their initiatives, including their goals, and

Table 1. SIIs climate mitigation potential.

	General features	Potential for mitigating climate change
Ends	Meeting societal challenges, social needs, or creating social value	SIIs can set climate mitigation as their primary end; SIIs can promote alternatives to high-emitting practices
Means	Bricolage, actor variety; collaboration; involving beneficiaries; empowerment; and social learning	General features or other potential means relevant are dependent on context

what challenges and activities they addressed. Regarding their means, to cover the theoretical dimensions (Table 1), we asked broadly about operations and linkages to other actors, with the use of more empirical concepts such as users and partners.

To increase the credibility of our data (Yilmaz 2013), we complemented interviews with secondary data (cf. Gioia, Corley, and Hamilton 2013) from SIIs' social media accounts and websites in addition to news articles that informed us about the SIIs and the research setting. Such sources were used for triangulation, e.g. to avoid any self-assessment bias following from the choice of respondents, to understand issues that remained unclear from interviews and to add more detail (cf. Yilmaz 2013). For example, secondary data supported our interpretations of initiatives' primary goals and provided context to respondents' accounts. Reports from public agencies, research institutions, and the local municipality also helped broaden our understanding of the research setting.

Emission-Intensive Activities in Our Research Setting

To investigate SIIs' potential for mitigating climate change, we decided to focus on SIIs within one relatively affluent and high-emitting setting. We chose a Swedish municipality with a subarctic climate and a population of around 100,000 inhabitants. It is one of 23 Swedish cities that have signed a climate contract committing to being climate neutral by 2030 (Viable Cities 2024), a part of a municipal project in which one of the article's authors has been involved since the start. On the national level, Sweden's energy sector has been successful in achieving low climate impact, and Sweden has been proclaimed as a global leader in terms of climate mitigation (The Swedish Environmental Protection Agency 2024). However, the current Government, in office since 2022, has significantly reduced climate ambitions, most notably in the transportation sector, leading to rising emissions (Swedish Climate Policy Council 2024). Apart from international flying, CO_{2e} from food consumption are comparatively high on a global level (1.8–2.2 tonnes per/year) (Röös, Ran, and Moberg 2024).

A consumption-based study (pre-COVID) of fossil CO_{2e} carried out in the studied municipality found a per capita level of 9.8 tonnes (Axelsson, Vanhuyse, and Dawkins 2018), slightly above the Swedish average the same year (The Swedish Environmental Protection Agency 2024). More specifically, the studied municipality's main areas of CO_{2e} in tons per capita were travel (4.7), food consumption (2.5), clothing and other product consumption (1.2), and energy use (1.0) (Axelsson, Vanhuyse, and Dawkins 2018).

The IPCC (2023) has identified industry, energy supply, transport, agriculture, and buildings as high-emission areas. Therefore, we looked for SIIs relevant for these high-emitting activity areas, aligning with the practice fields transportation; building; reuse, recycle; food consumption and production. In the studied municipality, transportation emissions stem from long-distance travel and the prevalence of flying. Moreover, goods, not least food, are largely imported. This is partly due to the subarctic climate and geographic location, being in the northern half of Sweden. This area is home to approximately one-tenth of the Swedish population, or 1.2 million people (SCB 2021). Flying also relates to cultural norms, where Swedes are known as avid global travellers. Distances and the subarctic climate may also influence the

normality of car-use for most residents. Thereby, transportation would be a relevant practice field as it is responsible for high emissions due to car-use and flying.

Food consumption relates to another emission-intense area, agriculture, and the practice field of food consumption and production. Due to the geographic location, the cold climate makes it difficult to cultivate many fruits and vegetables, as snow covers the ground for several months. High food consumption (and production) emissions are thereby a result of importing a high number of food products and that high meat and dairy consumption are culturally normal (Axelsson, Vanhuyse, and Dawkins 2018).

The building practice field relates to energy use (and its emissions), and despite clothing and other product consumption not having a direct IPCC (2023) equivalent, we identified the practice field of reuse and recycle as being of interest. Regarding energy, it should be noted that, despite the electricity supply in Sweden being mainly from hydro energy, nuclear, and wind power, district heating runs on waste and biomass incineration, producing high biogenic emissions (not included in official reporting or the above estimates). This also relates to the subarctic climate as heating is a necessity. Practice fields are also interrelated (Schartinger et al. 2017), e.g. transportation with consumption, as shopping malls situated outside the city centre influence how people transport themselves.

Selection of Social Innovation Initiatives

The starting point for finding relevant SIIs was the authors' knowledge about local actors and processes. This was complemented by conducting interviews with nine individuals who could help identify initiatives, including consultants with strong links to civil society, an incubator representative working closely with academia, and municipality strategists and project managers. They were asked about novel initiatives that addressed environmental issues, leading to a gross list of 39 initiatives. This deliberately left the interpretation of an initiative's theoretical fit for social innovation and climate relevance to us. We then used a checklist with criteria that an initiative had to fulfil (Table 2).

The criteria were first applied to the secondary data, whereby the number of relevant initiatives was cut to 17. Some excluded initiatives were too economic growth oriented, or too technology oriented (Criteria 1), some were interpreted as being less relevant for the practice fields which we deduced from IPCC's (2023) activity areas (Criteria 2), and some were not seen as novel enough (Criteria 3). In six cases, no initiator nor operating person responded or was willing to be interviewed. Subsequently, interviews were conducted with initiators or operating persons from 11 SIIs (Table 3). Respondents were identified through either our informants or secondary data.

Table 2. Social innovation initiatives addressing climate change.

Criteria
1. Not economic growth or technology oriented
2. Relates to practice fields deduced from emission-intensive activities identified by the IPCC: transportation; building; reuse, recycle; food consumption and production.
3. Novel initiative differing from existing solutions in the municipality

Empirical identification criteria.

Table 3. The study's social innovation initiatives.

Initiative description	Practice field	Primary data	Respondent(s)	Legal status	Secondary data
Electric bike delivery	Transportation	Interview: 43:01; In person at a café	Initiator	Limited liability company	Social media; newspaper articles
Electric moped taxi	Transportation	Interview: 53:48; via Zoom	Initiator	Limited liability company	Social media; website; newspaper articles
Cargo bike sharing	Transportation	Interview: 45:41; via Zoom	Operating individual	Municipal organisation	Social media; website; newspaper articles
Rural service hub	Transportation	Interview: 37:33; via Zoom	Initiator	Economic association	Social media; website; newspaper article
Lighting as a service provider	Building	Interview: 36:36; via Zoom	Initiator	Limited liability company	Social media; website
Building consultant	Building	Interview 56:13; via Zoom	Initiator	Limited liability company	Social media; website; television program
Do it together (DIT) bike mechanic	Reuse, recycle	Interview: 31:43; via Zoom	2 initiators	Nonprofit	Social media; website; newspaper articles
Sport and leisure library	Reuse, recycle	Interview: 48:38; via Zoom	2 operating individuals	Nonprofit	Social media; website; newspaper article
Second-hand store	Reuse, recycle	Interview 49:47; In person at their office	Operating individual	Nonprofit	Social media; website
Hydroponic farming	Food consumption and production	Interview 48:15; via Zoom	2 Initiators	Limited liability company	Social media; website; newspaper article
Vegan food truck	Food consumption and production	Interview: 1:06:02; In person in their food truck	2 Initiators	Limited liability company	Social media, newspaper article

Interviews were conducted in Swedish, and relevant codes and excerpts were translated into English by the first author, who is fluent in Swedish and a native English speaker. As the research was done during the COVID-19 pandemic, most interviews were carried out digitally.

Data Analysis

To analyse the verbatim interview transcriptions and secondary data, we followed the guidelines of Gioia, Corley, and Hamilton (2013), as shown by the data structure in Figure 1. The first author began by inductively coding, in NVivo, the interviews and secondary data for everything broadly related to our purpose. Together, the three

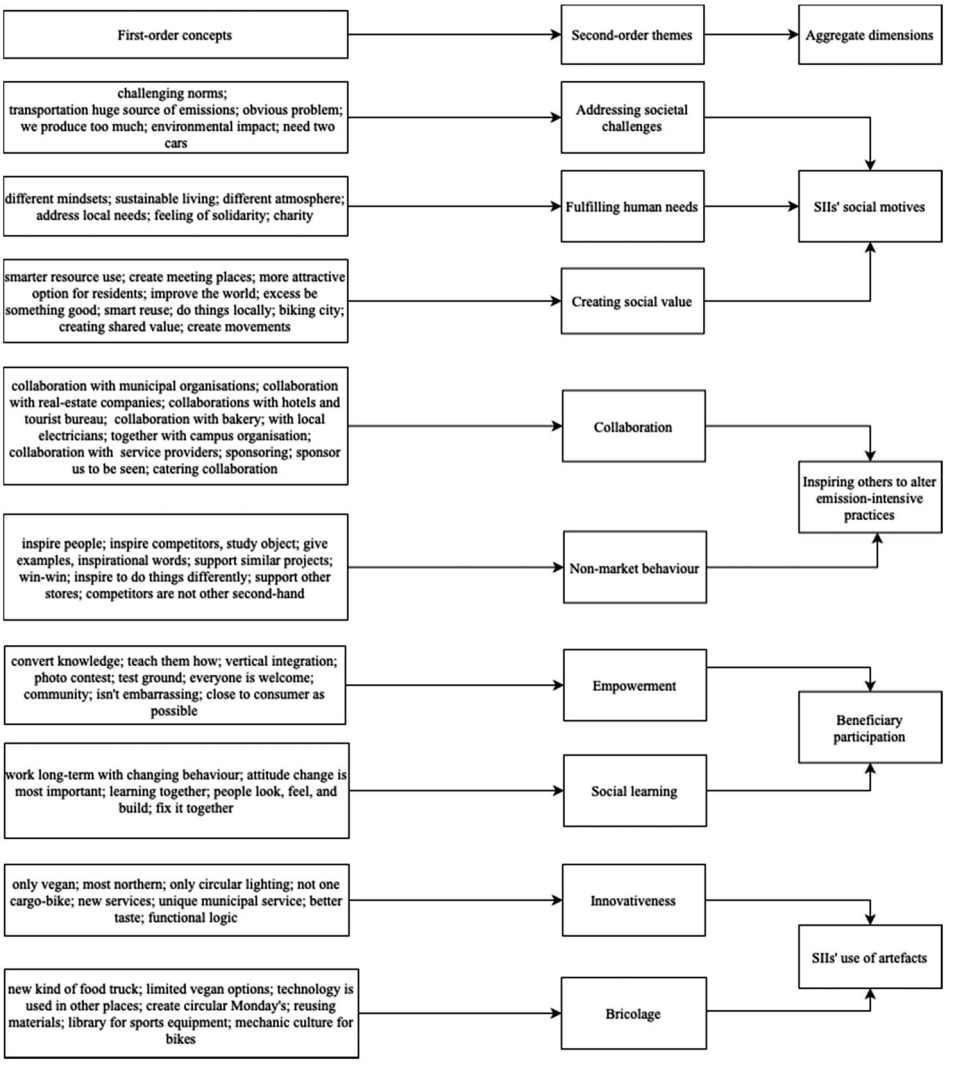

Figure 1. Data structure from coding to aggregate dimension.

authors discussed initial codes to determine at an early stage what was relevant for guiding and developing our research question (cf. Gioia, Corley, and Hamilton 2013). For example, codes that were too general for SII or not found to be of relevance for climate mitigation were excluded from the next steps. Particular attention was paid to what interviewees stressed, but also surprising statements. These codes were then organised into first-order categories based on the terms used by interviewees (Gioia, Corley, and Hamilton 2013).

Next, first-order categories that related to similar topics were organised into second-order themes. We did this by using our knowledge concerning relations between social innovation theory and climate change, where the first author began organising the second-order themes. Then, these were reviewed by the co-authors leading to a discussion of appropriate second-order themes.

Second-order themes were then organised into aggregate dimensions. Aggregate dimensions were organised according to how social practices were being altered by SIIs. In following the Gioia, Corley, and Hamilton (2013) method, and for practical reasons, only citations from interviews are presented under our presentation of the aggregate dimensions below, yet secondary data was used for creating codes and first-order categories.

Findings: Social Innovation Initiatives and Climate Change

Below, we present our findings demonstrating how SIIs' social ends and means alter social practices to be relevant for mitigating climate change. We found four aggregate dimensions demonstrating how SIIs can mitigate climate change: social motives, inspiring others, beneficiary participation, and use of artefacts. To analyse how the identified dimensions alter social practices, we discuss the extent to which the three elements of social practice are in focus, namely meaning, competences, and materials (cf. Shove, Pantzar, and Watson 2012).

SIIs' Social Motives

The first dimension showcases SIIs' motives related to their social ends. Motives for addressing social ends relevant to climate mitigation were categorised through the second-order themes addressing societal challenges, fulfilling human needs, and creating social value. Moreover, through these identified themes, we detected that SIIs' attempted to alter practices by focusing on changing the meaning of a practice. Also, this dimension suggests that motives could be directly or indirectly related to climate change and emission-intensive activities.

The lighting as a service initiative addressed a societal challenge, which the initiator coined 'the obvious problem', of humankind's excess resource use. The initiator then described his thoughts on pre-existing solutions arguing that they only rebranded unsustainable solutions. Instead, he wanted to change the meaning of the focal practice. He wanted lighting to be perceived as a service instead of as a product. This meant that his motives were indirectly related to climate mitigation, yet by targeting material flows in the construction industry, it could nevertheless affect emission-intensive production and be relevant for climate mitigation (cf. IPCC 2023).

The building consultant was motivated by a novel building solution that could address a societal challenge more directly related to climate change, by offering an alternative to concrete, an extremely emission-intensive material (IPCC 2023). Focusing on altering the meaning of normalised building techniques, her motive was to show that this could also work in a colder climate: 'It works to switch things like mud or change to straw or whatever, and that it can be relatively easy and cheap…It's connected to more than just emissions, so to speak, but also to the fact that we didn't choose to build in Southern Sweden. We chose to move up North because we wanted to have a real winter'. Thus, her motives were seemingly based on mixing a fascination for a new building solution with a climate-relevant ambition.

Next, the electric moped taxi initiator exemplified an SII that was motivated by fulfilling human needs. More precisely, she focused on citizens' need to transport

themselves by attempting to provide new meaning to the practice: 'For sure, half of the trips people make within the city could easily be possible with the same vehicle that I use. It would create a totally different atmosphere… I think there is a feeling of solidarity, and I think it connects to our relationship with one another'. In other words, she wanted a transportation practice less individualistic that was better for the environment by being less emission-intense.

Another relevant example related to fulfilling human needs comes from the vegan food truck. The initiators described how their motivation was indirectly related to climate change: They saw something missing in the municipality as they argued that there were a lot of vegans but no proper 'vegan scene'. Thus, by aiming to provide a vegan option, their motive was to create an alternative to emissions-intense meat-based diets, thereby attempting to give new meaning to food consumption practices.

The final theme explicating social motives was creating social value. An example is the hydroponic farming initiative who's motive for creating social value was indirectly related to climate change. Although their solution was centred around a novel solution (hydroponic food production), they wanted to create social value by providing 'community services'. Hydroponic food production could, in turn, change the meanings of both food consumption and distribution practices in the municipality. Although climate mitigation was not their main motivation, this food production means less emission-intensive production processes and, because food is produced locally, also decreases emissions from heavy transports.

The rural service hub also exemplifies an SII motivated by creating social value, that was indirectly related to climate change: 'Many need to have two cars and go back and forth to the city to do everything, so we wanted to create an opportunity to do things locally. It feels more sustainable than being reliant on cars to do everything'. One of its motives was related to the providing a community service that could change the meaning that rural citizens attached to their car-based transportation practices whilst simultaneously creating social value. As a positive side-effect, their SII would reduce the need for emission-intensive car-based travel.

The DIT bike mechanic initiators also wanted to create social value by increasing bicycle use. By changing how the mechanic culture was viewed, they seemed to be indirectly targeting citizens' emission-intensive transportation practices, creating social value in the process: 'We want to take tips from the mechanic culture in Sweden and make it more available. I mean, [the city] is a biking city, a lot of people bike and there are a lot of bikes, and newer bikes require certain types of tools and not everyone has access to these, so we wanted to create a meeting place for people to come and fix their bikes'.

A final example of a motivation to create social value comes from the electric bike delivery initiator. More precisely, he wanted the city to become a 'proper' biking city, and to achieve this, he argued that it needed to have biking delivery logistics. His motives were directly related to climate mitigation as biking reduces transport emissions.

Inspiring Others to Alter Emission-Intensive Practices

The second dimension is about inspiring others and can be classified as a social means. Through the second-level themes collaboration and using non-market behaviour, SIIs demonstrated how they attempted to inspire others to partake in social practice

change. Together, these themes show how SIIs' attempted to alter the meaning of practices to get others to enact similar positive solutions for mitigating climate change.

Most of the analysed SIIs provided examples demonstrating collaboration. For example, the rural service hub initiator explained how they collaborated with a lot of different organisations, including local citizens: 'We have had a lot of workshops, where we brought in local community members…it has been very important to have these co-creation processes…to learn how the space can be used'. By collaborating with local citizens, they could help explain what the service hub building could provide and mean for those citizens. Collaboration was important for the DIT bike mechanic initiative who noted: 'We are not a repair shop, we do not fix bikes for people, unless it's a difficult tire change. The idea is that we teach them and that we do it together'. By collaborating with bicycle owners, they could give positive meaning to biking and contribute to owners' competences regarding how to repair a bicycle. Also, the sports and leisure library interviewees expressed that they wanted to collaborate with many to ensure that everyone knows about them: 'We want to be friends with everyone'. As changing the meaning of consumption practices was central to their initiative, they felt that collaboration was a means to inspire and encourage others to alter consumption practices.

Next, SIIs also relied on non-market behaviour as a means to inspire others to alter social practices. For example, the second-hand store operator stated: 'It is possible that when we cannot accept products (donations) we send them to our competitors, we want to support one another. It's actually a competitive advantage to support one another'. The respondent then clarified that this use of the competitor term was not their own, by stating 'Our competitors are not the other local second-hand actors. Our competitors are stores that sell new things'. This helps explain how they aimed to change the meaning of consumption practices by increasing the availability of second-hand products, regardless of the provider. That consumption continuously has a large climate impact by fuelling virgin production, getting others to buy second-hand could potentially contribute to climate mitigation.

Another example of non-market behaviour comes from the building consultant initiator who focused on altering the meaning others attached to building practices. She explained wanting to decrease emissions by changing other builders' understanding of building practices to use more historical ones: 'So, I thought, can it be something from this place [our house] that can be used, that we have built up to show and demonstrate how building can be done differently, and to inspire and to bring the question up to others in the building sector, how can we do things differently'. Also focusing on altering other's meaning of practices, the lighting as a service initiator argued how he hoped to inspire what can be interpreted as 'his' potential competitors by encouraging other organisations to adopt a service mindset. This new mindset could enable others to apply the same meaning for altering practices within the industry. A final example of how non-market behaviour was linked to inspiring others comes from the rural service hub. The interviewed initiator displayed their non-market behaviour through explaining how they wanted their hub to become a study destination, not only for people but also for other organisations. She wanted her SII to encourage other villages to create similar hubs. This demonstrates how changing the meaning of how a community views the importance of community services can lead to the development of similar solutions.

Beneficiary Participation

This third dimension also gave insight into how SIIs used social means. It displays how the role of beneficiaries can have importance for mitigating climate change. The second-order themes that led to this dimension were empowerment and social learning, which can help spread new practices by increasing beneficiaries' engagement. These social means described how SIIs focused on altering the meaning and competences of practices.

The lighting as a service initiator described trying to empower people working as engineers by stating: 'Having a functional logic is important, and it requires vertical integration down the entire supply chain'. He found that his initiative could benefit engineers by instilling new meaning to help them understand why offering a service is better for the climate instead of selling new products. This logic could also increase their competences, i.e. enabling them to reuse light fixtures and perform other services. Engineers also benefit because increasing the know-how of circular practices can decrease resource use in terms of materials but also their time.

Empowerment was also the focus of the sports and leisure library initiative, whose operator argued: 'You don't have to buy new products just to try. We want to be a test ground, that someone can try a product at our place and see if it is fun or not. If you think it is a lot of fun, then go buy a new one, but otherwise you can just try it first, that's really important'. They believed they could change their beneficiaries' consumption practices by altering young kids (their direct beneficiaries) meaning of the practice. For example, beneficiaries learned that borrowing was not embarrassing and that borrowing is beneficial both from a climate and economic perspective.

Next, social learning was seen as a means for initiatives to alter social practices by focusing on changing beneficiaries' competences. One example was the DIT bike mechanic initiators, who stated: 'We need to make it possible for people to fix their bikes and teach them how to take care of their bikes to give them a longer lifetime'. They further argued that helping cyclists become more self-reliant could induce more people to bike. This demonstrates how an SII seeks to increase beneficiaries' know-how of a practice to alter that practice.

The building consultant also focused on social learning by showing that alternative building methods that were possible to do in Northern Sweden's arctic climate, arguing: 'We have thought about how we can organise this to share our knowledge, we have courses and have people here on study visits and those kinds of thing…We have planned several free courses and study visits'. For this SII, it was important to show how to build houses using new techniques. By increasing the know-how of the practice it can become more normalised within their context.

SIIs' Use of Artefacts

The fourth dimension highlighted the use of artefacts by SIIs, hence dealing with social means. Through the second-order themes innovativeness and bricolage, we could detect the importance of SIIs focusing on the meanings and materials to alter practices.

Innovativeness can be exemplified by the electric moped taxi initiator. She discussed the symbolic nature of her vehicle, which was an innovative artefact for the region:

'Transportation is a huge source of emissions, so from that I started to think, what can I do? I have been a year-round bicyclist since I moved [here] and I wanted to do something connected to that, something that can challenge the norm here, to do something different. And I knew this vehicle would stick out. I looked at different vehicles and bikes and so on, and with this vehicle, to be able to drive on the biking roads felt really cool, you can drive along the river with two passengers…' Thus, the vehicle spurred the hope of altering transportation practices. Another example of being innovative in terms of material artefacts come from the rural service hub's physical building. This new building stood out in the village as a materialisation of a meeting place. This meeting place can possibly alter locals' social practices, reduce travel needs, and mitigate climate change because it shows that a variety of services are locally accessible. The vegan food truck was also innovative for the municipality, as it was the only fully vegan option. As a material, vegan ingredients makes the offered material different, but their food truck also physically displayed that there were alternatives to conventional dining options as it was one of few food trucks in the municipality and that their food truck had a unique sign.

Bricolage was another way that artefacts were used. For example, the cargo-bike pool used bricolage by combining existing elements of pooling resources and cargo-bikes. Seeing the cargo-bikes around the municipality can make the material (the cargo-bike) significant for showing new practice alternatives: 'We have gotten in some information about how people use the cargo bikes from a photo contest…We saw that some people have filled their bike with stuff from IKEA. We have also had some students that have used the bikes to move from one student room to another, if students don't have that much stuff the cargo bike works well. It's enough to make a few trips with a cargo bike instead of renting a car and a trailer. It's a much better solution'.

The hydroponic farming initiative used innovative technology as a central means to attain a more sustainable farming end. Still, it was the use of bricolage, combining this existing technology with providing a local, centralised service, that made the practice relevant for climate mitigation. The initiators stated: 'We want to be as close to the consumer as possible…to provide community services'. This demonstrates that it was the meaning of the physical artefact that was most important for their attempt to altering social practices to mitigate climate change. A final example of bricolage can be seen from the second-hand store and sports and leisure library initiatives. Here, bricolage comes in the form of repurposing or reusing existing materials, which is central to changing the meaning of consumption practices. It also relates to the role of materials in these practices. Nonetheless, it is the meaning behind what is being shared or rebought that is important as it demonstrates an alternative to new product consumption, which can become significant for SIIs' mitigating climate change.

Conceptual Model

Based on the findings, we developed a conceptual model demonstrating how SIIs' social ends and means could influence social practices within a context (Figure 2). SIIs had social motives to address a societal challenge, to fulfil human needs, or to create social value, to, in our case, be relevant for climate mitigation. SIIs had various social ends that were potentially relevant for climate mitigation. These were achieved through the

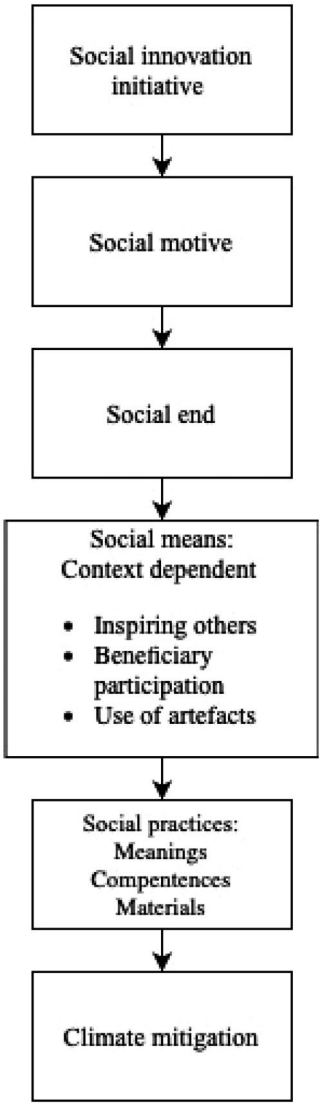

Figure 2. Conceptual model of how SIIs alter emission-intensive social practices through their social ends and means.

context-dependent social means inspiring others, increasing beneficiary participation, and use of artefacts. The practice change relevant for climate mitigation was implied through altering the meanings, competencies, and materials of social practices

Discussion

The purpose of this article was to explore SIIs' potential for mitigating climate change and answer the research question: How do SIIs attempt to alter social practices through their social ends and means to be relevant for mitigating climate change? In addressing this purpose and research question, we find that:

First, SIIs' different motives for addressing social ends focused on changing the meaning of common emission-intensive practices. This did not necessarily mean that SIIs' motives were directly about climate change mitigation; rather, motives could be directly or indirectly related. Most SIIs in the transportation practice field had social motives that were directly related to climate mitigation end because they explicitly sought to reduce car-based travel, a well-known cause of carbon emissions (IPCC 2023). However, SIIs in the building, reuse and recycle and food consumption and production practice fields had motives that were more indirectly linked to climate mitigation. They could, for instance, replace and potentially reduce demand for various products that generate carbon emissions through their production. SIIs expressed motives categorised into creating social value, approaching societal challenges, or meeting human needs that were relevant for climate mitigation. For example, the rural service hub's motive was to create social value (value for the local community) by giving residents the benefit of having services close at hand, increasing the local community's well-being (Grimm et al. 2013; Mulgan 2019). This motive was indirectly related to climate change; but is relevant for climate change mitigation as a social end because it can reduce car-based travel.

This example shows how SII's motives, relevant for a climate mitigation social end, attempt to alter social practices by being both attuned to, and intrinsically connected to, their contextual realities (i.e. location, culture, and regulation; cf. Hargreaves 2011). This seems to be a strength of SIIs as they find motivation in being able to identify and understand the common local social practices that cause emissions, and what meanings, competences, and materials they rely upon (cf. Cunha and Benneworth 2020; Deserti and Rizzo 2020; Domanski, Howaldt, and Kaletka 2020). This gives them an opportunity to identify and provide viable alternatives. Through instilling new meaning into the social practice that their solution could alter, this could be realised, e.g. introducing an electric moped taxi to challenge the mobility practices in the municipality. This and other examples shows that SIIs can challenge their realities to alter the meaning of certain detrimental social practices (cf. Domanski, Howaldt, and Kaletka 2020).

Second, through the dimension inspiring others, the non-market nature of initiatives (Mulgan 2019) demonstrated how SIIs attempted to alter the competences and meanings of practices relevant for mitigating climate change. Nonetheless, this was not black and white as several SIIs also relied on market components, such as being registered as limited liability companies or expressing the desire to attract consumers (e.g. the vegan food truck). However, even if such components were part of SIIs' means, they were ultimately used to alter the given meaning of a social practice, showcasing alternative solutions (Caroli et al. 2018; Giesecke and Schartinger 2024). This was what was important for SIIs, not expanding customer reach for the sake of selling more and increasing profits. For example, the lighting as a service initiative did not want to sell more lighting equipment but to provide a service that helped extend the lifetime of the materials in use. Providing this service was a way of getting other actors to also understand the importance of this. While this is characteristic of social innovation, i.e. changing the meaning of a focal practice, it is also relevant for climate change as it can reduce consumption and subsequent material demand. Moreover, to achieve sustainability, practices must not only change, but the levels of

certain activities must also decrease (Parrique et al. 2019). This relates to some of the studied SIIs as they did not aim to grow their own initiatives, but wanted new social practices to spread independent of their SII. Moreover, this combined with the presumed contribution to lower levels of emission-intensive transportation (by changing to bike) and agri-food related consumption (by changing to a plant-based diet). Also, influencing the given meaning to such practices and changing the competences surrounding such practices was salient, e.g. borrowing sports equipment is both something one needs to learn not to be embarrassed about and something that one needs to learn how to do. These examples are both highly representative of social innovation and seemingly relevant for climate mitigation as they could potentially replace new product consumption (and subsequent demand to produce more).

Third, SIIs' used two types of social means, empowerment and social learning, to increase beneficiary participation (cf. Howaldt and Schwarz 2017). This shows another way of focusing on the competences and meanings that must change for social practices to change (i.e. Shove, Pantzar, and Watson 2012). Empowering beneficiaries was showcased, for example, by the sports and leisure library initiative who empowered beneficiaries so that they could alter their own consumption practices. This example demonstrates how SIIs attempted to alter problematic practices by empowering beneficiaries to alter a practice beneficial for themselves (cf. Anglidou and Psaltglou 2017; Avelino et al. 2020). Additionally, SIIs' beneficiaries can help inform about alternatives to emission-intensive activities, an essential part of spreading the competences and meanings of new practices (Howaldt and Schwarz 2017). One example is the building consultant who aided social learning by sharing her climate-neutral building techniques and demonstrating these to address emission-intensive building practices. Both empowerment and social learning highlight how SIIs' social means can be used to alter the meaning and competences of practices. However, beneficiaries in terms of future generations, or nature, were not visible in the data analysis. This can be a result of our local focus using SIIs as our unit of analysis.

Fourth, SIIs' use of artefacts demonstrated the importance of attaching a symbolic meaning to materials as a means for altering social practices. For instance, having a food truck, cargo-bike, or electric moped taxi showed how materials were used in a symbolic way as a means for changing the meaning surrounding normal social practices. By giving new meanings to these materials (cf. Shove, Pantzar, and Watson 2012), alternative practices became more noticeable within the studied context as their novelty makes them unique and helps them stick out within the context. An electric moped taxi, for example, may not have the same symbolic significance in a larger city with a warmer climate. Moreover, it was through bricolage (Olsson et al. 2017) that these materials emerged. For example, the hydroponic farming initiative introduced an existing technology into the context, putting produce production and service as close to the local community as possible. This decreases emissions by eliminating the use of large transports, and by using less land for cultivation.

Our model, containing these four dimensions, helps explain how SIIs' can mitigate climate change. Having social motives, inspiring others to alter emission-intensive practices, increasing beneficiary participation, and using artefacts as a symbolic means for altering practices were prominent across the SIIs, and related to all four practice fields. With the studied municipality being in Sweden, it may be that a focus on altering transportation practice by enabling biking may be contextual, as this may not be as

common in cities with less favourable biking infrastructures or those with more favourable conditions, e.g. Amsterdam or Copenhagen. Building practices differ greatly depending on context, especially due to weather conditions. This may make the two studied SIIs addressing building practices unique in Northern Sweden, but such a practice field may appear differently in Southern Europe, for example as different building methods are used. Next, second-hand consumption practices have been increasing in Sweden, which may make SIIs in this practice field more successful if social learning is already occurring, as the practice becomes more common. The food consumption and production practice field had unique challenges based on culture and location. Spreading vegan practices can be challenging as it is not central to Swedish culture, which can be an opportunity for an SII introducing vegan dishes, but difficulties in totally changing diets to become vegan. Finally, there was little cross-over between practice fields, but collaboration across fields, as an often-studied SII aspect (i.e. Cunha and Benneworth 2020; Wittmayer et al. 2019) could be more prominent in other contexts.

Conclusions

This article explored SIIs' potential for mitigating climate change and answered the research question: How do SIIs attempt to alter social practices through their social ends and means to be relevant for mitigating climate change? A qualitative analysis based on one geographic setting gave insight into SIIs practical potential for mitigating climate change. As alternatives to market-driven solutions, SIIs had social ends that focused on altering the meaning of practices that were beneficial for climate mitigation. SII actors' motives related to problematic emission-intensive social practices within the local studied context, even when climate change was not the primary focus of activities. Moreover, the nonmarket nature of SIIs came to the fore as actors described that being imitated was desired. Our analysis highlighted that altering problematic practices was linked to SIIs social motives. The global challenge of climate change was approached through SIIs' local lens, using their local context to create alternative solutions, ultimately helping, and motivating, to alter emission-intensive activities. Also, SIIs' use of social means suggests how altering social practices focus on the meaning, competences, and materials of such practices. Therefore, emission-intensive social practices can be altered by changing others' given meaning of common social practices, their know-how of such practices, while also providing alternative kinds of symbolic materials.

Our conceptual model contributes to the social innovation literature (Olsson et al. 2017; Ziegler et al. 2022) by providing a basis for future comparative studies. As our results suggest, having social motives, inspiring others to alter emission-intensive practices, increasing beneficiary participation, and using artefacts as a symbolic means for altering practices are a first step for SIIs' potential for mitigating climate change (i.e. Scott-Cato and Hillier 2010). Future studies can start by applying our model in other municipalities and countries to test its' potential and to see if other social means are more prevalent. Through comparative studies within and between practice fields, our four identified dimensions can be evaluated in other contexts. Also, studying other affluent contexts can investigate if other means unique for other practice fields may emerge. For example, the studied municipality introduced an SII into the transportation

practice field showing what social learnings are significant for them, but if enabling cycling practices is common in other contexts is unclear.

One limitation of this study is that reductions in emission were not studied. Therefore, we can only suggest that SIIs in the studied context had potential for mitigating climate change. As SIIs address social practices, daily routines can be reflected upon, and emission-intensive activities can be altered (cf. Nyberg and Wright 2022; Quilley 2012) where future research can study how SIIs solutions can lead to decreased emission. A second potential limitation was our main data collection being based on interviews with the SII actors' themselves. Using multiple methods and conducting interviews with multiple actors, including beneficiaries, would help triangulate the accounts of SII actors. Third, a limitation was our focus on one region. Although this study helps increase our knowledge of non-technological experiments (cf. Suitner, Haider, and Krisch 2024) to introduce climate mitigation solutions, an international comparative study would help further increase our understanding of SIIs' climate mitigation potential.

Disclosure statement

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