It's all about community: On the interplay of social capital, social needs, and environmental concern in sustainable community action

Lisa Hanna Broska[a,b,*]

[a] Research Centre Juelich, Institute of Energy and Climate Research – Systems Analysis and Technology Evaluation (IEK-STE), 52425 Jülich, Germany

[b] Technical University Bergakademie Freiberg, Schloßplatz 1, 09596 Freiberg, Germany

* Corresponding author.
E-mail address: l.broska@fz-juelich.de

Abstract

Behavior change towards sustainable lifestyles such as adoption of renewable energy technologies is a significant element in the fight against anthropogenic climate change. Increasingly, private households can be observed to take up different renewable energy technologies; however, the introduction of these technologies is not accompanied by a broader adoption of pro-environmental behaviors, as recent studies have shown. At the same time, group settings and social capital seem to promote the uptake of wide-ranging sustainability measures. Six case studies were conducted among different sustainable community projects in Germany to shed light on why and how broad sustainability transformation in such settings comes about. Findings suggest that successful implementation of wide-ranging sustainable measures and changes in behaviors in community settings result from motivations that originate from an interplay of social needs, social capital, social norms, and environmental concern. Strong environmental attitudes, not among all, but a critical mass of members and key individuals are necessary. The desire for community and other motives, along with social influence and social norms push individuals with low environmental concern to participate in sustainable endeavors.

Keywords

energy transition, pro-environmental behavior, spillover effects, social norms, motives, sustainability

1 Introduction

Behavior change and sustainable consumption are frequently demanded for a successful fight against anthropogenic climate change [1, 2]. Of particular interest has been the production and consumption of energy by private households, since in Europe 26 % [3] and in Germany 25.5 % [4] of direct energy consumption is residential. In this context, behavior change means an active reduction in energy consumption and the adoption of energy-efficient technologies. On the production side, people can have significant impact by taking an active part in the energy transition towards renewable energy sources [5]. The latter, adoption of different renewable energy technologies by private households, is happening quite successfully in Germany, usually by becoming prosumers of solar power [6] or by joining a community renewable energy project [7]. However, simultaneous efforts to reduce energy consumption and a broader uptake of sustainable consumption and pro-environmental behaviors in and around the home is called for [1, 8]. The literature on prosumers of renewable energy has discussed spillover effects to reduced energy consumption and other pro-environmental behaviors (e.g., [9, 10]), but results have been largely inconclusive or even negative (e.g., [6, 11, 12]).

At the same time, in some community-based settings – e.g., eco-suburbs [13], transition towns [14], cohousing projects [15], and ecovillages [16] – the adoption of a broad range of sustainable measures (i.e. sustainable technologies, behaviors, and contracts for sustainable goods and services) has been observed [17]. Reasons are likely manifold: the range of technologies that can be applied is greater for groups, ownership structures and financial barriers may prevent single households from being more involved in the energy transition; by acting as a group the scope of action along with the knowledge available are expanded [18] and issues like social dilemmas and social conventions surrounding established behaviors can only be solved by a group as a whole [19].

A comparative study between low-carbon municipalities and intentional communities (i.e. top-down and bottom-up approaches respectively) found in particular bottom-up intentional communities to be successful in implementing a broad range of sustainable measures and changing behaviors [20]. While both types provide low-carbon infrastructures, only intentional communities establish social structures that foster sustainable practices by creating shared visions, decisions, rules, and collective living patterns [20]. This finding seems to suggest that resources embedded in social structures, i.e. social capital [21], are crucial. Indeed, social capital and its various elements have been identified as strong, if not strongest, motivators for pro-environmental behavior [22] as well as sustainable community energy initiatives [23, 24].

However, there are no in-depth explorative case study analyses of a wider variety of bottom-up community projects that result in a broad transformation of households and lifestyles towards sustainability. In particular the motivations of the people active in such sustainable community projects and the interplay of motivation and social capital are under-researched. This paper seeks to close that gap by way of qualitative comparative case study research looking at six different sustainable community projects across Germany. Sustainable community projects are defined here as (bottom-up) citizen initiatives, whose activities include efforts to reduce the environmental impact of their members' housing and lifestyles. The central finding of this study is that along with environmental and social motives, social capital and social norms, springing from the social structure of these sustainable community projects, function as motivational forces for members to adopt wide-ranging sustainable measures and behaviors.

This paper addresses the following research questions: What motivates people to participate in sustainable community projects that result in the transformation towards sustainability of their households and lifestyles (i.e. that result in the adoption of a wide range of sustainable measures)? Does social capital play a motivating role in the adoption process of sustainable measures? Findings of this study suggest that central motives stem from social needs and environmental concern, while social capital functions as additional motivator. As a result, strong environmental attitudes are not necessary among all, but among a critical mass of members and key individuals. Social capital, the desire for community, and other personal motives push those not greatly concerned with the environment to become members of sustainable community projects. Wide-ranging sustainable measures are adopted because of environmental motives and social norms.

The following section provides an overview of the current literature on (1) spillover effects among members of community renewable energy initiatives and prosumers, (2) social capital's role in pro-environmental behaviors and participation in sustainable community projects, and (3) stated motives for engaging in pro-environmental behaviors and participating in sustainable community projects. Section 2 concludes with a summary of the research gaps revealed in the literature review. Section 3 introduces the research design, methods, and background to the cases. Section 4 presents the results, and is followed by the results' discussion and conclusions in Sections 5 and 6 respectively.

2 Literature review and identified research gaps

The following cumulative literature review begins with a discussion of empirical findings of spillover effects among members of community renewable energy initiatives and individual

prosumers to see where a broad transformation of lifestyles towards sustainability has been observed. Based on the discussed findings that a broad transformation of lifestyles towards sustainability was detected in some social settings, the second subsection reviews the literature on the motivational role of social capital and social norms in pro-environmental behaviors and participation in sustainable community projects. Subsection 2.3 reflects on previously identified motives for engaging in these behaviors and efforts. Together the three subsections reveal what is known thus far about what motivates people to participate in sustainable community projects that result in the transformation towards sustainability of their households and lifestyles. Section 2 ends with a summary of the identified research gaps that this study addresses.

2.1 Spillover effects among prosumers and members of sustainable community projects

The ever-growing literature on community-based renewable energy projects has highlighted the broader significance of such initiatives beyond the obvious development of renewable energy technologies [25], i.e. increased acceptance of renewable energy technologies and the energy transition, increased awareness, knowledge, and intention to take up low-carbon technologies and other sustainable measures and behaviors [26-29]. However, there is little evidence of a widespread actual uptake of other pro-environmental behaviors and technologies by members [26, 30, 31]. Of course, community-based renewable energy projects have usually a singular focus on producing renewable energy and, moreover, are removed from members' households and personal behavior. That separation is not in existence when self-consumption occurs in community-based renewable energy projects, i.e. when members are both producers and consumers of energy, so-called prosumers. However, no literature exists on possible spillover effects to other pro-environmental behaviors in such settings, as Berka and Creamer [32] point out.

It does exist for individual prosumers, i.e. single households that install renewable energy technologies. The fact that they are prosumers of their own energy has led to expectations of positive spillover effects, especially when it comes to reducing energy consumption [12, 33]. Studies looking at prosumers and spillover effects to other pro-environmental behaviors have been manifold, but their results ambiguous. Few have found a reduction in electricity use [34, 35], others have found both a reduction and an increase [11] or only an increase [36, 37], and several have found no changes in electricity consumption [6, 38, 39] and no changes in pro-environmental behaviors more generally [12, 40]. Studies that looked at self-reported intentions to engage in pro-environmental behaviors, however, have found a self-reported increase in adoption of such behaviors [9, 10, 12], indicating that awareness is growing but not translating

into actual behavior change. This increase of energy awareness among prosumers was also supported by studies explicitly investigating it in this context [37, 41].

On the other hand, expectations might need to be lowered when it comes to reduced energy consumption as a result of behavior change, since it has been shown that energy (and water) saving occurs mostly because of technology and design and not because people change their behavior [42]. Then again, instances where sustainability measures and sustainable behaviors are adopted simultaneously and broadly, are mentioned in the literature. For one, they are observed among very small numbers of individuals, among so-called 'home front transitioners', i.e. single households attempting low-impact lives with reduced consumption and living standards [43]. For another, such sustainable lifestyles are seen in community settings – ecovillages [16], eco-suburbs or eco-districts [13, 44], transition towns [14, 45], cohousing or group-built housing projects [15, 46] – and only in these are larger groups of people involved. Bottom-up approaches, i.e. projects founded by private citizens, in particular have been successful in implementing wide-ranging sustainable measures [20]. In-depth case studies of such group projects exist only for intentional communities and mainly for ecovillages [20, 47, 48]. There are no in-depth comparative case studies of a larger variety of projects.

Middlemiss [49] along with Berka and Creamer [32] suggest that community-based renewable energy projects are more likely to encourage a broader uptake of sustainable behaviors among their members if they actively engage their members and aim not only to introduce renewable energy technologies but also have wider environmental goals that include changing members' lifestyles. This certainly seems to be the case in those instances mentioned above, where wide-ranging lifestyle changes were observed. Furthermore, these community projects are not detached from their members' homes. Their members are prosumers of renewable energy and intentional communities are marked by close joint or adjoining living quarters. In such conditions, the likelihood that social norms and social capital (see Section 2.2) will have an impact increases (see [50] on the spatial aspects of social capital).

Social norms are discussed as one explanation for behavioral spillovers in the literature [51, 52]. However, empirical studies are rare and often inconclusive [53-55]) and the connection between social norms and spillover effects is frequently named as an area where more research is needed [53, 56]. Social norms are behavioral rules shared in a social group (or entire society), or resulting behavioral patterns within that group (or society), and are partially sustained by the group members' approval or disapproval [57, 58] (for a short review of the variety of contexts and ways, in which social norms are studied, and the many behaviors they have been proven to

influence, see Vögele et al. [59]). Social norms are considered by some scholars to be a form of social capital (e.g. [60]) and are reviewed in more depth in section 2.2.

Spillover effects in group settings have also been little explored. An exception is a study by Elf et al. [61], who found that newly formed and bonded groups of like-minded people provided support and information, and raised awareness about sustainable behaviors among members. Sintov et al. [54] speculate that behavioral spillover is successfully induced by social norms when people, who adopt the initial behavior, perceive those who also engage in the behavior as an in-group and are motivated to adopt other behaviors consistent with that group's social norms. Though these authors don't use the term, their findings seem to suggest that newly created social capital in these groups contributed to sustained behavior change and behavioral spillover.

2.2 Social capital as key motivator of pro-environmental behaviors and participation in sustainable community action

The dependence of community action, i.e. collective action, on social capital has been researched widely [62]. Social capital – a set of real or potential resources inherent to relationships or social networks of relations [63-67] – can be divided into three dimensions: structural, relational, and cognitive social capital [68]. Structural social capital focuses on the social networks themselves, their ties and configuration. Three types of structural social capital have been identified: bonding (i.e. ties within a group), bridging (i.e. ties between groups), and linking social capital (i.e. vertical ties between people and organizations) [69, 70]. Some scholars only focus on the structural aspect of social capital [50]. Others consider social networks only as the source, in which social capital is produced, and focus instead on the elements in relational and cognitive social capital [50, 66]. Relational social capital includes trust, social norms and sanctions, obligations and expectations, identity and identification, while cognitive social capital consists of shared knowledge, understandings, values, language and beliefs [68, 71, 72]. This broader understanding of social capital – applied here – originates from seminal works by Coleman [60] and Putnam [73], and has become a dominant conceptualization of social capital [74], though there exists no ultimate consensus on the definition of social capital [68].

There is some evidence in research on social capital that some individuals hold key roles within social networks, so-called social referents (e.g. [75, 76]). These leadership figures are key for utilizing social capital in the first place [76]. The role of leaders in groups and their behaviors' long-lasting effects on other members' behavior has been shown in experimental settings [77-

79]. They are strong role models for group members at the beginning and shape people's beliefs for the future with their initial behavior [77]. In literature on community action [65] and sustainable community initiatives [14, 80, 81] the importance of key personnel has also been noted: these key figures ensure that the network of people holds strong, that the sense of purpose permeates the entire network and that necessary skills are learned and shared.

Social capital (or its elements) is usually discussed as a success factor for collective action [82, 83]. It is in this capacity, and usually in the form of preexisting social capital, that it is most widely mentioned in the literature on community renewable energy [7, 24, 84-86] and sustainable community action [87, 88]. Others highlight social capital building as an outcome, a benefit of community energy initiatives [7, 89-91]. However, social capital is hardly ever named as a motivating factor, only very indirectly [92, 93], or single elements of social capital are mentioned as motivators. Studies of this kind have proven the significance of social norms [23, 94, 95], shared social identity [23, 96-98], trust [7, 23, 99-101], and the necessity of preexisting social relationships along with shared community values [81].

The same is true for individual sustainable activities. Social capital is rarely explicitly mentioned; most focus on one element of social capital only: peer effects [22, 102, 103] (i.e. causal effects of social capital [104]), trust [105, 106], social identity [107, 108], social networks [109], and social norms, the factor most widely researched and found to be of key importance for adopting and maintaining new sustainable lifestyles [106, 110-126]. Moreover, social identity has been closely linked to the effectiveness of social norms regarding pro-environmental behaviors [127, 128]. Thus, social norms are arguably a pivotal social factor for successfully combating climate change [129, 130].

The motivational aspect of social capital is a research focus in organizational studies (e.g. [131-134]). The work of Bhandar et al. [135] is particularly noteworthy. Their study examines the different roles of social capital in collaborative action of multiple organizations. They find that social capital fulfills different roles in different phases of a collaborative project. In the initial phase, i.e. the founding stage of a project, social capital functions as a motivator, particularly through trust in preexisting social networks. In the design and development phase social capital is primarily an integrator. Through it diverse knowledge is integrated and shared knowledge, understanding, and language is created. In the later phases of a collaborative project social capital functions as facilitator of further collective action towards the project.

These findings highlight that social capital has different roles, among them the role of motivator. Social capital also changes and is created. Preexisting and newly formed social

capital seem to be equally important. Furthermore, all these findings combined would suggest that social capital plays a role in the realization and motivation of sustainable community action and individual pro-environmental behavior. It is, therefore, also a likely contributor to the particular case of a broad uptake of a wide range of sustainable measures in group settings; however, no definitive proof of such a correlation exists and is only hinted at in the study by Schäfer et al. [20] discussed in Section 1.

2.3 Stated motives for active participation in sustainable community projects and behaviors

However, the influence of the social on personal motives to participate in sustainable community projects, particularly community renewable energy, has been proven. Studies into motives of members of community renewable energy projects reveal a set of reoccurring groups of motives: economic, environmental, social, political, technological, and personal motives [100, 136]. Similar motives have also been identified in studies about motivations behind pro-environmental behaviors [137, 138], sustainable consumption [139], adoption of renewable energy technologies in the home [140-142], carbon offsetting [143], and sharing activities like car or meal sharing [144]. Most of these studies highlight the predominance of economic and financial motives. Nevertheless, environmental concerns and social motivations, like desire for integration in the local community and creation of friendships [100], community building [136] and social status [140, 141, 145, 146], are never absent.

Four previous research findings stand out in particular:

Social needs drive (sustainable) community action. Behind motivations lie human needs and need satisfaction [147], a prominent part of which are social needs such as affection, belongingness and identity, love, the need for the esteem of others, understanding, participation, etc. [147-149]. Part of the need to belong is the desire for community. In his work on "the desire for community" Brent [150] contends that community is an illusion along with its attributes of autonomy, unity, and power, but that exactly that illusion, the mere desire for community is what drives social change. He describes the importance of collective action, through which community has the possibility to become 'real' and is created. A study by Briceno and Stagl [92] looks at the connection between social need fulfillment and consumption patterns. They find that collective action aimed at sustainable consumption can fulfill social needs and that social needs, particularly community building, motivated people to get involved.

Peters et al. [151] looked at user behaviors of electric vehicle adopters and found that environmental motives and environmental self-identity[1] were key for consistent sustainable energy behaviors. Similarly, pro-environmental self-identity was determined to be a significant predictor of spillover effects among pro-environmental behaviors [158], and strong environmental motives positively influenced the level of engagement in community renewable energy initiatives [94]. Casey et al. [159] assert that ecovillages emerge from a desire to live sustainably. These findings suggest that when it comes to a broad adoption of sustainable measures and behaviors, an important, if not most important, motive is environmental concern.

On the other hand, Sloot et al. [160] looked at the separate effects of personal environmental motivation and group involvement, i.e. membership in a community energy initiative, on sustainable energy behavior. Their study revealed, by first accounting for the influence of personal environmental motivation, that group involvement did positively influence members' sustainable energy intentions and behaviors, as well as intentions to engage in further pro-environmental and group actions. This seems to suggest that to a limited extent being part of a sustainable community project might also induce spillover effects to pro-environmental behaviors not directly targeted by the project, though of course the study did not observe actual uptake of other behaviors.

Finally, Hicks and Ison [136] observed not only that different community energy projects are based on a different set of motivations each time, but that the underlying motivations behind a community energy project significantly influence the resulting form of the project, i.e. the outcomes of the project. Since the present study seeks to study not any sustainable community projects, but those that specifically resulted in a broad adoption of many sustainable measures, technologies, and behaviors in and around members' homes, the case studies were selected due to their desired outcomes. Therefore, to look back onto their members' motivations will be telling in what motivating factors underlie community activities that do result in a broad and

[1] Several psychological concepts related to environmental behaviors and underlying motivations are studied in the literature. There are, e.g., environmental self-identity (the extent to which one sees oneself as someone who acts environmentally-friendly [152]), environmental or biospheric values (stable beliefs about the value of the ecosystem [153, 154]), and environmental attitudes (a predisposition to evaluate the environment favorably [155]). Connections between the constructs have also been proven: Both environmental attitudes and values are constructs measuring environmental concern [155], though values are more stable and underlie environmental attitudes [156]. Similarly, environmental self-identity has been shown to influence attitudes [157] and environmental values to influence self-identity [152]. As a result, it can be speculated that when interviewees voiced pro-environmental attitudes and motives, there are environmental values and environmental self-identity behind them. However, the verification of this goes beyond the scope of this study.

simultaneous uptake of sustainable measures around the home and various pro-environmental behaviors.

2.4 Main research gaps

The literature review revealed several key findings from research into community-based renewable energy projects and individual prosumers. Social capital, single elements of social capital, and social norms can be significant motivators for both community projects and individual adopters of renewable energy technologies. Many different motives are behind both types, among them economic considerations, environmental concern, and social needs. Spillover effects, i.e. behavior changes and the implementation of a wide variety of sustainable measures beyond the initial aim of installing a renewable energy technology, have not been proven unequivocally among the two types. However, spillover effects have been observed in groups and sustainable community projects, particularly in communities where members' homes were in some way included in the project. Here the literature review reveals a gap, since research is limited when it comes to the particular case of sustainable community projects that result in many different sustainable measures. That is also the case for motivations behind these particular cases as well as for the role social capital might play. As motivations have been shown to influence the outcome of projects, a closer look is warranted.

3 Study design, cases, and methods

For the investigation of the central research question of this study – what motivates people to participate in sustainable community projects that result in the transformation towards sustainability of their households and lifestyles (i.e. results in the adoption of a wide range of sustainable measures) – the following research design was adopted (see Fig. 1). Subsections 3.1 and 3.2 outline the methodological approach taken by detailing the case selection, data collection and analysis. The third subsection provides background on the selected cases.

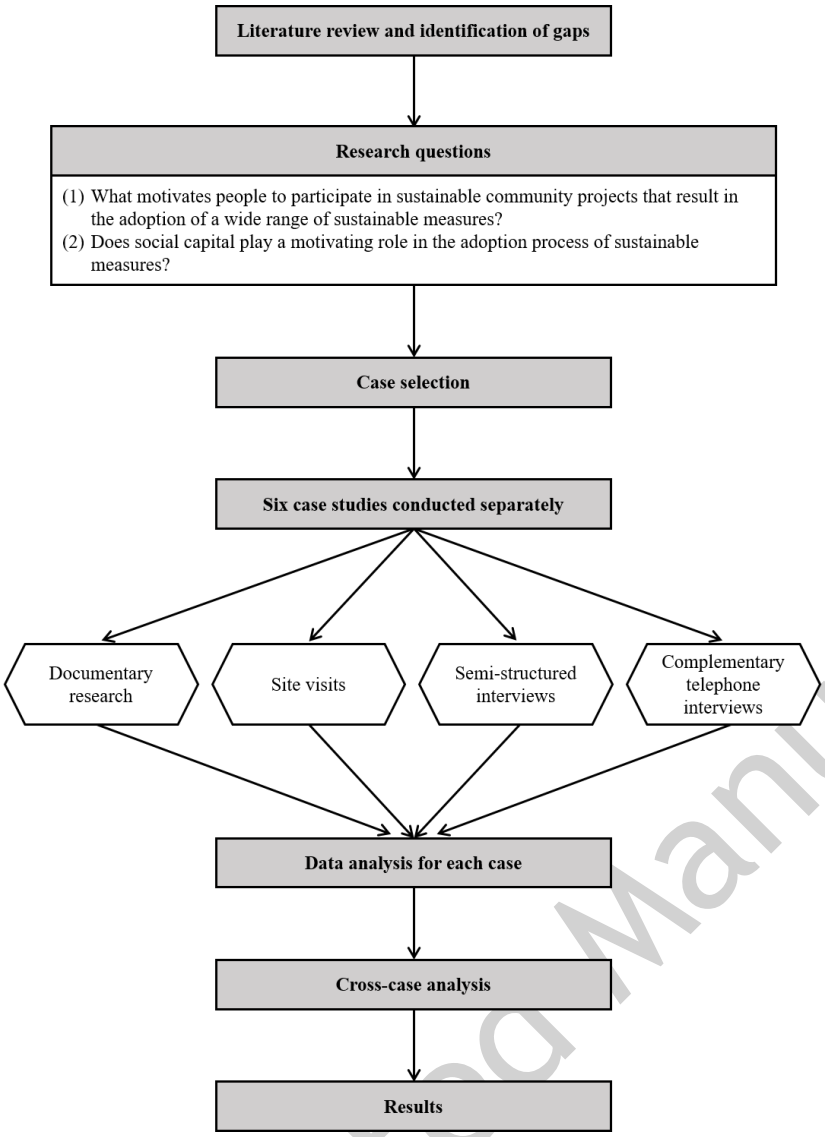

Fig. 1. Research design.

3.1 Case selection

While sustainable community projects are not unique to Germany – they can be found across Europe and beyond [161] – Germany has by far the greatest number of such projects in the European Union, approximately 1750 according to Caramizaru and Uihlein [162]. Furthermore, Germany is considered a pioneer with regard to community energy projects not only because of its large number, but also variety of projects [163]. This made it possible to choose from a diverse number of projects across Germany to conduct this study. At the same time, the case studies are easily comparable because they all face the same framework conditions of one country. Insights gathered from these cases might function as a starting point for similar studies in other countries or even international comparative studies. It is very probable that results will be similar. First, because universal human needs are behind motivations (see section 2.3), and second, because comparable projects can be found in other countries (e.g. [47, 162]). As

discussed in Section 2, motivations influence the outcome, i.e. the form of a project [136]. Thus, if similar projects emerge in other countries, many motivations are likely to coincide as well.

Starting point of the case selection were different sustainable project types already identified in the literature: ecovillages and energy communities, which were not disconnected from members' households. Further literature and internet searches for other community project types resulted in housing cooperatives and group-built housing projects that resulted in homeowners' associations. Such forms of community living are on the rise in Germany [164] and a large number of them have sustainability aspects as an integral part to their projects [165].

In order to choose viable projects, a number of selection criteria were determined: The projects had to consist of (1) a group of (2) private citizens (3) jointly active in or investing their private capital in a sustainable community project (see definition in Section 1), which (4) includes in its endeavors the implementation of sustainable energy technologies and/or energy efficiency measures in members' homes, and (5) whose members are adopting further sustainable measures.

Another selection criterion was to choose the six sustainable community projects so as to represent the panoply of forms, organization types, locations, and actions that are in existence in Germany (see Table 1). These projects are located in five different states of Germany (three projects in former East Germany, three in West Germany), were founded between 1992 and 2014, and are two eco-settlements, two housing cooperatives, one energy cooperative, and one ecovillage. This sampling across the panoply is important because the origins of similarities and differences due to context-specific characteristics can be identified. More generalizable similarities despite different backgrounds will also become apparent.

Table 1
Overview of the community initiatives.

Community name	Community type	Abbre-viation[3]	State of Germany	Legal status[4]	Membership[6]	Landscape	Housing type	Founding year	Number of interviews
Moldenhauer Hof	eco-settlement[1]	ES1	Brandenburg	WEG (formerly eV, then GbR); GbR for PV[5] system	16	rural	town houses	1992 (planning); 1994 (land acquisition); 1999 (completion)	6
Landhof Schöneiche	eco-settlement	ES2	Brandenburg	WEG	41	suburban	town houses	1992 (planning); 1994 (founding)	1
Gut Jahnishausen	ecovillage (member of GEN[2])	EV	Saxony	eG; GmbH (formerly for the energy systems)	53	rural	flats	2001 (founding of eG)	2
Möckernkiez	housing cooperative	HC1	Berlin	eG (formerly eV, then GbR)	2300 (members of cooperative); approx. 800 currently in residence	urban	flats	2007 (idea); 2009 (founding of eG)	11
Bioenergiegenossenschaft Mengsberg	energy cooperative	EC	Hessen	eG	150 (households connected to the district heating)	rural	detached houses	2014 (founding of eG)	4
PatchWorkHaus Aachen	housing cooperative	HC2	North Rhine-Westphalia	eG	39	urban	flats	2008 (planning) 2014 (founding of eG)	7

[1] Ecovillages and eco-settlements are small communities focused on a low-impact, environmentally sustainable life [17]. While ecovillages are members of GEN, eco-settlements are small rural projects not part of a larger organization.
[2] GEN – Global Ecovillage Network
[3] Abbreviations are composed of the community type and an assigned number where more than one of a type is included.
[4] WEG – homeowners' association (*Wohnungseigentümergemeinschaft* in German),
eV – registered association (*eingetragener Verein*),
GbR – company/partnership under the Civil Code (*Gesellschaft bürgerlichen Rechts*),
eG – registered cooperative (*eingetragene Genossenschaft*),
GmbH – limited liability company (*Gesellschaft mit beschränkter Haftung*)
[5] PV – photovoltaics
[6] Membership – people living in the project or community including children (except where indicated otherwise)

3.2 Data collection and analysis

Data on the initiatives was gathered from multiple sources. Documentary analysis of various types of documents were carried out. Many documents were provided for the study by the projects: documents crucial for the founding process and self-published materials such as websites, reports, and promotional materials. External sources about the projects were likewise gathered: a book excerpt, television and newspaper reports. Site visits to each project were carried out. In order to answer the posed research questions and to gather further details on each project's activities, thirty-one semi-structured interviews were conducted anonymously among members of all six community projects (two were not direct members but otherwise closely connected as members of the board or of a support association). Two complementary telephone interviews were carried out: one with a member who was interviewed again in person later on, and one follow-up telephone interview after the in-person interview. Participants were selected through snowball sampling. This seems to have resulted in an overrepresentation of pensioners and women. Therefore, the interviewees are no representative samples for the projects' membership. Box 1 shows the interview guide for all of the interviews.

Box 1
Interview guide.

- Sustainable measures (technologies, behaviors etc.) introduced in the community project
- History of the project – creation process and/or development (depending on when the interviewee joined the project)
- History of the community and/or the project with sustainability
- Personal history with sustainability
- Personal motivation to (co-)found or participate in the project (follow-up questions about main motive and key experiences that might have led to the decision)
- Challenges faced in the creation phase of the project or living in the project

The interviews were then analyzed separately with the help of Mayring's [166] qualitative content analysis. Central to qualitative content analysis is the development of a category system. Based on the interview guide and the research questions the interview material was worked through to deduce categories. Within a feedback loop the categories are checked, revised, and reduced to main categories. Explication is another key step employed in qualitative content analysis, should the need for clarification beyond the source arise.

3.3 Background to the case studies

Box 2 gives a short overview of the background and beginnings of each of the projects. Furthermore, Table 2 lists the wide range of sustainable measures that were introduced in and across the different projects.

Box 2
Short description of historical beginnings of each project.

Moldenhauer Hof (ES1)
Moldenhauer Hof had its beginnings right after German reunification during a time marked by suburbanization processes [167], when many West Berliners sought to move to the surrounding countryside. During an eight-year creation phase eight young couples, most with small children, came together to create the eco-settlement on former farm land (141 acres/57 hectares). New sustainable town houses built entirely of natural materials were put up where the remains of the farm buildings had been. A major drawback of the project in terms of sustainability is its poor connection to public transport making the use of cars indispensable to its members.

Landhof Schöneiche (ES2)
The development of Landhof Schöneiche, right on the border with Berlin, also belongs to the phase of suburbanization processes after German reunification. However, this project was created by local former East Germans as a "group self-help" project when they had difficulties finding affordable living space for families with many children. The time was characterized by sharply rising housing prices and uncertainty as houses were slowly returned to previous owners who had been dispossessed. In the course of its planning, the idea of sustainable construction became a central concern.

Gut Jahnishausen (EV)
The ecovillage in Jahnishausen was started by a group of seven women, who bought a castle complex at auction in order to create a multigenerational community inspired by other ecovillages in Germany, such as ZEGG and Sieben Linden. While the castle main building is owned by a separate association tasked with its preservation, the side buildings were refurbished with natural materials to make them energy-efficient and now house the ecovillagers.

Möckernkiez (HC1)
When the freight yard at Gleisdreieck, a large waste land in the center of Berlin, was turned into a park, parts of the area were repurposed for residential construction. A group of local citizens formed an initiative to prevent anonymous investors from buying the land, and instead planned the construction of a new urban quarter with 14 apartment buildings in the passive house concept themselves. From the outset multidimensional sustainability, particularly ecology and social aspects, including accessibility for people with disabilities, played a key role.

Bioenergiegenossenschaft Mengsberg (EC)
Mengsberg, a village consisting of approximately 280 households, participated and won in the federal competition "Our village has a future" (*Unser Dorf hat Zukunft* in German) held by the Federal Ministry of Food and Agriculture [168]. Part of this five-year endeavor was the planning and realization of many separate sustainable community projects. Mengsberg is characterized by many old buildings in the traditional half-timbered style, some listed as national heritage. Thus, while several public buildings of the village were thermally refurbished, most of Mengsberg's building stock could not be renovated to be more energy-efficient. As a result, the villagers responded to the demand for more sustainability by creating a solar district heating.

PatchWorkHaus Aachen (HC2)
The cohousing project PatchWorkHaus Aachen became reality over a nine-year period, starting with a small group, who wanted to live in a city location with several generations under one roof. Early on the group started working with the architecture firm "Alte Windkunst", which specializes in sustainable architecture and group-built projects [169]. The project was driven by a number of ideas: Replacement of traditional life only in family units in favor of an intentional multigenerational community, extensive sharing, clear ownership structures to prevent real estate speculation, along with social housing and housing accessible for people with disabilities.

Table 2
Overview of sustainability measures adopted in the community projects.

(1) Sustainability measures in the energy system	**Community project[1]**
Heating	
decentralized heat and power plant (CHP) fueled by biogas	HC1
solar district heating (fueled additionally by wood chips and BioLPG)	EC
solar thermal system	ES1*, HC2, EV
wood chip furnace	ES1*, EV
wood pellet furnace	ES1, HC2
Electricity	
contract with a green electricity company	ES1^{+}, HC1, EV, HC2
decentralized combined heat and power plant (CHP) fueled by biogas	HC1
partial on-site production through PV	ES1, ES2*, HC1, HC2$^{\#}$, EV
wind turbine^{s}	EC
Energy-efficiency measures and energy conservation	
attempts at self-sufficient living	ES1, ES2*, EV
composting toilets	ES1, ES2*, EV
decentralized wastewater system (constructed wetland) without energy input	ES1, ES2*, EV
extensive green roof	ES2, HC2
extensive insulation to cut down heating needs	EV, EC^{s}
KfW 55 (energy-efficiency standard for houses)	HC2
only locally sourced wood (as fuel for the district heating)	EC
passive house concept	HC1
refurbishment of old buildings	EV
Transport	
car-free district	HC1
carsharing	HC1, HC2, EV
citizens' bus^{s}	EC
extensive usage of public transport and bicycles	HC1, HC2, EV
avoidance of air travel (by some members)	HC1, EV
(2) Other sustainable activities	**Community project**
attempts at reducing waste	ES1, ES2, HC2, EV
collective buying of goods	HC2, EV
collective participation in a vegetable box scheme	ES1*, HC2
consumption of organic products	ES1, ES2, HC2, EV
extensive practice of foraging	EV
nature trail and children's forest for environmental education^{s}	EC
sharing of collectively owned areas and appliances	ES1, ES2, HC1, HC2, EV
sustainably managed community forest^{s}	EC
use of organic building materials	ES1, ES2, HC1^{+}, HC2, EV
use of recycled building materials	HC2, EV
vegetarian lifestyle (practiced by many members)	ES1, EV

[1] For an explanation of abbreviations see Table 1
* - formerly; + - partially; # - in planning; s – separate project, same village, overlapping membership

Figure 2 compiles sociodemographic data on the interviewees and compares the distribution of household types with data for the whole of Germany (Fig. 2 (a)). People living alone or in smaller family units were overrepresented among the interviewees, compared to the entire German population. Whether this is also the case for the entire membership of each project cannot be said. Interviewees in EV and HC2 mentioned an overrepresentation of women in their projects.

The considerable financial demands on participants also led to some goals of social inclusion not being realized. The result was a form of gentrification in some of the projects (ES1, HC1,

HC2): most of the members are middle class, many academics, and some came into money by way of inheritance. The interviewee listed in Figure 2 as a member of a support association, made it clear that the only reason for not being a full member of the project was the lack of sufficient financial means.

Role in the community project	
member	24
initiator and member	5
non-member (otherwise connected, i.e. member of the board or of a support association)	2
Gender	
female	20
male	11

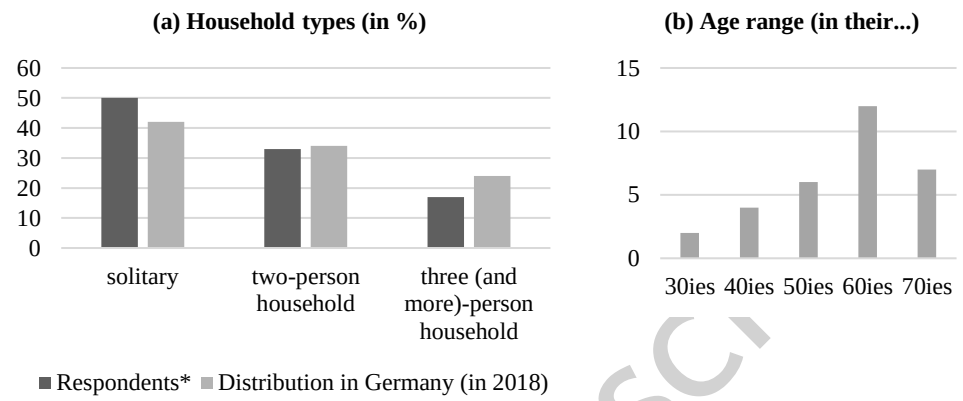

Fig. 2. Sociodemographic data on the interviewees (source for household type distribution in Germany: [170])
(* Two-person households consisted of couples (26.7%) and single parents with one child (6.7%).
Three (and more)-person households were families with one or more children.)

4 Results

The following two subsections address the posed research questions each in turn: What motivates people to participate in sustainable community projects that result in the adoption of a wide range of sustainable measures (i.e. result in the transformation towards sustainability of their households and lifestyles)? And in Subsection 4.2, does social capital play a motivating role in the adoption process of sustainable measures?

4.1 Motives for participation and creation of the projects

When asked what motivated members to join these projects, physically and financially, many individual motives were named. Some of these motives were distinctly connected to the particular project's characteristics. However, a common tendency could be observed (see Fig. 3). Many considered ecological and sustainable aspects important motivators (2/3 of all interviewees). Most stated the desire for community as motive (87 %). In terms of each person's prime motive, community was also by far the most important with 57 % (in second place is ecology/sustainability with a share of 20 %).

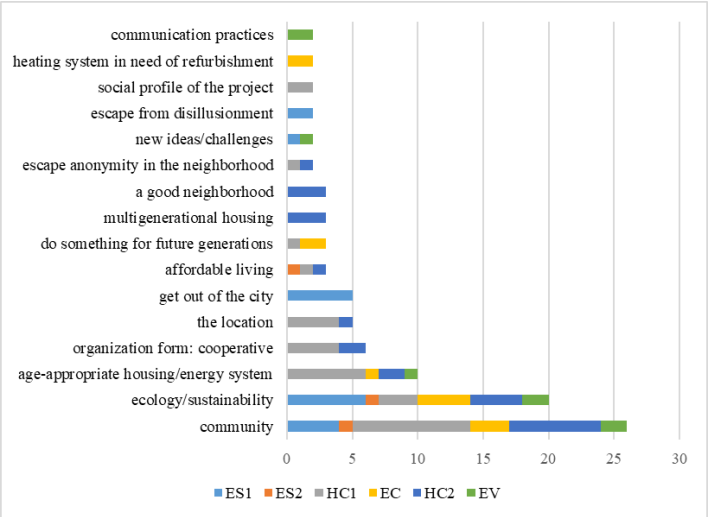

Fig. 3. Stated motives to participate in the project (multiple answers, n=30).

A closer look at the motives reveals linkages between all motives and five main motives, around which all other motives cluster: community, sustainability, cooperative, age-appropriateness, and place-based motives (Fig. 4). The interconnectedness of the main motives was also highlighted by two interviewed initiators (HC1 and EV). They understood sustainability as a multidimensional term, which includes three interconnected aspects: ecology, economy, and the social.

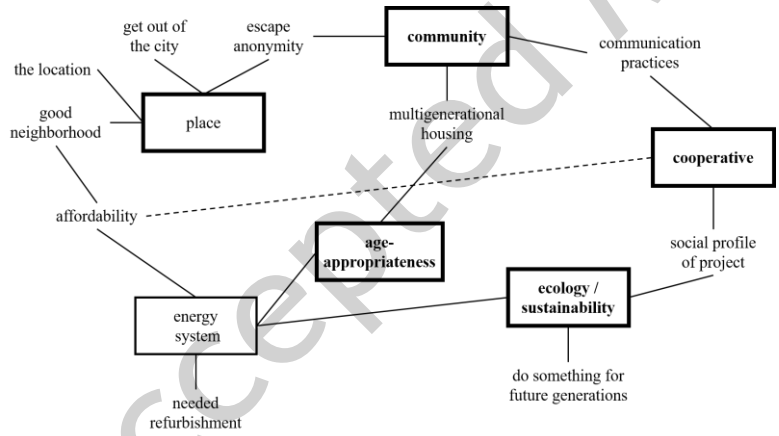

Fig. 4. Main motives and linkages between motives.

Several very different place-based motives were named by the interviewees. Dominant for *Moldenhauer Hof* was 'get out of the city' – unsurprising, since it was founded in the countryside by Berliners (cf. Box 2), while the 'location' of the projects, a 'good neighborhood', and 'escaping anonymity' were relevant to members of *Möckernkiez* and *PatchWorkHaus*, both located in cities.

Those motivated by 'age-appropriateness', voiced concern for their impending old-age, and thus named the necessity to adapt their lifestyles to their increasing age among their motives to

participate. This motive is absent among the two eco-settlements, which were founded by young families. All other projects have a mixed-age membership. Community, the motive most important to people interviewed, was only in part a response to living alone. It was voiced also by people living in family households of two or more people.

Of the six case studies four are organized as cooperatives (EV, EC, HC1, HC2); one is a classic energy cooperative. Only among housing cooperatives' members was the organization form itself a motive. Three characteristics of cooperatives were highlighted, when interviewees elaborated on the motive. Firstly, the democratic operation, i.e. the co-determination rights of members: Co-determination is not linked to the share an individual invests, i.e. irrespective of share's amounts. Each member gets one voice at the general assembly. Secondly, the financing: Each member invests private capital and only these assets of the cooperative are liable to creditors. When seeking further finances, it is the cooperative, and not its members, that is the borrower. This allows members to be co-owners, when they could not have become owners on their own due to a lack of creditworthiness. Thirdly, the social character of the organization form: Due to the ownership structure, cooperatives foster equality. All members are equally renters and owners in housing cooperatives, i.e. they own a share in the cooperative, but rent their flats. Combined with members' equal co-determination rights, which are not linked to the shares they own, it disempowers wealth inequality among members.

Ranking	ES1		HC1		HC2		EC		EV*		ES2**	
1	ecology / sustainability	6	community	9	community	7	ecology / sustainability	4	community	2	community	1
									ecology / sustainability	2	affordable living	1
									communication practices	2	ecology / sustainability	1
2	get out of the city	5	age-appropriate housing	6	ecology / sustainability	4	community	3				
3	community	4	organization form: cooperative	4	multigenerational housing	3	do sth. for future generations	2				
			the location	4	a good neighborhood	3	heating system needed refurbishment	2				

Fig. 5. Top three ranked motives per project (in terms of times named).
(* no ranking possible; these motives where named equally by the two interviewees in EV,
** no ranking possible; only one interview conducted in ES2)

In all six case studies, ecology or sustainability were named as motive by interviewees. However, *Möckernkiez* (HC1) stands out. Ecology is absent among its top three motives (Fig. 5). Among the interviewees of this project social motives outweighed all others: they joined the project first of all for the community that was to be created, the age-appropriateness, i.e. accessibility of the flats, and the project's organization form cooperative. The importance of

social motives is reflected in the project's mission statement; however, so is the aspiration for sustainability and ecology (cf. Table 3).

In different projects different people voiced the same attitude, four even the exact same phrase, when asked whether the project's focus on sustainability had been a motive to join it or participate in its creation: they negated it, but added "sustainability is a matter of course". It implies, environmental attitudes are deep-rooted. Without a sustainable profile, the project would likely not have been considered, as one interviewee explicitly expressed. Community in all these cases was reiterated as core reason for them to join.

While economic motives are absent among the top 5 motives overall, they are among the top three when projects are looked at separately (Fig. 5). Financial considerations were reflected in motives in four of the six cases: ES2, HC1, HC2, and EC. In the first three instances they revolved around affordable living space. The energy cooperative, tasked with providing thermal energy, solved members' problems with old and outdated heating systems fueled by heating oil.

Interviewees got involved in the projects at three different points in time. The first were initiators of the projects (n=5). Then others became members and actively participated in the realization process of the projects (n=21). Lastly, some joined after the projects' primary completion (n=3). Slight differences in the motives of these three groups could be observed: all initiators named both 'community' and 'ecology/sustainability'. Of those that participated in the realization process 18 were motivated by a desire for community and 15 by environmental concerns. Among the three who later joined the projects, all cited 'community' as a motive. None of them cited 'sustainability', though one did express deep-rooted environmental attitudes.

Probing into the projects' history with sustainability revealed the extent of sustainability to have grown with the projects in three cases: ES1, ES2, and HC2. At the same time, personal histories of members revealed in all these cases prior involvement with environmental issues. For example, in the case of *Schöneiche* (ES2) the initiators of the project were involved in the *New Forum* (*Neues Forum* in German) a political opposition movement in East Germany instrumental in the collapse of the GDR, which emerged from various human rights, peace, and environmental groups and later became one with the German green party. In the other three cases, sustainability was at the core of the initial founding idea.

Table 3
Comparison of characteristics and mission statements in the case projects.

Comparison criteria	ES1	ES2	HC1	HC2	EV	EC
primary focus	living space	living space	living space	living space	living space	energy supply
keywords in mission statement/ short description[1]						
community/collectively	x	x	x	x	x	x
sustainability			x			
ecology	x	x	x	x	x	x
social	x		x			
renewable energy						x
economical		x			x	
multigenerational			x	x	x	
self-determined				x		
existing or emergent community	emergent	emergent	emergent	emergent	emergent	existing
joint living spaces	x	x	x	x	x	
existing buildings or new construction	new	new	new	new	existing	existing
passive participation possible			x			x
sustainability/ecology among top three motives[2]	x	x		x	x	x

[1] Sources: [171-176].
[2] Sources: Interviews.

4.2 Social capital in the adoption process of sustainable measures

Results show that in sustainable community action, three essential stages ultimately result in a broad adoption of sustainable measures (see Fig. 6). There are different underlying motivations at each adoption stage. The adoption stages are: (1) becoming a member of a sustainable community project, (2) adopting sustainable measures as part of the project, and (3) adopting sustainable measures that are independent from the project (spillover effects).

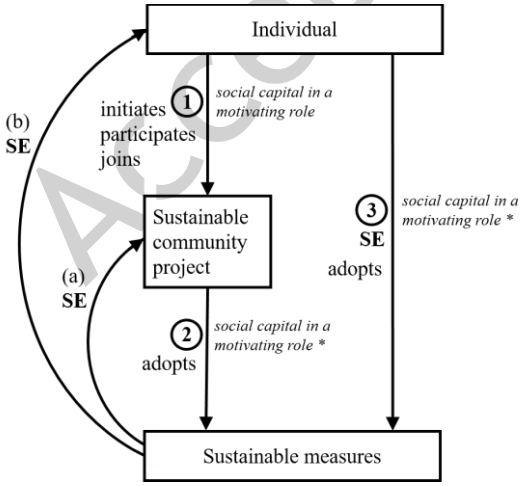

Fig. 6. Stages in the adoption process of sustainable measures in terms of actions taken by an individual (including spillover effects and the motivating role of social capital).
(a)/(b) – feedback loops, i.e. step 2 in the adoption process or step 1 & 2 can be repeated more than once;
SE – spillover effects;
* – instances of perceived social norms.

At stage 1 (as mentioned in Subsection 4.1), an individual can become part of a sustainable community project at various points in time. An individual can initiate a project, become a member or co-founder and participate in its realization, or join when the project is largely completed.

At stage 2, individuals as members of the community project adopt sustainable measures, usually as part of a decision-making process, in which a decision is reached by majority or even unanimous consent. Depending on the project (cf. Table 3), members were more or less actively involved in the physical realization process. As indicated by feedback loop (a) in Figure 6, this process repeats itself with every sustainable measure that is adopted and can happen even when what the project had initially set out to do has been realized. Thus, this stage can be relevant also for those individuals that join the project later, after initial realization has been completed. For example, sustainable housing and most renewable energy systems were implemented in the initial development phase, while measures like solar PV (ES1, ES2), participation in an organic vegetable box scheme (ES1, HC2), and car sharing (HC1, HC2) were adopted later on.

The second feedback loop (b) shows that the entire process of (1) and (2) can also be repeated. Out of the success of the original project can grow the idea to implement further sustainable measures. Because of how the project is organized (e.g. EC), or because of financial requirements (e.g. EV), or because not all members of the original project want or are able to get involved (e.g. ES1), a separate project is founded. This was particularly often the case for the various sustainable measures adopted in *Mengsberg*, all founded as separate endeavors but with similar membership (cf. Table 2). Both (a) and (b) can, therefore, indicate spillover effects.

Some of the sustainable measures adopted by individuals in the community projects are seemingly independent from the community project. This is most often the case for sustainable behaviors, and is indicated as stage 3 in Figure 6. Examples include behaviors around sustainable consumption and food, especially consuming organic products and a vegetarian lifestyle, but also efforts to reduce waste. Some interviewees reported that they were already engaging in one or the other sustainable behavior before joining the project, i.e., they were taking them up independently of the project. These cases shall not be of interest here; nevertheless they show deep-rooted environmental attitudes.

At each stage social capital functioned as an external motivator. The influence of social capital was observed in all six cases.

Stage 1, essentially the founding stage, in which members are recruited for the projects, is strongly influenced by preexisting social capital. One third of the interviewees (members of ES2, HC1, EC, HC2) indicated that they were motivated to join the projects by trusted members of their social circle. Only *Mengsberg* was created in a preexisting community. Five interviewees also related how they induced people in their social networks to join the project (ES2, HC1, EC). Here, initiators played a significant role. They utilized their existing social capital, especially trust in their social networks, to get others involved in the project. Initiators also created bonding and bridging social capital, when they campaigned for new members among strangers and other groups (bridging social capital) that had formed with similar ideas for projects. Several instances occurred, where almost entire groups fused with HC1.

Stage 2 coincides with the realization of the projects. In all cases, except the energy cooperative *Mengsberg*, the exact configuration of sustainability measures (e.g. which technologies are to be installed) had not been defined from the outset. Options were discussed, some discarded because of financial restrictions, though frequently the more expensive but sustainable option chosen. For example, in *Möckernkiez* the generation of heat through waste water heat recycling was discussed but discarded and a financially feasible sustainable option installed instead. They also chose the environmentally friendly insulation material mineral wool over Styrofoam, though it involved additional costs of 7 Cents per square meter.

In some instances, interviewees, who had no interest in ecological aspects initially, recounted how initiators motivated them to endorse sustainable measures. Thus, initiators acted as opinion leaders and enforcers when it came to implementing sustainability. At the time of the interviews, the same people voiced personal beliefs about how significant sustainability is. Shared beliefs and values seem to have been created. The realization of the projects was also a drawn-out process of several years. In that time and after, strong networks and trust among previously unknown members were also established. This was particularly highlighted in the many feedback loops of type (a) and (b) observed among the projects. Especially (a) demands high levels of trust, since frequently sustainable measures were introduced informally at that point (e.g. car sharing in HC1).

Stage 3 is marked by voluntariness. The uptake of measures at that stage is not directly regulated by the communities. However, the results show that indirect regulation takes place via social capital. More precisely, perceived social norms motivated the omission of some unsustainable behaviors as well as implementation of sustainable measures.

Spillover effects and social norms appear to be closely linked. Interviewees perceived social norms predominantly in phases of spillover effects, i.e. at stage 3. Social norms against three lifestyle choices were indicated: norms against unsustainable consumption (stage 3), unsustainable energy supply (stage 2), and unsustainable transport (stage 3). One interviewee stated, "Formerly I used to order things from Amazon. Now, I no longer dare to. What if one of my neighbors accepts the package for me." Ordering goods at the online retailer Amazon, is perceived as unsustainable and socially questionable, and at least this interviewee perceived an injunctive social norm in the community regarding that particular company.

In the same, as well as in another of the community projects social norms against air travel were perceived. In one instance an interviewee spoke about others in the community talking about their travel plans or previous vacations, markedly all to locations one does not get to by airplane; it clearly made the interviewee reflect on sustainable modes of travel, which is a descriptive norm. In another instance an interviewee exclaimed, "Sometimes a glance alone is enough if someone says, 'I'm going to Mallorca now.' I don't have to say anything! [outraged face] But in the end, it is the decision of every person here. Voluntariness is a very, very high commandment." Going to Mallorca, necessarily by air plane, was perceived as unacceptable behavior, but an angry glance – one of the many possible reactions to norm violations observed by scientists [177] – was deemed enough.

Social norms against unsustainable energy supply were alluded to in yet another community initiative. The initiator of the project said, "In this group, I would never have dared to propose an oil or gas heating system." Instead sustainable options were discussed and eventually implemented.

5 Discussion

The focus of this comparative case study has been the identification of motives and motivators that drive sustainable community actions in bottom-up community projects. Regarding the first research question, the results show that the motivation to participate in (or initiate) sustainable community projects consists of various individual motives predominated by a desire for community and environmental motives, and followed by age-related, organizational, and place-based motives across all six cases studied. Additional external motivators issuing from social capital play a significant role across all stages of the adoption process of sustainable lifestyles within such community projects. Thus, the second research question can be answered in the affirmative.

In the following subsections, these findings and their implications are discussed and limitations of the study reflected on.

5.1 Discussion of findings

Starting from Hicks and Ison's [136] insight that motivations determine the outcome of sustainable community projects, commonalities and differences were searched for among the motivations of members of six projects that all resulted in a broad adoption of wide-ranging sustainable measures and behaviors. Across all six cases, results differ only little in stated motives and in dominance of elements of social capital.

In Section 2.3 environmental motives were identified as likely very important for both the participation in sustainable community projects and a broad uptake of pro-environmental behaviors. This has been confirmed by the present study. However, the dominant motive overall was community; clearly primarily social needs drove people's motivation for participation. The main motives (cf. Fig. 4) also include 'cooperative', 'age-appropriateness', and place-based motives. The demographics of the interviewees (see Fig. 2) as well as overall demographic developments in Germany [178] seem to have an influence on the motive 'age-appropriateness'.

The four main motives roughly follow the tripartite model of sustainability. Deliberately or unintentionally[2] they all tried to integrate economic, environmental, and social sustainability. They were realized within their members' financial means and include considerations to ensure a stable financial position into the future. Some more expensive sustainable technological options were not adopted. Environmental sustainability is included when they integrated and try to integrate many environmentally friendly technologies and behaviors. Some included social sustainability by way of multigenerational living and inter-generational caretaking (a core concern in three of the projects (cf. Table 3)). Cooperatives, as well as the creation, strengthening, and (or) future-proofing of communities (i.e. keeping it attractive for the young and preventing rural exodus) are also part of social sustainability. Cooperatives bridge economic and social sustainability. Registered cooperatives under German cooperative law (in German *Genossenschaftsgesetz*) serve the purpose of promoting economic, as well as social and cultural interests of their members through joint business operations (§1 I GenG). The democratic nature of cooperatives leads to continuous interaction among members, which is

[2] Most interviewees considered sustainability to be closely and only linked to ecology, while particularly the initiator of *Möckernkiez* considered sustainability's multidimensionality. This is reflected in the differences of the mission statements or short self-descriptions, in which only *Möckernkiez* mentions sustainability explicitly (cf. Table 3). Community and ecology are the aims common to all cases.

conducive to the formation of social capital and 'real' community. Since co-determination rights are not linked to the shares owned, it disempowers wealth inequality among members. Furthermore, studies into ownership structures in different communities revealed, they have significant influence on the quality of community: while homeownership has positive effects, rentership less so [179]. In ecovillages, Litfin [47] observed: those ecovillages with a two-class system of owners and renters have less well-functioning communities. Thus, cooperatives are both social endeavors and facilitators of successful community building and building of social capital.

As previously discussed in Section 2, environmental self-identity and motives seem to be correlated with consistency in sustainable behaviors [151] and the level of engagement in community initiatives [94]. Sustainability as motive to participate in the project was lowest in *Möckernkiez* (cf. Fig.5). A likely explanation might lie in the demands made of the project's members. It is by far the largest project among the case studies, which allows many to be quite passive in their participation in the project. Interviewees who voiced minor interest in ecological issues also reported less active involvement in the implementation of sustainability measures. On the other hand, initiators expressed particularly deep conviction of the necessity of sustainable action and community action. Consequently, they also invested considerable time and effort into the sustainability of a project. This also seems to support the argument that the level of engagement is correlated with environmental motivation.

Overall, however, environmental attitudes were very high, which is in line with the finding that members of sustainable projects have significantly more positive attitudes towards the environment or renewables than non-members [157]. Environmental attitudes and environmental motives were in a few instances not expressed congruently by people. Not always when strong environmental attitudes were voiced, was ecology or sustainability named as motive to participate. Others expressed strong environmental attitudes and named them as motives, but also admitted that initially the environment had not at all been a concern. Here again, social capital came into play.

Because of the sequential adoption process of sustainable measures in sustainable community projects, social capital was observed to function as added motivator at three points in the process, not just at the beginning of the collaboration as previously observed by Bhandar et al. [135]. Preexisting social capital, especially trust in existing social networks functioned as motivator in the decision to participate in the projects. New bridging and bonding capital was formed and motivated people to join, who were previously outside founding members' social

networks. Within the newly formed groups knowledge sharing and trust building occurred. Additionally, influence was exerted by initiators and other individuals centrally located in the social network. Combined, these elements of social capital motivated members to implement or support the implementation of sustainable measures. By the time the initial projects were realized (or founded), more trust had been created and shared values and norms had been established. These functioned as added motivators for spillover effects, i.e., yet more sustainable measures were implemented and sustainable behaviors adopted. Social norms seem to play a special role in spillover effects, since instances of social norms were reported not only but predominantly in relation to spillover effects.

Thus, the study reveals a complex interplay of social capital, social needs, and environmental concern, common to all six case studies: For many members it was the desire to be part of a community, i.e. a social need, which drove them to join and invest. Trust within existing social networks functioned as additional motivator. Within these groups or communities, preexisting social capital was used or entirely new social capital was forged, and then utilized to motivate collective action to further the project's goals. This newly formed social capital included trust and implicit behavioral rules regarding sustainable actions, i.e. social norms. These social norms seemed to be experienced both by possible norm violators and norm enforcers. Perceived norms made possible violators rethink their future actions and choose to conform to the norms for fear of sanctions. Possible norm enforcers chose to sanction, even if mildly. Increased trust among the projects' members made implementation of further sustainable measures through collective action possible. Equally important are underlying preexisting environmental attitudes, not among all, but among a critical mass of people and among important individuals (e.g. initiators). Initiators particularly have extensive preexisting social capital and seemed to be apt in creating and using social capital to motivate sustainable action.

5.2 Limitations of the study

Some limitations of this research need to be acknowledged: First, what almost all of these projects have in common, is the requisite to move house in order to join the project or even build a new home to realize such wide-ranging sustainability measures. To uproot an established household, demands a great sense of urgency on the part of people. Furthermore, it is not feasible for a broad majority. However, the examples of *Mengsberg* and *Jahnishausen* prove that such projects can also be realized in old and even historical buildings and do not necessarily require relocating.

Second, to what extent people did have strong underlying environmental attitudes, accepted sustainability as a social norm within that community, or internalized them so as to transform their own attitudes, cannot be definitively said on the basis of qualitative interview research. What could be gleaned from these limited glimpses into people's decision-making and self-justification of their actions was that all these facets played a role.

Third, this study did not look at how effective the projects' efforts actually are. It could be observed that some projects more than others created the necessary infrastructure to make sustainable behavior easy for members. For example in connection with transport, not all introduced ride sharing schemes. The sustainability of projects regarding transport seems to be largely dependent on location. Projects in or close to cities or with good connections to public transport reduced the need for car ownership, while rural settings with little public transport seemed to make cars necessary. In the latter case ride sharing schemes seem to become particularly important, but were not introduced in all rural cases. However, these were only observations made in passing. An in-depth exploration of how effective the efforts were to reduce the ecological footprint of members was beyond the scope of this study.

The same is true for the social goals surrounding multigenerational housing. Whether some of the projects, especially those that do not explicitly aim for multigenerational housing (cf. Table 3), will suffer a problem of reproduction in the future is unclear and would require longitudinal observations. The problem seems to be more likely in projects situated in rural areas (esp. ES1 and EC), since migratory patterns in Germany are characterized by rural exodus of the young [180]. In *Mengsberg* (EC), the sustainable community project itself was seen as a way to fight these developments. Whether they are successful remains to be seen.

Fourth, the connection between socio-demographic groups and environmental attitudes, including support for sustainable community projects, has not been explored. The significant differences of environmental awareness among different social groups in Germany have been identified before, e.g. in a study conducted biennially by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety [181]. Their results show that socially well-off groups have more pronounced environmental awareness and indicate above-average commitment to environmental and climate protection as well as pro-environmental behaviors.

6 Conclusions

The central aim of these case studies was to investigate motivations behind sustainable community actions that resulted in the transformation towards sustainability of members'

households and lifestyles. The findings add to the literature on spillover effects, motivations, and effects of social capital for sustainable behavior and technology adoption in community settings. A variety of sustainable community projects, which made their members' homes and their energy supply more sustainable and whose members adopted a broader set of pro-environmental behaviors and made sustainable lifestyle choices, were selected and studied in depth. Group projects were focused on, since previous research has shown the adoption of wide-ranging sustainability measures particularly in group settings [23].

The results show: successful implementation of wide-ranging sustainable measures and changes in behaviors in community settings results from motivations that in turn result from an interplay of social needs, environmental concern, social capital, and personal motives. The social need to be an active part of a community was a major motivator to participate in these sustainable projects. The effective use and creation of social capital and adherence to shared values and norms made the realization of the projects and the implementation of various sustainable measures successful. Strong environmental attitudes among a critical mass of members and key individuals was essential.

Research into adoption of pro-environmental technologies and behavior change programs frequently focus on environmental attitudes (along with behavioral costs) to explain ecological behaviors (e.g. [182]). The findings presented here highlight that not only a person's environmental attitude is of consequence. If a person joins a living environment where sustainable infrastructure and behaviors are established, as in these case studies, and does so for reasons other than environmental motives, that person is essentially facing a green default option. A lack of environmental attitudes does not influence her/his household's energy supply for instance. This insight complements research into green defaults, showing they tend to stick not only among those concerned with climate change [183]. Of course, the way inhabitants use energy and behave in other environmentally relevant areas cannot be influenced by default options. This might be influenced effectively with market-based instruments [184]. However, this research demonstrates, even if such instruments are not introduced, strong environmental attitudes are still not a necessary requirement. Then other motives like the desire for community, which can be linked to the sustainable option, and especially the influence of social capital become important. If a critical mass of people and significant others in social networks have pronounced environmental attitudes and use their social capital, e.g. by enforcing social norms, a broad adoption of sustainable measures can result.

Political support of such projects might lead to a more extensive employment of renewable energy technologies in residential housing as well as pro-environmental behaviors through community action. Various support programs for community projects exist in Germany and elsewhere. For example multigenerational housing projects were supported by the Federal Ministry for Family Affairs, Senior Citizens, Women and Youth in a previous support program [185]. If all such programs were to include mandatory requirements for wide-ranging sustainability measures, the whole spectrum of community projects would be included in a transformation towards sustainability. The considerable financial demands on participants also led to some goals of social inclusion not being fully realized, which highlights the need to include social justice issues in future political support for sustainable community projects, or to apply community energy concepts to social housing, as discussed by McCabe et al. [186].

Further research should try to quantify the effects detected in this qualitative study. Particularly the amount of people needed in a group who harbor environmental attitudes versus the numbers of those who are indifferent towards the environment (but see other goals satisfied by the project) should be quantified. Furthermore, the influence of the social position on membership in sustainable community projects should be explored in depth and possible implications analyzed. Exploring the long-term success of these and similar projects in achieving their social and environmental goals will be an interesting line of research in the future.

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