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Research Perspectives on Renewable Energy Cooperatives in Germany: Empirical Insights and Theoretical Lenses

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Abstract: Transformation of energy systems is influencing economic policy agendas all over the world, particularly so in industrialized countries. In this process, Germany has taken a pioneering role. Technical innovations, institutional frameworks, and business models established there are of interest for other countries trying to achieve broader use of renewable energies. Energy cooperatives have been an important building block of the energy transition in Germany, though their practical importance is neither quantitatively nor qualitatively reflected in the academic literature. Drawing on recently collected data, this paper presents an overview of German energy cooperatives in terms of their (1) organization, (2) membership, and (3) financing. We then review theories from economics and the social sciences that, on various levels, have been used to analyze cooperatives in other fields or other forms of community-driven organization. We discuss how these theories could be applied for a better understanding of energy cooperatives, derive a preliminary research agenda and assess the scope for interdisciplinary work among economists, sociologists, and other related disciplines.

Keywords:
Business models; Decentralization; Energy cooperatives; Energy transition;

JEL classification:
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1. Introduction

All over the world, the sought after transition of the energy sector towards greater deployment of renewable energy sources and de-carbonization is driving change in economic and environmental policy [1]. Against this background, different strategies such as large scale, centralized projects as well as small scale, decentralized projects are being pursued to achieve better diffusion of renewable energies. In this regard, especially industrialized countries are making efforts to promote decentralized energy supply concepts [2; 3; 4].

This general characterization of renewable energy deployment efforts particularly fits the case of Germany, where political measures have been laying a path toward development of a multi-faceted renewable energy sector with various technologies in use at different scales. A prominent example is the feed-in tariff system, which is based on the real generation costs of a specific technology and guarantees investment security for generators of green electricity for a time scale of up to 20 years [5]. Investment security ensured through the feed-in tariff system, improving technical aspects of renewable energy use, and a trend towards decentralization of energy supply have also allowed the entrance of new actors and business models in the German energy sector. In other words, technical and political change has been accompanied by changes in social institutions. Prominent among the groups of new actors are (family) farms and citizens, and business models often build on consumer participation and ownership, especially in the context of decentralized energy supply [6; 7; 8].

Within this context of new actors entering the market as investors and new emerging business models, energy cooperatives have gained particular attention, as they combine common economic goals with social and cultural factors, such as voluntary and open membership and considerable co-determination rights for their members through democratic organization and member control, features that seem to be particularly compatible with sustainability aspects characteristic of renewable energy projects [9].

This particular focus on energy cooperatives has been reflected by a dynamic growth of cooperative organizations within the German renewable energy sector. Over the last ten years, more than 800 energy cooperatives have been newly founded in Germany (see section 2.1). Until now, however, research on energy cooperatives has been relatively rare, especially in Germany. The few existing studies are focused on practitioners' problems and rarely build on existing theoretical foundations. The present paper attempts to address this gap by providing an overview of the phenomenon from the organizational and member perspectives, drawing

on recent data that include registration data from cooperatives, a member survey, and publicly available balance sheets. We also present various theoretical approaches that could be useful for shedding light on the development of energy cooperatives in Germany.

The paper is structured as follows. In section two, the recent growth of energy cooperatives in Germany is described, a typology of energy cooperatives is presented, and cooperatives are distinguished from other forms of renewable-energy projects involving citizen participation. Further emphasis is put on financial characteristics and membership structures to introduce the reader to the topic from different viewpoints. The third section looks at the literature, starting with a governance perspective from transaction cost economics, which is then deepened via a discussion of recent work in behavioral economics, followed by a sub-section presenting the structural view. Here, the role of cooperative market power in non-competitive markets is stressed, followed by a section that looks at the role of consumers. Next, by looking at participation, conflict, and trust in (energy) cooperatives, we shift the focus from an economic to a sociological one. In a concluding section, we synthesize the literature in light of the empirical data analyzed and derive a research agenda for the field of renewable energy cooperatives in Germany.

2. The Status Quo of Renewable Energy Cooperatives in Germany

Empirical analysis is an important part of research on energy cooperatives in Germany, and topics such as growth, finance, or member characteristics have been addressed through various surveys. Before presenting our own empirical insights, we provide a brief, general overview on models of financial citizen participation in Germany.

2.1. Models of Financial Citizen Participation in Renewable Energy Initiatives in Germany

Community energy initiatives are multifaceted, and a diversity of ownership models exists concerning how to put them into practice. Projects can be either completely owned by the community or developed in co-ownership with the private or public sectors [10; 11; 12]. Patterns of ownership are determined by project initiators and managers [13], who themselves operate within the boundaries set by legal forms, financing schemes, and available equity capital [14]. In the following, differences between ownership models are explained in greater detail.

The proliferation of ownership options for citizen participation schemes in Germany has been discussed in a recent study by Holstenkamp and Degenhart, who use a financial approach focusing on equity capital and voting rights to distinguish between citizen participation schemes in a proper sense (community ownership) from mere financial participation. Apart from cooperatives, two ownership models are of importance. The most widely used structures are limited partnerships with a limited liability company as general partner (*Gesellschaft mit beschraenkter Haftung & Compagnie Kommanditgesellschaft,* abbreviated as *GmbH & Co. KG*) and civil partnerships (*Gesellschaft bürgerlichen Rechts* or *GbR*) [15].

In the first projects that were put into practice in Germany, choice of specific legal form was driven mainly by questions of liability and distribution of project risk [14; 16]. An answer was found in the GmbH & Co. KG structure, which merged two traditional legal forms: the private limited liability company and a general partnership. In this model, a developer of a limited liability company establishes a limited partnership for investors, and the GmbH takes on the "full partnership" role (with unlimited liability). Typically, the GmbH & Co. KG allows simplified management structures, separating management, consisting of project-initiating investors, from further investors. Furthermore, measured by return on equity after taxes, it can also provide possible tax advantages for investors over other organizational forms, depending on the personal income and tax parameters of investors [17]. These two aspects made the GmbH & Co. KG structure highly successful, and it became a preferred model for citizen-owned wind parks (so-called "Bürgerwindparks") in Germany [17; 18]. Another popular business model, particularly for small- to medium-scale local community solar PV projects, is the arrangement of a solar association as a trustee who establishes a GbR. A disadvantage here is the direct liability of the partners, which has made it feasible only for smaller projects [16].

Considering the recent trend towards energy cooperatives, the cooperative model possesses advantages that tend to influence the decisions of initiators. The crucial question of liability is solved by the cooperative model as well. Partners are generally not liable individually, which also makes the model attractive for larger projects [19]. Some key differences between a GmbH & Co. KG and a cooperative can be found in the purpose of their establishment and governance structures. For example, the cooperative model is linked explicitly to the promotion of its member's goals, which generally also include social principles and values that go beyond profit maximization, including collaboration, social responsibility, in-company

democracy, communal self-help, and the provision of quasi-public goods [20]. Here, cooperatives can fill a significant gap, as discussed in the cooperative literature [21].

Summing up, cooperatives are not the only relevant business model for financial citizen participation within the energy sector in Germany, but they are the organizational form that has become the most relevant regarding active participation in local energy policy. In the following, empirical data on energy cooperatives in Germany is presented. First, we review approaches used to classify them. Then, following one of the approaches, we present descriptive statistics on the growth of registered renewable energy cooperatives in Germany.

2.2. Classification and Growth of Energy Cooperatives in Germany

2.2.1. Existing Classifications

A theoretically-informed typology of energy cooperatives in the German context and beyond – as a basis for theory-building [22] – is generally missing from the literature. The same can be said about establishing a link to general classifications and typologies of cooperatives according to strategic orientation, or ownership and control rights [23; 24]. Moreover, only a few studies have tried to classify energy cooperatives in Germany so far. Flieger and Klemisch draw a historical distinction between electricity cooperatives of the first phase of rural electrification in Germany and recently founded wind and photovoltaic energy cooperatives, bioenergy villages, national green electricity traders, and energy consumer cooperatives. For their classification, at least three attributes are implicitly used: energy-sector value chain, technologies in use, and age of cooperatives [25]. Klemisch and Maron use a typology by Flieger and suggest a separation of energy cooperatives along the energy-industry value chain [26]. These existing classifications lack, however, an empirical grounding and are not well-integrated into any theoretical framework.

In the following, (1) technology, (2) level of value addition, (3) historical development, and (4) regional distribution are used as criteria for describing German energy cooperatives. The first two criteria are important especially for the economic analysis presented in section 3, whereas the latter two form the basis for political-economy, institutional, or evolutionary explanations. Data are drawn from a database of energy cooperatives in Germany, continuously updated and maintained by two of the authors [27], which builds on entries in electronic cooperative registries and information available on the internet.

2.2.2. Classification based on the Value Chain Approach and Technology

The value chain of an organization consists of primary and secondary functions, which are separated by streams of inputs and outputs [28]. According to the value chain approach, energy cooperatives are defined as organizations with the legal form of a cooperative that conduct their business activities along the energy industry value chain. Adapting Porter's corporate value chain concept to the energy sector, we distinguish between cooperatives according to their primary activities – generation/production, distribution/transmission, or trading – in the following way:

- Generation/production (n = 635): Cooperatives that are classified as generation cooperatives possess power generation facilities or hold investments in companies that operate them. Generation in this case means not only of electricity but also heat.
- Distribution/transmission (n = 198): Cooperatives that operate local electricity grids or local district heating networks are grouped as distribution cooperatives. Often these cooperatives also have generation facilities, but the network infrastructure is central to their business model and, thus, we group them together as distribution cooperatives.
- Trading (n = 40): We classify as trading cooperatives those that primarily generate a spread by buying and selling energy (or energy resources). Cooperatives that sell the energy they generate are grouped as generation cooperatives, even if they are also traders.

The technology-in-use classification is useful for further differentiating within the large group of *generation* cooperatives. With a few exceptions, most German energy cooperatives use renewable energy technologies that are promoted by the German feed-in-tariff system in accordance with the Renewable Energy Sources Act (EEG). Overall, power generation from renewable energy sources is dominated by electricity from windmills (7.9%), biomass (6.8%), photovoltaics (4.5%), and hydro power (3.4%) [29]. Most cooperatives are engaged in power generation using photovoltaics (495) followed by biomass (200) and wind (76). Hydro power (29) as well as solar thermal and geothermal power production (8) play a minor role. It is important to mention that many cooperatives use more than one power production technology, and only 29 cooperatives are engaged in fossil-fuel technologies.

Activity has been mainly focused on photovoltaics because the technology is fairly simple, and it is easy to scale production-plant size according to available space. Often roofs of public buildings, such as schools or town halls, are used to install solar panels. Municipalities, churches, and other organizations are more likely to provide roofs to cooperatives as

compared to investor-oriented firms, and numerous cooperatives have occupied this niche market. In contrast, generation of electricity from windmills is not very common among cooperatives. Reasons are the greater risks and higher upfront investments involved; also, competition for land with other investors is fierce.

2.2.3. Classification based on historical Development

Cooperatives in the energy sector are not a new phenomenon. As opposed to the US experience [30; 31], however, German cooperatives in the energy sector have not received much attention in the academic literature. With more than 6,000 firms, electricity cooperatives – mainly rural distribution cooperatives – were the second largest group within the German rural cooperative association in 1930 [32]. Around 40 of these old electricity cooperatives survived concentration processes which followed the 1920s and reached a peak in the 1930s, and they continued through the liberalization of electricity markets in 1998. The following **Fig. 1.** displays the number of newly formed energy cooperatives over the past 35 years.

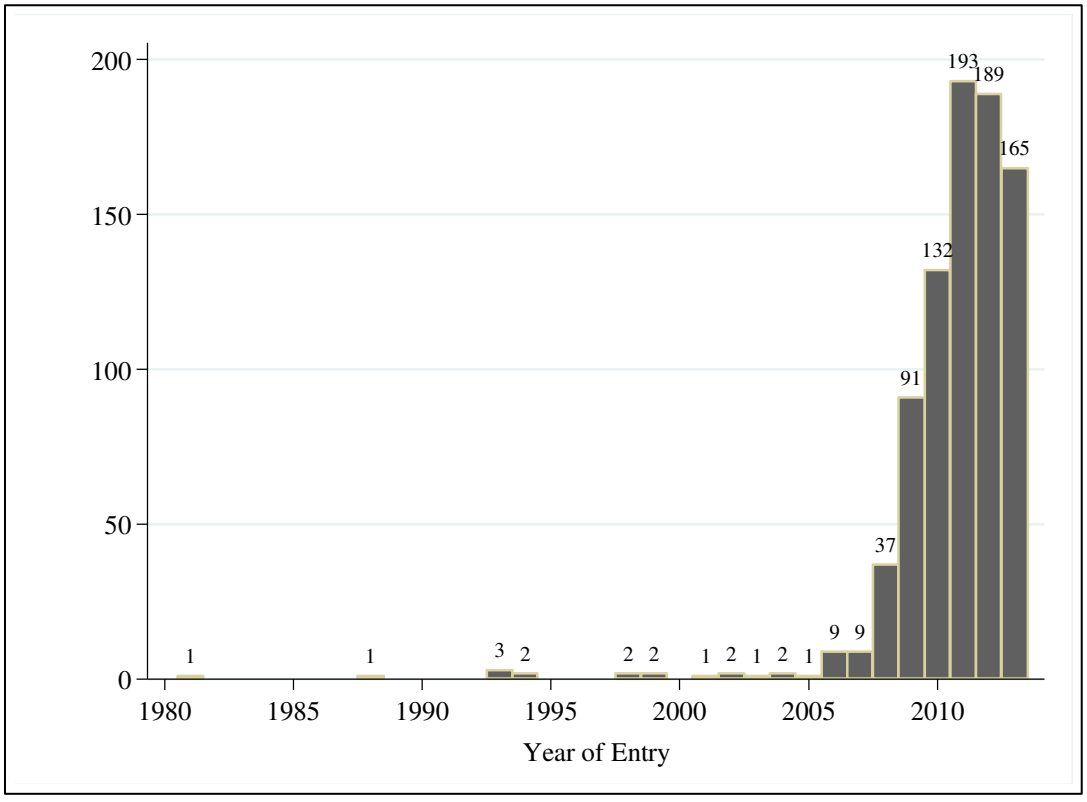

Fig. 1. Number of newly Formed Energy Cooperatives in Germany in the Years 1980-2013. (Source: authors' design)

It can be seen that few energy cooperatives were formed in the years 1970-1985. Mostly these were energy-supply cooperatives for member-supply and biomass cooperatives that processed biomass for energy generation. In the period that followed – 1985 to the mid-1990s – was dominated by small pilot projects pioneering in generation of electricity from renewable sources. The cooperative as an organizational form in the energy sector started to re-emerge with the rise of renewable-energy generation cooperatives and so-called bioenergy villages in the second half of the 2000s. The peak in growth in 2011 could indicate a saturation effect. Currently, cooperatives are facing difficulties in developing new business models, and the current number of 907 cooperatives may grow at a slower pace in the coming years. Further development especially hinges on concrete changes being made in the legal framework, as The Renewable Energy Sources Act is currently under revision.

2.2.4. Classification based on regional Development

Energy cooperatives concentrate in certain areas. Bavaria is the federal state with the largest number of them, followed by Baden-Württemberg, and Lower Saxony. This distribution is partly mirrored in the capacity of renewable-energy installations. It also is a result of diffusion processes and regional spillover effects. In some regions, renewable energy initiatives have attracted imitators. This has resulted in some spatial clustering of energy cooperatives, sometimes actively fostered by umbrella organizations. The cooperative association of the Weser Ems region has, for instance, actively promoted and supported the foundation of cooperatives in the region; meanwhile, the Agrokraft GmbH has sold the franchise-like *Friedrich-Wilhelm Raiffeisen Energie* concept.

At the same time, as shown in Table 1, founding dynamics differ across federal states. Baden-Württemberg and Bavaria have both shown similar growth in absolute terms in 2009-2011, but strongly differ before and after those years. Energy cooperatives are almost absent from some parts of Eastern Germany, which may be explained by the negative historical legacy of forced collectivization under the former socialist regime as well as lower disposable income and wealth.

Table 1. Regional Distribution by Years of Formation of Existing Energy Cooperatives in Germany. (Source: authors' design)

Period/ Year	**-1959**	**1960 - 1979**	**1980 - 1990**	**1991 - 1997**	**1998 - 2005**	**2006 - 2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**Total**
Federal State												
Baden-Württemberg	3	1	1	0	1	4	21	28	45	27	26	157
Bayern	28	5	1	1	9	10	22	28	43	55	48	250
Berlin	0	0	0	0	0	1	2	2	5	2	9	21
Brandenburg	0	0	0	0	0	2	1	2	1	4	4	14
Bremen	0	0	0	0	0	2			1	2		5
Hamburg	0	0	0	0	1	0			1		2	4
Hessen	1	0	0	0	0	5	3	12	13	23	14	71
Mecklenburg-Vorpommern	0	0	0	0	0	0		2	8	3	3	16
Niedersachsen	2	6	0	2	3	19	21	17	26	16	14	126
Nordrhein-Westfalen	5	1	0	0	1	5	12	20	21	13	11	89
Rheinland-Pfalz	1	0	0	0	0	0	4	3	5	14	8	35
Saarland	0	0	0	0	0	0		2	2	1	3	8
Sachsen	0	0	0	2	0	3	2	2	4	6	2	21
Sachsen-Anhalt	0	0	0	1	1	1	3	4	4	4	3	21
Schleswig-Holstein	0	1	0	0	0	2	1	7	8	13	4	36
Thüringen	1	0	0	0	0	1		3	7	7	14	33
Total	**41**	**14**	**2**	**6**	**16**	**55**	**92**	**132**	**194**	**190**	**165**	**907**

The numbers presented in this section provided a general overview of recent developments of renewable energy cooperatives. In the following, we seek to deepen the empirical analysis and provide insights on financial and membership characteristics.

2.3. Financial Characteristics

A detailed analysis of the economic development of energy cooperatives over time is missing from the literature as previous research has largely neglected financial issues and is based on small samples [19]. The following economic analysis of energy cooperatives attempts to fill this gap by evaluating a large number of German renewable energy cooperatives and analyzing their published financial statements for the period 2010-2012, focusing on

renewable energy generation cooperatives, which represent the largest group in the sector (see section 2.1.) [33].[1]

The development of capital provides a general picture of the financial power and growth rates of organizations. **Fig. 2.** displays the amount of capital that was allocated by generation cooperatives between 2010 and 2012. The majority of these firms are relatively small. In 2010, 69% of surveyed cooperatives each disposed of capital of up to one million Euros. In 2012, this group covered 65% of surveyed cooperatives. Furthermore, a slight growth of larger renewable energy generation cooperatives can be observed up until 2012. The number of surveyed energy cooperatives that disposed of more than two million Euros capital increased from 14% in 2010 to 20% in 2012. Accordingly, the number of energy cooperatives that disposed of capital of up to two million Euros decreased from 86% in 2010 to 80% in 2012. Consequently, it is likely that either existing energy cooperatives have raised more capital in order to increase project sizes throughout the observed years or that newly initialized projects have started with higher investment volumes. Yet very large energy cooperatives, those with a capital of more than five million Euros, remain an exception.

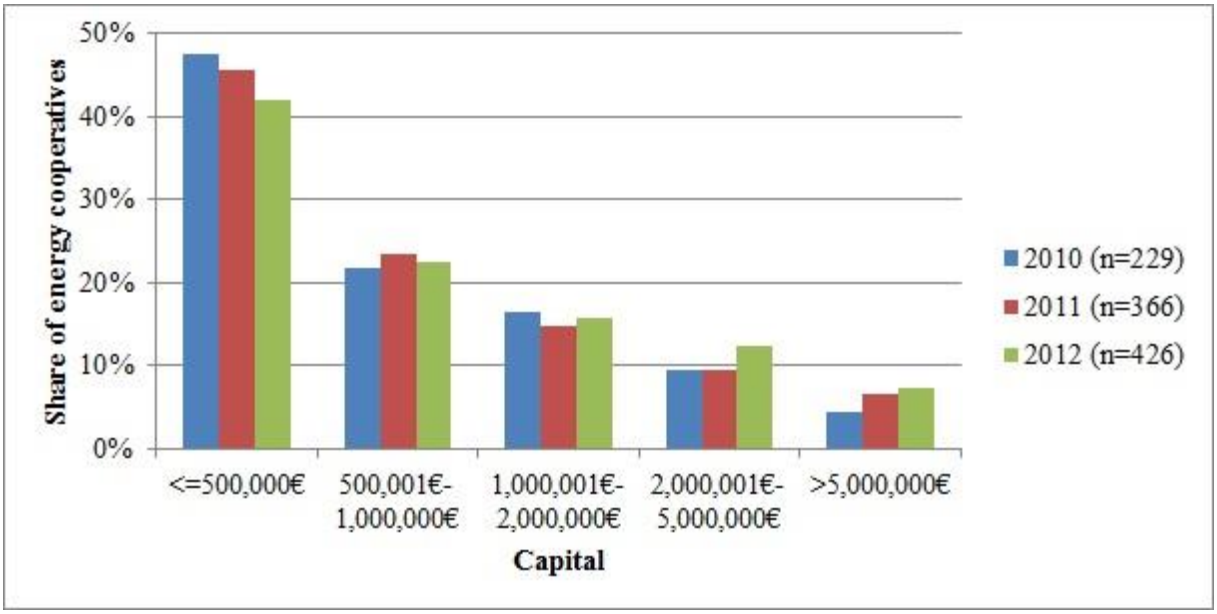

Fig. 2. Capital of German Energy Generation Cooperatives in 2010-2012. (Based on [33])

In line with slightly growing investment volumes for new projects and the expansion of activity fields of established cooperatives, the number of members has risen as well. In 2010,

[1] The assessment was conducted by one of the authors in 2013/2014. More details on the data and further results are available in a discussion paper [33].

about 62% of surveyed renewable energy generation cooperatives had between 3 and 100 members, around 23% had between 101 and 200 members and 15% of surveyed renewable energy generation cooperatives had more than 200 members. In 2012, the share of energy cooperatives with 100-200 members increased to 30%, whereas the share of surveyed renewable energy generation cooperatives with 3 to 100 members decreased to 50%. Meanwhile, the share of surveyed energy cooperatives with more than 200 members slightly rose to 19%.

Growing memberships may indicate that capital growth of German renewable energy cooperatives is primarily based on equity financed from members' shares. As displayed in **Fig. 3.**, surveyed energy cooperatives had relatively high equity ratios. Furthermore, equity ratios remained stable throughout the observation period. In 2010 as well as in 2012, 60% of surveyed generation cooperatives had an equity ratio between 31% and 100%. Respectively, 40% of surveyed cooperatives had an equity ratio up to 30% in 2010 and 2012.

Fig. 3. Equity Ratios of Energy Generation Cooperatives in 2010-2012. (Based on [33])

Against the background of the presented empirical results, three claims can be made. First, renewable energy generation cooperatives are small to medium-sized organizations. Second, high equity ratios are in line with fundamental cooperative principles. By collecting equity from their members, cooperatives realize member support and provide them with services [34]. Nevertheless, additional capital is needed to realize projects. This is mainly provided by loans from cooperative banks [19]. Third, the shift towards higher capital rates, high

membership numbers and stable equity ratios indicates that despite of growing investment volumes, financial requirements are still met to a great extent by members.

2.4. Member Characteristics

Besides the presented survey on developments in the cooperative sector in general and financial characteristics in particular, a closer look at member characteristics may reveal significant distinctions that can help us to better understand the success of renewable energy cooperatives in Germany. The following survey presents key characteristics of the social structure of cooperative members as well as their preferences regarding organizational aspects.[2]

2.4.1. Social Structure

In terms of age, the majority of cooperative members are older than 35 years of age, with 47% being 35 to 55, another 42% being older than 55 and only 12% younger than 35. Regarding gender distributions among energy cooperative members, we found that an overwhelming majority of energy cooperative members are men, representing 80%.

Concerning educational backgrounds and income structures of involved individuals, further statistics are striking. The majority of energy cooperative members are university graduates (51%). Consequently, higher income groups are overrepresented: 71% have an individual monthly gross income over 2,500 Euros, 17.5 % have a monthly gross income of 1,500 to 2,500 Euros, and the remaining 11.5 % have gross income of less than 1,500 Euros per month.

2.4.1. Organizational aspects and member perceptions

Data on the motives of participating members reveal a strong preference for democracy in organizational issues and regarding social issues. We found that 77% of the interviewees attribute democratic characteristics to energy cooperatives. Reasons given for this perception were the one-person-one-vote principle as well as the chance to participate, even with small investments.

Although the interviewed cooperative members seem to appreciate the democratic character of energy cooperatives, their degree of active participation in organizational meetings and decision-making processes is middling, as only 28% are permanently present at organizational

[2] The survey was conducted by one of the authors in 2012. It is based on 2,826 respondents from 80 community-energy initiatives. Out of these 1,872 people are members of energy cooperatives from all over Germany and from all renewable energy sectors (solar, wind, biomass). More results and background are available in [35].

meetings and another 24% are present frequently. Although 50% claim to participate actively in discussions and express themselves in meetings, a majority (76%) never initiates any ideas for further developing the cooperative, rather delegating this operative task to the executive committee. A reason for this seeming discrepancy might be that 96% of the interviewed members feel well informed with regard to their energy cooperative's organizational and operative issues.

Participation in an energy cooperative also led to significant attitude changes towards broader issues in the energy sector. According to a query where several answers were possible, 42% of members came to believe that a decentralized energy supply is a considerable alternative to centralized energy infrastructures *after* joining the cooperative. Furthermore, 41% support the further deployment of local community initiatives and 36% demand more citizen participation.

These empirical insights reveal, first, a dominance of middle-aged men with academic degrees to be investors in renewable-energy cooperatives. A reason for this might be that, although energy cooperatives have comparatively low requirements for financial participation, the required amounts for membership pose in some cases an obstacle for individuals with restricted financial budgets. Consequently, individuals having an academic degree, who generally dispose of higher incomes, are overrepresented. Second, the ongoing growth of energy cooperatives seems to be induced by preferences of initiators for a high degree of participation, support for further deployment of renewable energy, and support for the decentralization of energy supply, rather than concerns about supply security, as the infrastructural conditions for rural energy supply through conventional energy suppliers are already given [36].

3. Theoretical Perspectives on Energy Cooperatives in Germany

The objective of this section is to review the literature that may help to advance our understanding of energy cooperatives. Besides approaches already being used in the analysis of cooperatives in (agricultural) economics, we also look at some promising new approaches from behavioral economics and the sociological literature.

3.1. Energy Cooperatives from an Economics Perspective

From an economics perspective, energy cooperatives are distinct in many ways. Cooperatives do not have the objective of maximizing profits, as is typically assumed for the firm in

microeconomics. As an alternative to markets and hierarchies, they are consequently subject to different transaction costs. More than in investor-oriented firms, member behavior may be driven by concerns of fairness or other-regarding preferences. From a structural perspective, cooperatives have effects on market structures that differ from investor-oriented firms. Also, customers of energy cooperatives may have motivations that go beyond purchasing cheap electricity. The following sub-sections will address these issues in more detail.

3.1.1. The energy cooperative as an organizational form: A transaction cost approach

Fundamental analysis on governance and the theory of the firm dates back to the seminal work of Ronald Coase (1937), who was the first to note that using market mechanisms involves costs other than production costs. He showed that it is sometimes cost-efficient to execute transactions within a hierarchical organization, that is, not using market mechanisms. The costs of using market mechanisms for an economic exchange, later termed transaction costs, stem primarily from efforts to acquire information on prices and (potential) trading partners, to negotiate and to conclude contracts, and to monitor agreements. Additional costs result from modifying and enforcing contracts [37]. Building on Coase's work, his analytical approach for determining the size of a company and regarding the analysis of operational coordination mechanisms has been continually developed. The properties of a transaction – specificity, uncertainty, and frequency – determine its transaction costs and, with a transaction cost minimizing agent, result in a governance structure that is optimally adapted to these properties. Within this context, a central role is played by specificity, which describes the possibility of an alternative use of assets and can lead to the so-called lock-in effect: an exchange-based dependency which can be exploited opportunistically by one of the exchange parties through the appropriation of relationship-specific rents. Consequently, concerns regarding the possible appropriation of returns usually play a crucial role in the assessment of the efficiency of a given governance structure for an economic exchange [38].

Within this typology of transaction costs and governance structures, cooperatives in general, and consequently also energy cooperatives, are classified as hybrids within the spectrum of coordination mechanisms, ranging from market to hierarchical organization. On the one hand, members pool some, but not all, of their qualifications and resources in the cooperative enterprise's business. The use of the market is limited or even absent; hierarchy dominates. On the other hand, members of a cooperative remain economically independent, and they can use their qualifications and resources for other tasks, mostly for market transactions. To sum

up, the cooperative association possesses features that provide benefits in terms of integrating transactions into a collective organization while allowing independence of other operational aspects. However, this equilibrium is revocable, as a cooperative can lead up to the creation of a merged firm, if the characteristics of the underlying economic exchange call for more hierarchical organization (e.g., in cases of high specificity and high uncertainty), or can lead up to the dissolution of a cooperative, if the benefits of independence loom large. Cooperatives are often formed to economize on information costs or avoid opportunistic behavior and "hold-up" in the presence of specific investments [39].

Although the field of energy cooperatives knows a variety of dimensions and forms, in practice several regularities can be identified that show in exemplary manner the hybrid character of energy cooperatives. The cooperative association is systematically oriented towards organizing activities through coordination and cooperation of involved actors (mostly private individuals). Consequently, fundamental operational decisions such as investments are undertaken jointly. A second feature is the pooling of resources and competencies, through which advantages can be generated from extended market shares, transfer of competencies, and sharing of scarce resources. Furthermore, the involvement of multiple parties and their resources offers risk-sharing possibilities. The pooling of resources and risk-sharing features are particularly relevant for citizens involved in generation cooperatives. Here, members can participate actively within local energy policy, without bearing extensive economic risks. However, contractual incompleteness within the institutional setting of relational contracting as a regulating measure for the relationships among the involved parties can induce opportunistic behavior, resulting in significant risks that are likely to remain in a cooperative organization [40].

Besides the menace of opportunistic behavior, a number of other disadvantages, resulting from shared property rights, constrain the organization of economic exchanges in a cooperative association. Departing from the analysis of cooperatives in the agricultural sector, problems devolving from the division of residual claims and control rights have become known as the (1) Free Rider, (2) Horizon, (3) Portfolio, (4) Control, and (5) Influence Cost problems, the relevance of which is explained in the following paragraphs.

In the context of cooperatives, the Free Rider problem refers to scenarios where gains from cooperative action are accessed by individuals who do not participate in or contribute equally to the organization in comparison to other members. For example, new members receive the same patronage and residual rights as old members who have contributed over much longer

periods. The Horizon Problem describes divergences between a participant's residual claims to her net income and the productive life cycle of her investment. This is caused by a lack of transferability of residual claimant rights and can lead to underinvestment in research and development or other intangible assets. Like the Horizon Problem, the Portfolio Problem also stems from the tied nature of equity in the cooperative. More specifically, changes in interests or risk attitudes of an investor cannot be immediately adjusted for within the cooperative, as wide agreement among members must be reached first. Such coordination problems of democratic governance, typical for cooperatives, represent the core of the Control and the Influence Cost Problems. The Control Problem is similar to the fundamental principal–agent problem set but is, in the context of cooperatives, further compounded by a lack of external competitive market pressures to discipline involved parties, particularly the executing managers of a cooperative. Finally, Influence Costs are incumbent on all organizations where decisions affect wealth distribution among members. They are greater, the more variable members interests and potential gains are [41; 42].

For energy cooperatives, the Control and Influence Cost Problems are of particular importance. In general, it can be assumed that parties joining a cooperative have common interests. However, a detailed analysis may reveal that conflicting issues and heterogeneity potentially exist. Assuming that members of an energy cooperative have different institutional backgrounds (e.g. energy-consuming private individuals and resource-providing farmers in a bioenergy cooperative), it can be conjectured that conflicts may arise concerning the trade-off between what price to pay for input materials (e.g. energy crops) that represent an income only to some of the involved parties (e.g. farmers for the case of energy crops) and the residual claims of all involved parties on the net income of the cooperative, which is reduced by high prices for input materials. That is why, in practice, such a constellation of actors can rarely, if ever, be found organized within a single cooperative. Other relevant fields where such problems are even further aggravated are urban energy cooperatives [43, 44].

To conclude, members of a cooperative might undertake efforts and bear costs to influence and control operative decisions, therewith reducing the transaction-cost efficiency of a hybrid organization. Especially in bio-energy cooperatives – where infrastructures at various stages are characterized by a complex value-addition process, including the energetic exploitation of raw materials and distribution of production output and waste – this problem may give rise to more hierarchical organization. In contrast, solar energy cooperatives are less prone to these problems, since the underlying technology does not rely on socially complex production

processes and, therefore, typically does not involve parties with heterogeneous interests. Consequently, the democratic organization of energy cooperatives and co-determination rights assigned to all members can generate extensive organizational costs, which may restrict their operational decision-making and management [44].

The findings of this sub-section have been gathered to provide a rationale for choosing a cooperative as an organizational form within the energy sector, given the assumptions of standard neoclassical economics. However, recent findings question this framework; consequently, the next sub-section is dedicated to the topic of behavioral economics, applying some findings of this field to several questions within cooperative analysis.

3.1.2. A Behavioral Economics Approach to Energy Cooperatives

Over the last three decades, insights from Behavioral Economics have challenged many of the assumptions underlying the model of homo economicus prevalent in Neoclassical Economics. Often through using psychological and economic experiments, humans have been shown to conditionally act cooperatively and to reciprocate behavior, to be loss averse rather than risk averse, and to act in contradiction with utility-maximizing behavior and full rationality more generally [45; 46; 47].

Experimental Economics, supported by evidence from Neuroeconomics [48], has furthered our understanding that in particular contexts – for instance when actors are socially proximate or market pressure is absent – decision-making processes of parties involved in an economic exchange can be influenced by preferences for fairness, reciprocity and other behavioral patterns that deviate from the assumptions of the standard economic approach depicted by the hypothetical figure of homo economicus [49].

In cooperatives, as economic institutions whose initiators are typically individuals living in geographical proximity, where relations among involved parties are characterized by social proximity, and whose inter-firm rights of co-determination are based on a democratic principle rather than on voting schemes proportionate to equity, member behavior is often better characterized by the so-called cooperative spirit than the homo economicus model [39]. It is likely that concerns regarding fairness are important behavioral drivers in cooperative organizations, especially in comparison to investor-oriented firms, and it is, thus, surprising that virtually no behavioral research exists drawing on members of cooperatives as a subject pool, although potentially interesting and deviating behavioral patterns may be manifold.

First, experimental findings show that democratic institutions, such as those present in a cooperative association, affect the level of cooperation of parties involved in an economic exchange. Given a decision or policy, the level of cooperation is higher when decisions are made democratically by involved parties, whereas the same decision or policy imposed undemocratically through another mechanism does not induce similar levels of cooperation [50]. This is in accordance with the premise regarding the endogenous formation of preferences which states that economic institutions may affect preferences through their direct influences on situational construal, forms and structure of reward and incentive schemes, the evolution of norms, and task-related learning, as well as their indirect effects on processes of cultural transmission [51].

Second, the comparably higher willingness to cooperate and the existence of fairness preferences seem to also affect the individual contributions of parties involved in a cooperative. The fundamental proposition from institutional economics' Incomplete Contract Theory, that shared property rights lead to inefficiencies and underinvestment in the presence of incomplete contracts, is contradicted by experimental findings. Here, fairness preferences of some actors in a heterogeneous set of involved parties can act as an enforcement device that complements explicit incentives enforced by the courts such that joint ownership induces the most efficient ownership structure, as shown by high and efficient levels of investment under joint ownership in investment games [52]. These experimental findings can be explained as follows: First, cooperative members endowed with social preferences (e.g. fairness and reciprocity) are more likely to engage in mutual monitoring (of given levels of personal costs and benefits) which may prevent uncooperative members from appropriating rents from economic exchange. In other words, monitoring reduces the inequity among involved parties. What is more, cooperative members with a concern for fairness are less likely to act opportunistically. They can be best described as "conditional cooperators" who reciprocate the behavior of others, therewith reducing inequity, which may include uncooperative behavior as a means of punishing non-cooperators and restoring equality among involved parties in a cooperative [53].

These more general insights from behavioral economics are also of specific interest in the context of energy cooperatives. Here as well members typically originate from a common region and, in setting up the organization, require involvement of a wide set of actors in the enterprise's activities. Social proximity and, therefore, social preferences are likely to play an important role in determining behavior – at least for some members. These effects, fostering

cooperative behavior, are further intensified by the fact that initiators of energy cooperatives often consciously decide in favor of the organizational form of a cooperative in order to play an active role in local energy policy. In this, their decision-making process tends not to be solely determined by monetary payoff considerations but is rather also influenced by civic virtues (see also section 2.4) which, in turn, foster cooperative behavior.

To date, fairly little is known about behavior in cooperative organizations. More specifically, in spite of the wide range of behavioral economics applications drawing on subjects from business environments [e.g. 54], to our knowledge, cooperative members have not yet been subjected to experimental work. This is even more surprising if one looks into the mushrooming experimental literature seeking to extend the experimental subject pool beyond easily available students in all kinds of field studies [55; 56; 57]. Accessing members and managers of cooperatives for behavioral research is, thus, a promising task for future studies in order to be deal with questions that, thus far, could not be addressed with standard economics, such as cooperatives as an organizational form as seen from an incomplete contract perspective.

3.1.3. Cooperative pricing under imperfect competition

In recent years, Comparative Economic Organization and Transaction Cost Economics have played a dominant role in the development of cooperative theory. They have been successful in explaining why cooperatives are formed and under what conditions they can outperform investor-oriented firms (see section 3.1.1. and [58]). In the past, structural approaches rooted in industrial organization have also investigated what kinds of functions cooperatives perform for the economy as a whole [59; 60; 61; 62] More specifically, this strand of literature has looked into the role of cooperatives under conditions of imperfect competition. With upstream market power of processors and retailers prevalent in agricultural markets, this question also has received much recent attention from regulators and policy makers who often want to know what kinds of benefits cooperatives can create for the economy and society as a whole [63]. This has resulted in a small revival of empirical work based on this so-called competitive yardstick school of cooperative thought in agricultural economics, which argues that regional prices and prices investor-oriented firms have to pay are driven up [64; 65; 66].

Market power imbalances not only exist on markets for agricultural produce but also on those for electrical power, which are highly concentrated in most European countries. Although the shares of the largest four companies in Germany – Vattenfall, EnBW, RWE, and E.ON – are

decreasing through an influx of small-scale renewable energy generation, the "big four" still account for more than 80% of the retail market share [67]. In a recent study, the German competition authority has described these market structures as oligopolistic [68].

It would, thus, be quite revealing to mimic the work of agricultural economists by investigating the effect of cooperative market share on prices, either within regions of a state [64] or across member states and time [65]. One challenge will be to construct panel datasets that allow identification of the respective effect [65].

3.1.4. Quality uncertainty and consumer demand for electricity from cooperatives

There is some indication that the German transition towards a sustainable energy system is, at least to some extent, driven by consumers [69]. Today, at least 10 % of all households in Germany voluntarily opt for electricity tariffs entirely based on renewable energies [70], typically also involving price premiums which have been the subject of a mounting literature on stated and revealed preferences of consumers with regard to sustainable consumption and "green energy" in Germany and elsewhere [71; 72; 73].

Similar to organic or fair-trade food or, as in George Akerlof's famous example, used cars [74], it is often not easy to distinguish quality differentials for a good when information on its characteristics is costly. As a result, adverse selection – a process where low-quality suppliers have an incentive to enter the market and, as a consequence of decreasing prices, drive out high-quality suppliers – may take place, ultimately bearing the risk of a complete market collapse. This can be especially true if aspects of the production process are an essential factor in consumer valuation for a good and, as in the case of household electricity, the good reaches the consumer in a homogeneous quality, independent of the particular supplier chosen. Put differently, renewable energy is a credence good; its consumption does not yield information on the production process, creating risks of adverse selection and fraud on the supplier's side.

As predicted by theory [74], this situation has resulted in various forms of transparency initiative, signaling, or guarantees on the supplier's side. Providers of renewable energy spend much of their marketing budgets on elaborating how exactly the electricity they sell is produced, seeking to establish trustful relationships with consumers. Some large utilities in Germany promise to customers that they are establishing new renewable energy production capacities and that, for reasons of transparency, they do not engage in trading of renewable energy certificates at the stock exchange.

With respect to cooperatives, information asymmetries have mostly been investigated on the supply side. In rural finance or dairy processing, costs of locally available information can in many cases be reduced by integrating transactions into more hierarchical organizational forms, ultimately resulting in the identity of owners, producers, and processors [39]. The same applies to the energy sector, where much of the costly regulation of electric utilities in fully integrated markets can be avoided, especially in rural areas where energy cooperatives have been successful historically [43; 69]. Today, with unbundled electricity markets in Germany, the traditional cooperative model of user-owner identity is not fully applicable anymore. Greenpeace Energy, Germany's largest electricity cooperative, supplies renewable energy to more than 100,000 customers but, in sharp contrast to agricultural cooperatives, where user-owner identity is typically 100%, has only about 23,000 members. In other words, the vast majority of the users are neither members nor owners of the cooperative. These empirical realities also call for advancing cooperative theory [69].

A first step in this direction has been taken by Sagebiel et al., who investigate consumer preferences for electricity produced by cooperatives independent of the survey respondent's membership status [75]. The authors conduct a Choice Experiment in which they distinguish between attributes of electricity contracts by focusing on the governance characteristics of suppliers. They do not find strong support for an increased willingness to pay for electricity from cooperatives. Rather, renewable energy and price seem to dominate respondent decision making. Yet, more research is needed to further substantiate these claims and to learn more about the motivations of customers to purchase energy from renewable energy cooperatives rather than from investor-oriented corporate suppliers with otherwise comparable features.

3.2. Energy Cooperatives in the Social Sciences

From a social-science perspective, energy cooperatives are first and foremost understood as social entities, characterized by multiple social relationships featuring individual and collective actions. Social scientists can employ a number of different perspectives in order to investigate energy cooperatives as social phenomena:

On the macro level, energy cooperatives can be considered as societal and network actors embedded in social and environmental movements [76; 77]. Energy cooperatives can, for example, be viewed as actors in the energy transition and the social-ecological transition movement.

The meso level comprises inter-organizational processes. Here, energy cooperatives are recognized as actors of collective action. Different theoretical approaches, such as social psychology, socio-economics and socio-ethics, have been applied to study processes of decision making, participation, cooperation, strategies, discourses, ideas and visions in traditional cooperatives which might serve as future topics for discussion of energy cooperatives [78; 79].

In the following, however, we will focus on the micro level. Here, social scientists are concerned with inter-personal relations and behavior. Focusing on the micro level has two particular advantages. First of all, it allows relevant aspects of community building to be plausibly analyzed. Secondly, links to existing and on-going empirical observations can be made. We highlight three distinct micro-level phenomena: participation, conflict and trust. Analysis informed by these theoretical concepts is crucial for deepening the understanding of social behavior and relationships in general and energy cooperatives as social entities in particular, as they have received different forms of attention in the existing literature.

3.2.1. Perspectives on Participation and Civic Engagement

Participation and civic engagement are challenging research areas in the social sciences, especially in democracy theory and in studies focusing on community energy. In various ways, social processes and practices in and between energy cooperatives as well as other forms of community energy, affect principles of participation, engagement, collaboration, and citizen involvement. These are crucial in the debate on civil society and participation and include (1) political and social participation in the context of planning renewable energy plants through formal and informal participation practices [80], (2) financial and collaborative participation through membership in cooperatives with respect to organizational and internal participation practices [81], and (3) communicative and deliberative consensus dialogues, often known as participation through discourse [82].

The “classical” way of classifying the level of citizen involvement in participatory processes has been provided by Arnstein’s “ladder of participation” [83]. Although originally developed for assessing degrees of citizen participation in public administrative processes, such approaches have also been extended to community energy initiatives with the aim of classifying levels of involvement of various in- and outside stakeholder groups. A challenging task will be to further develop the linear and hierarchical character of the model and to

integrate more horizontally oriented frameworks for analyzing community-energy initiatives, for instance from a social-learning perspective [84].

Regarding the discussion on the lack of legitimacy and shortcomings of representative democracy, new forms of citizen involvement are seen as a way to re-vitalize democracy [85; 86]. Decisions made in energy cooperatives resulting from collective action processes may find greater societal acceptance, and may form broader consensus, than decisions made by investor-oriented firms [87]. Yet, as in other forms of non-profit sector organization, a lack of legitimization and representation may arise from access barriers set up by an organization to control membership composition and to grant access only to a selected few. On the other hand, energy cooperatives typically allow for broad participation of local citizens, are open and accountable, and do not discriminate against small investors. Although they lack the formal representation, legitimization, and control of public utilities, with these properties they have the potential to achieve a similar status. Further, participation and inclusion cannot only be reached through membership. As laid down in the International Co-operative Alliance (ICA) principles, the cooperative enterprise should share concern for the community. Consequently, it has the ability to build bonding social capital in local networks of diverse actors, therewith generating benefits beyond the immediate boundaries of the organization. Two important aspects of participation are thus crucial. First, the institutions formally governing a cooperative define the level of democratic control and possibilities for participatory processes within it. Second, and more informally, practices in a cooperative enterprise may spill over to the public, affecting both members and external stakeholders, while creating a network and (hopefully positive) experiences with participatory and democratic practices.

3.2.2. Conflict in Energy Cooperatives

Conflict is one of the key phenomena in the social sciences. It is seen as a mechanism inherent to social life and is deeply embedded in its social context [88; 89; 90]. Conflict within organizations can be broadly defined as the "perception of incompatibility between values, needs, interests or actions" [91] between individuals or groups. There is no integrative, overarching theory of conflict in cooperative organizations, and very little attention has been

paid to conflict within energy cooperatives. Therefore, we highlight some theoretical assumptions that can function as a starting point for further analysis.[3]

A fundamental assumption of conflict theory is the notion that conflict supports change [89]. According to Pondy [88], conflict in an organization can have positive or negative effects on its productivity, stability, and adaptability, depending on a variety of factors. Since energy cooperatives in Germany frequently face legislative changes which require flexibility and adaptation, the impact of conflict on such organizations as a whole can be seen as decisive for their future. This assumption is supported by cooperative scholars, who regard the flexibility and adaptability of cooperatives as central for their survival in a constantly changing economic and political environment [93; 94; 95].

Conflict theory illustrates that negative outcomes of conflict are especially triggered if norms and values are at stake [96]. Taking this into account, it seems vital to pay attention to the role values play in energy cooperatives. The importance of a "cooperative spirit" and clearly defined member value strategies for a cooperative's success has been extensively discussed in the history of cooperative theory [97; 98]. Empirical studies show that individual definitions of cooperative spirit can vary even within cooperatives [99]. It has also been shown that founding members of energy cooperatives pursue a wide range of motivations which might be informed by underlying values that may be different from those of newer members [36]. However, neither the ways that values form a part of these different motivations nor the ways in which values are at stake in conflict within energy cooperatives have been investigated in depth.

Regarding conflict causes, studies show that cooperatives struggle with a number of very different issues over time (see section 3.1.1. and [40]). While in the founding phase conflicts of interest and conflicts pertaining to values underlying a cooperative's strategy might be more pronounced [95], issues regarding codetermination and agency, goals and appropriate governance approaches might be more relevant in later stages [100; 101; 102].

Although there is also some work available on dispute-resolution mechanisms [103], empirical research on conflict in cooperatives mostly focuses on cooperative governance (see e.g. [104]). Findings suggest that conflict in cooperatives is more complex than, for example, in work organizations and, therefore, requires very particular management approaches [98]. Reasons for this include the diverse backgrounds and motivations of cooperative members

[3] Although we focus on intra-organizational conflict, energy cooperatives can also be examined as social actors in local and national conflicts over resources [92], as well as in other inter-organizational conflicts with other civil society actors, local administrations, regional cooperative associations, and other stakeholders.

[102], complex relationships among members based on member values [105], as well as the democratic nature of cooperatives, which makes conflict more pronounced and potentially more varied in them than in hierarchical organizations [106; 107]. Darr [106] illustrates how conflict can strengthen or weaken democratic structures within cooperatives. Cooperative structures can also lead to suppression of conflict or to sudden outbursts of it. Conflict may be suppressed because fear of losing face is evoked at the thought of voicing opinions in large meetings or because parties feel that voicing their opinions could put social relationships at stake [108]. Cooperatives therefore need to implement measures to facilitate conflict in advance or during board meetings, establishing small group discussions, self-audits or anonymous dispute-resolution mechanisms [108].

This brief review illustrates that the analysis of conflict not only can help to inform management strategies but also provides a lens through which we can learn more about the social dynamics and organizational development of energy cooperatives in general. While we can gain some insight into potential fields of conflict by drawing from existing literature on cooperatives in general and energy cooperatives in particular, we know very little about the causes, types, involved parties and other particularities of conflict in energy cooperatives, the social and cultural factors influencing conflict as well as the utilization and evolution of formal and informal resolution mechanisms. Empirical research is needed in order to better understand the nature of conflict and its potential impacts on the particular social structures of energy cooperatives as well as their organization.

3.2.3. Trust in Energy Cooperatives

Another aspect which is relevant to social relationships in organizations in general and in cooperative organizations in particular is trust [109]. Consequently, investigation of trust may, for instance, contribute to better understanding of the potential advantages of energy cooperatives in contrast to other forms of citizen-participation schemes and corporate projects for renewable energy. It may also provide some explanations for recent trends in the energy cooperative sector.

Trust is seen as a highly problematic but recurrent feature of social relationships [110] and multiple definitions are in use [111; 112]. It has been claimed that trust provides a range of benefits and is seen as being essential to stable relationships, vital for maintenance of cooperation, fundamental for any exchange and necessary for even the most routine of

everyday interactions [110]. Referring to its benefits, trust has also been related to social capital as having impact on the organizational effectiveness or productive activity [113; 114].

Since the 1990s, the concept of trust has been increasingly recognized by sociological theories as well as economists and management scholars [109]. Consequently, a large body of literature has developed that theorizes and empirically validates its various impacts. Luhmann [115] was one of the first to provide a theoretical approach to this concept. He understood trust as a function that reduces social complexity by going beyond available information and generalizing expectations of behavior so as to replace missing information with a sense of an internally guaranteed security [115].

Up until now, little attention has been given to the role of trust in the context of energy cooperatives. Walker et al. [116] analyzed the concept in relation to the development of community renewable energy, problematizing the view that trust is a characteristic of the community approach as well as a project outcome which builds social capital. Their findings suggest that, although trust is one key component of the necessary conditions for a successful community energy project, it is not universally ensured solely by the community label but is rather dependent on the social dynamics of a project and what the actual community involved consists of [116].

However, substantial research has been conducted on the significance of trust in traditional cooperative organizations (e.g. agricultural cooperatives). Study findings have emphasized that trust plays a crucial role as, for example, a mechanism of control and coordination in processes of governance [112; 113; 117]. In this vein, Borgen [117] suggests that trust based on identification can mitigate the agency problem – an issue that applies especially to larger organizations and relates to the separation of ownership and control [118].

In the spirit of the open membership principle, the size of some energy cooperatives in Germany quickly increased after establishment, with the largest ones now comprising several thousand members (e.g. Greenpeace Energy with about 23,000 members) [119]. It has been argued that consequences from increased size may include higher complexity and heterogeneity and social ties becoming weakened [118]. If trust is a vital mechanism for the efficient coordination and operation of large memberships, sources of trust in energy cooperatives might be worth investigating and supporting.

It can be assumed that forthcoming changes in the German Renewable Energy Sources Act and their potential implications for citizen-owned renewable energy projects could lead to increased professionalization in the energy cooperative sector. This might entail mergers of

established organizations, thus leading to the creation of larger units with the aforementioned challenges.

A detailed review of the existing literature on trust and cooperatives may help to better inform the emerging energy cooperative sector about strategies for mitigating governance problems and enhancing efficiency. Empirical research is necessary to test the findings and assumptions already generated regarding the traditional cooperative sector by comparing them with renewable energy cooperatives.

4. Discussion and Conclusions

To better understand organizational changes in the German energy sector, energy cooperatives should be investigated thoroughly, since they represent a synthesis of technological and social change. As the phenomenon is particularly complex, an analysis from a variety of scientific disciplines is appropriate. The aim of this paper has been to respond to this task by combining an empirical overview of German energy cooperatives with theories that may be potentially useful as starting points for further empirical and theoretical analysis.

As little is known about behavior in cooperative organizations, we have identified several tasks for further research for economists and social scientists. Experimental work could provide insights on the (endogenous) formation of other-regarding preferences within cooperatives. It is still an open question whether cooperatives attract particularly (socially) cooperative members, whether member distributional preferences are transformed by membership, or whether both processes are at work simultaneously. This methodologically challenging question could perhaps be best answered by carefully designed experiments and interview-based empirical research. Shedding light on this question could also help to explain why cooperatives exist, although they are not considered to be efficient from an incomplete contract point of view. Along these lines, transaction cost economics also offers potentially useful explanations for the (co-)existence of cooperatives with investor-oriented firms. Integrating findings from behavioral economics with transaction cost theory could be promising, and some initial steps in this direction have already been taken [44].

Another challenge is the question of cooperative pricing under imperfect competition. Agricultural marketing cooperatives typically organize the processing and selling of produce that is supplied to them by independent farmers. Most energy cooperatives, however, organize generation (i.e., production) from pooled capital. In addition, markets for renewable energies

are highly regulated, which may also impact price movements. To distinguish cooperative energy marketing and trading from generation and to identify their respective effects on prices and competition both theoretically and empirically is a challenging task. Yet, it may also be rewarding to revisit the classical works on cooperative pricing under imperfect competition, in order to find out more about the effects of cooperatives on the economic energy system as a whole. Likewise, the role of consumers in driving growth of renewable energy cooperatives remains largely unexplored. Although some exploratory research exists in this direction [75], it is still very much an open question whether the many customers of renewable energy cooperatives are willing to pay price premiums for the *type of good* they purchase (i.e., for electricity from renewable sources), whether they are paying for *the way the good is produced* (i.e., for consumer-controlled and democratically organized production), or whether these two things interact.

For the social sciences, we have sought to demonstrate how theories of participation, trust, and conflict may illuminate our understanding of energy cooperatives as social phenomena at the micro level. Participation and civic engagement are essential preconditions for activating social capital and for achieving vital communities. In the end, we believe that these factors are decisive for determining success or failure of cooperatives. Investigating conflict can also contribute to understanding the nature of social relationships within cooperatives and their development as a whole. Such research is likely to have practical implications for the successful management of energy cooperatives as well. Trust creates social ties and cohesion. Further exploring the role of trust in energy cooperatives may lead to better understanding of inter-personal commitments therein. This can help to mitigate governance problems and enhance project efficiency. Integrating such sociological perspectives with the experimental economics approaches mentioned above could be promising. Trust games are one possible avenue for such research. In the future, it will also be important to put more emphasis on the role of policies, such as the Renewable Energy Sources Act. Our paper has not exhaustively discussed these issues. Reviewing political science theory could be one way to extend this discussion. Likewise, work in social, environmental, and consumer psychology, with a special emphasis on evaluating the potential of inter- and trans-disciplinary work, could also broaden the perspective that we have taken here.

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