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The Power of Co-Creation in the Energy Transition—DART Model in Citizen Energy Communities Projects

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Abstract: Successful energy transformation is interconnected with greater citizenry participation as prosumers. The search for novel solutions to implement the transition to renewable energy that will neutralize the barriers to this process, e.g., the reluctance of citizens to get involved, lack of trust in decision-makers and lack of co-ownership of energy projects, is inevitable as a part of the bottom-up process. Energy communities have vast potential to scale up Renewable Energy projects. Due to the fact that in Poland, establishing citizen energy communities in the cities is not allowed, the key success factor of energy transformation is to engage housing cooperatives and other housing communities in this process. A similar legal framework prevents communities from establishing themselves in the Czech Republic and Hungary. The research problem of this paper is to identify determinants of the co-creation process in Renewable Energy project activation at the housing cooperative level. The aim is to identify key conditions that housing cooperatives should establish in order to successfully undertake Renewable Energy project implementation using a co-creation approach. The literature study shows that the term "co-creation" is not often used in energy transition projects, although many local energy transitions are indeed co-created, unfortunately not in a structured methodical manner. In the research, we apply the DART (Dialogue, Access, Risk, Transparency) model as the framework to conduct the analysis. The study has been carried out using quantitative and qualitative research methods and based on primary and secondary data. Our findings indicate that considering the different areas of the DART model, co-creation was most visible in the area of dialogue-communication between cooperative authorities and its members, while it was least visible in the area of transparency. Based on the results pertaining to the implemented project, the researchers postulate the inclusion of factors beyond the DART model that further shape the co-creation process.

Keywords: co-creation; value co-creation; DART model; citizen energy community; housing cooperative

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1. Introduction

Co-creation is a crucial concept enhancing green energy transformation. Research indicates that successful energy transformation is interconnected with greater citizenry participation as prosumers, and also with grassroots co-creation strategies in this area, as well as the application of appropriate law and financial instruments [1,2]. Pivotal for the success of energy transition is the involvement of citizens in their various roles as users, producers, consumers or owners [3]. Successful co-creation requires a multi-level process and the adoption of the 'by and for the citizens' way of thinking and working. The need for deeper participation of society, citizens and inhabitants has been observed in many urban energy projects [4,5].

Instead of being treated as consumers, citizens should therefore be perceived in a broad sense as the empowered actors of energy transition. The dimensions of citizen co-creation include their assuming roles in co-designing policies and law, co-producing solutions and innovations, co-implementing projects and finally being co-beneficiaries of the green transformation process. Effective energy transformation needs the mainstreaming of the top-down approach and being complemented by the bottom-up, where citizens play an active role. This approach is embodied in the new strategy of the EU to document clean energy for all Europeans. In today's Europe, political decision-makers have presented a growing awareness of the fact that without empowering citizens and granting them ownership of the energy transition, the transition will not advance. The search for novel solutions to implement the transition to renewable energy that will neutralize the barriers to this process, e.g., the reluctance of citizens to get involved, lack of trust in decision-makers and lack of co-ownership of energy projects, is inevitable as a part of the bottom-up process. The process can be seen as the paradigm shift strengthening democracy and the legitimization of the energy transition policy [6].

Energy transition is crucial for adapting to and mitigating the ill effects of upcoming climate change [7]. Several international agreements aim to reduce CO_2 emissions by individual countries [8]. The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity. Access to affordable, reliable, sustainable and modern energy is one of the goals [9]. According to the European Green Deal, the European Union aspires to become the world's first "climate-neutral bloc" by 2050. The plan's key principles include producing clean energy, establishing a circular economy, practicing green-style building and renovation, enhancing biodiversity, eliminating pollution, practicing sustainable mobility and farm-to-fork agriculture [10]. The development of the energy transition in the EU leads to the new role of consumers and citizens. New Energy Directives [11,12] announce equality between consumers, energy communities and already existing entities like incumbent producers and distributors of energy on the liberal energy market and existing public institutions creating law and policies. Unfortunately, the concept of citizens' energy was not fully introduced in previous European regulation, so the emergence of public participation issues in EU energy strategies and policies is a step forward.

The regulations at the EU level are aimed at the development of a decentralized energy system. At the level of individual countries, they are reflected in different national regulations and constitute the basis for policy actions based on a mix of monetary and non-monetary incentives. Non-monetary incentives affect the space of social opportunities, social capital (norms, ownership), human capital (change agents, opinion leaders) and natural capital, while monetary incentives refer to the sphere of financial and physical capital (technology) [13].

Academics underline the importance of economic incentives and peer effects in citizen's decision-making process regarding citizen involvement in energy projects. Results of the research of citizens' PV (photovoltaic) projects show that subsidies and peer effects are significant factors driving the likelihood to adopt and spread the technology [14]. Hanke and Lowitzsch highlight that energy transition depend on the participation of all societal groups, hence it is crucial to provide competitive energy prices to energy community members by removing existing obstacles such as high tax and levy burdens or administrative and regulatory complexities [15]. On the other hand, the importance of more prescriptive, non-monetary incentives targeting end-users in the energy system with respect to their engagement in energy matters is highlighted by Hoffman, Adelf and Meyer [16]. By introducing an agent-based model (ABM) for end-users as part of an interdisciplinary simulation system, they indicated that feedback and non-monetary end-user incentives support energy engagement and willingness to cooperate. In addition, factors influencing end-user engagement that go beyond purely economic considerations such as trust, familiarity, perceived risk, perceived complexity and effort are also highlighted by Parrish et al. [17]. This confirms that energy is not only a techno-economic question

but has a great significance for the whole of society—its culture, values, lifestyles and power structures [18–20]. It also requires social innovation (SI) where the public takes on active roles through institutionalized public engagement, dialogic processes and forms of participation such as citizen science co-design [13,21–23].

Decentralized visions of the energy future are emerging, as the energy transition opens up new spaces for citizen participation and engagement [24]. Nowadays, citizens' engagement with the sustainable energy transition is high on the agenda in the EU. Constructs such as community energy, social innovation, energy justice and decentralized energy production are at the center of research and policy reports [15,25]. Yet policy certainty at the national level and social interactions at the local level need a new approach in the policy design [26]. According to Eurostat data from 2018, European citizens are the second key consumers within today's energy market, having a share of 26.1% of final energy consumption. Due to the importance of the individuals within the energy market, our paper places its attention upon energy cooperatives that incorporate dwellers into common renewable energy investment projects.

European legislation recognizes two kinds of energy communities (EC), citizen energy communities (CEC) (According to Directive (EU) 2019/944 **'citizens energy community'** means a legal entity that (a) is based on voluntary and open participation and is effectively controlled by members or shareholders that are natural persons, local authorities, including municipalities, or small enterprises; (b) has for its primary purpose to provide environmental, economic or social community benefits to its members or shareholders or to the local areas where it operates rather than to generate financial profits; and (c) may engage in generation, including from renewable sources, distribution, supply, consumption, aggregation, energy storage, energy efficiency services or charging services for electric vehicles or provide other energy services to its members or shareholders;) and renewable energy communities (REC) (According to Directive (EU) 2018/2001 **'renewable energy community'** means a legal entity (a) which, in accordance with the applicable national law, is based on open and voluntary participation, is autonomous, and is effectively controlled by shareholders or members that are located in the proximity of the renewable energy projects that are owned and developed by that legal entity; (b) the shareholders or members of which are natural persons, SMEs or local authorities, including municipalities; (c) the primary purpose of which is to provide environmental, economic or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits). Renewable Energy Directive (EU) 2018/2001 describes renewable energy communities, while Internal Electricity Market Directive (EU) 2019/944 recognizes citizen energy communities as new types of non-commercial entities: Despite their engagement in an economic activity, their primary purpose is to provide environmental or social community benefits rather than prioritize profit-making [27]. It should be added that energy communities can be any form of legal entity.

ECs have vast potential to scale up Renewable Energy projects and simultaneously to generate growing amounts of clean energy [28]. ECs have demonstrated the capacity to be resilient social structures that apply collective solutions and adapt to local conditions so as to catalyze energy transition processes [29]. Local conditions are strongly differentiated in the legal, awareness, economic and financial scopes. The level of utilization of renewable energy, however, differs locally. An average EU household uses 20% renewables [30]. Some member states like Sweden (56.4%), Finland (43.1%), Denmark (37.2%) and Austria (33.6%), however, obtain significantly higher shares of energy from renewable sources. In contrast, others like the Netherlands (8.8%), Belgium (9.9%), Poland (12.2%) and Hungary (12.6%) have significantly lower shares of Renewable Energy [31].

In light of the aforementioned facts, it is valuable to conduct an analysis with regard to Poland's case, where the progress of energy transformation is not satisfactory and where due to regulatory barriers, the development of ECs has been stopped. In recent years, local governments and enterprises created approximately 34 [32] REC (in the form of energy clusters). Citizens were not invited to these communities despite the fact the legal rules

offer such a possibility. Although there is a lack of CECs in Poland (only one exists in a rural area) due to unfavorable legal regulations, the concept can be applied through housing cooperatives producing clean energy [33]. A similar legal framework prevents communities from being established in the Czech Republic and Hungary [34].

Approximately 16 million (M) of Poland's inhabitants live in various types of housing communities (approximately 40% of its total population). Hence, nowadays, a rapid growth of citizen-based energy projects is potentially possible by mobilizing housing communities into the process. Unfortunately, there are few good practices to be seen. Therefore, to identify the way forward, it is crucial to recognize key factors in the implementation of RE projects in Poland's housing communities. Enacting RE technologies in housing communities is not only a technological challenge, but also a social challenge and requires the approval of residents.

Due to the fact that in Poland, establishing CECs in the cities is not allowed, the key success factor of energy transformation is to engage housing cooperatives and other housing communities in this process. These organizations, acting as prosumers, can realize RE projects and, albeit, only in a limited way, fulfil their energy needs.

The research problem of this paper is to identify determinants of the co-creation process in RE project activation at the housing cooperative level. The aim of the paper is to identify key conditions that housing cooperatives should establish in order to successfully undertake RE project implementation using a co-creation approach. The research will be conducted based on the case study of the photovoltaic farm put in place by Housing Cooperative Wroclaw South. It is a pioneering (first in Poland) initiative in large-scale innovative photovoltaic project investment (30,000 inhabitants).

In the process of identification, we primarily observed key success factors, but barriers to this process were also identified. The practical implication of the research is to provide recommendations for policymakers and managers of RE projects. Moreover, the structure of the paper is intended to support realization of the aim of the paper, thus it is formulated based on the DART model. This provides a framework for conducting the analysis.

The initial part of the paper provides a theoretical background and defines the notion of co-creation. Selected aspects of co-creation implementation in energy and housing cooperatives (CEC) are then analyzed in the second part of the paper. The third part discusses elements of the DART model, while the fourth part presents the methodology of the research and its limitations. The fifth part provides results of our qualitative research findings and follows this up with a discussion. Conclusions and recommendations are presented in the last part of the paper.

2. The Theoretical Framework

2.1. Co-Creation—From Business to Social Innovations in Public Sector

More than four decades ago, Elinor Ostrom and his fellow economists studied the collaboration between public departments and the local citizenry. These researchers (for the first time) discussed the idea that successful co-production of public services requires the participation of citizens. The first work on co-production entered the public domain in the 1970s [35–38]. However, the potential for application of this idea was not fully explored back then. Due to changes in technology and culture, it is now possible to make the phenomenon flourish and real.

In today's world, the value of co-creation has been noticed by many companies operating in several fields, but the basis was provided by the model outlined by Tannenbaum and Schmidt in 1957. This model illustrated the evolution of the strictly autocratic leadership and decision-making style (where the leader is the only one talking) in the direction of the participatory (i.e., the polar approach). The strictly autocratic approach is concentrated on the decision-maker and provides the opportunity to make rapid decisions. In complex situations, however, where strategic decisions have to be made, there is a higher risk of lack of acceptance of changes by internal and external stakeholders when such an approach is applied. A polar approach is one wherein the leader steps aside, and designated team

members identify problems, search for solutions and make decisions (group decision-making). This approach is oriented towards employee participation and gives broader decisive freedom [39].

In the last two decades, co-creation has emerged as a promising new value-added approach in commercial business. This has only recently been introduced to other sectors, including the public [40]. For many years, especially in the management field, except for co-production in the public sector, the concept of citizen inclusion into the shaping of local policies in the form of social consultations, social participation and partnerships in the implementation of projects has been evolving. Co-creation is the next, more advanced step towards the decentralization and boosting of innovation within public projects e.g., public participation is one of the impactful factors for the implementation of the smart cities concept [41]. Indeed, the need for the integration and institutionalization of collective deliberation through processes of dialogue, engagement and debate, inviting and listening to wider perspectives from public and diverse stakeholders has been recognized in the EU's innovation policy [42].

2.2. Definition of Co-Creation

Prahalad and Ramaswamy [43] claim that the role of the consumer can change from isolation to connection; from being unaware to being informed; from passive acceptance to active involvement. They called the new approach "business value co-creation" [44]. This co-creation engages customers (end users, e-customers, global customers, customer communities and non-customers) and their knowledge on how products/services can be harnessed to generate new values [45]. Table 1 presents a review of co-creation definitions provided by various authors within the last 30 years. It can be noticed that the term has evolved from merely mentioning the participation of end users (consumers, clients, employees) in a business context to one that describes the seeking of active cooperation of inhabitants and citizenry in various projects (social, technological, energy, etc.). According to some researchers, this evolution can also be seen with respect to the entities that employ co-creation: Initially, private companies, then non-governmental organizations (NGOs), subsequently, hybrid organizations and finally, the public sector.

Still, while some authors claim that the phenomena of co-creation appeared initially in business and concerned a co-creation with end users that influenced the growth of business competitiveness [46,47], others, such as Ostrom [35] indicate that the new context from co-production to co-creation first appeared as the involvement of citizens in public service delivery (Ostrom 1996 and her other later works). All authors, however, unanimously underline the importance of civic participation and involvement [48] and bring to light the notion that the key benefit in applying co-creation is the democratization and enhanced legitimacy of the decision-making process [49].

An analysis of definitions shows that common keywords exist: Cooperation, communication, actor involvement, exchange, doing something together and democratization. These capture the co-creation paradigm. The aforementioned definitions emphasize the active involvement of citizens and stakeholders [3], the sense of empowerment and citizenship, the building of trust between stakeholders and communities, the sharing of power and responsibility, improvements in the social legitimacy of decision-making and the deliverance of solutions in a timely and efficient way. Moreover, consumers, employees and citizens play various roles in the co-creation process. These include co-initiator—the citizen is represented as the initiator and local government as the enactor; and co-designer, where citizens and local government co-create projects, policies and plans that are enabled by local government—here, citizens directly participate in designing how (public) services are to be delivered to them and take on the roles of co-implementer, co-producer, co-beneficiary or/and co-evaluator.

Table 1. Co-creation definitions.

Authors	Definition of Co-Creation
Ostrom (1978)	Public services are "co-produced" by both paid and unpaid labor
Von Hippel (1987)	The co-creation is the participation of end-users
Nonaka and Takeuchi (1995)	Encouraging staff to put forward their ideas without hesitation and to develop the business with great enthusiasm; encouraging communication and collaboration between individuals with diverse backgrounds-as individuals with more diversity challenge the existing behaviors and beliefs that actually hinder future development
Ostrom (1996)	Co-creation is the involvement of citizens in the process (design, production or delivery) of public service delivery
Prahalad and Ramaswamy (2004)	Joint creation of value by the company and the customer; allowing the customer to co-construct the service experience to suit their context
Prahalad and Ramaswamy (2004); Vargo and Lusch 2004	The co-creation is the active involvement of *end-users* in various stages of the design, production, deployment and testing of public services or goods and processes
Bekkers (2007)	Co-creation is a sense-making 'myth' or 'ceremony' in order to achieve political legitimacy and thus stress the importance of citizen participation as a relevant process that can be used as a strategy to be applied to address issues of a possible democratic deficit
Yong Nie, Kunio Shirahada & Michitaka Kosaka (2013)	The co-creating process is a value creation, where the enterprise works in cooperation with all the stakeholders, especially the customers
Voorberg W.H., Bekkers V. J. J. M & Tummers L. G. (2015)	'Co-creation' is an involvement of citizens in the (co)-initiator or co-design level. 'Co-creation' indicates the decision-making or policy-making processes with involvement of citizens as (co-)initiators or co-designers. Co-production is considered as the involvement of citizens in the (co-)implementation of public services
Venkat Ramaswamy, Kerimcan Ozcan, (2018)	Co-creation is enactment of interactional creation across interactive system-environments (afforded by interactive platforms), entailing agency engagements and structuring organizations
Scalings (2018)	Co-creation is an umbrella term that captures a variety of activities where different innovation actors gather in a joint activity to achieve mutually beneficial outcomes
Selvakkumaran S., Ahlgren E.O., (2018)	Co-creating—doing something together with another person or entity. The co-creation that they arrived at is that co-creation is where creation of a solution happens with the citizen/or end-user being considered as a valuable partner in product or service delivery
J. Torfing, E. Sørensen, A. Røiseland, (2019)	Co-creation in the public sector is a process through which two or more public and private actors attempt to solve a shared problem, challenge, or task through a constructive exchange of different kinds of knowledge, resources, competences, and ideas that enhance the production of public value in terms of visions, plans, policies, strategies, regulatory frameworks or services
Itten A. et al., (2020)	Co-creation is an intervention which actively involves citizens and stakeholders in making decisions about issues that affect them. Co-creation is working together in equal, reciprocal and caring relationships to create a more holistic understanding of context and exploring shared responsibilities for energy transitions
Gjørtler Elkjær L, Horst M., Nyborg S., (2021)	Co-creation in energy transition-the coming together of actors across organizational boundaries to create mutually beneficial outcomes

Source: Own work.

2.3. Co-Creation in Cooperatives and Communities

Depending on the type of organization, the process of co-creation is realized by different stakeholders with diverse interests, motivations and value systems, as well as differential organizational levels and levels of co-creation engagement (Table 2). The type of organization, its openness to the environment and specificity of stakeholders determine the aims and tasks realized in the co-creation process and also the possibilities of initiation of this process (bottom up, top down). In the case of private enterprise, co-creation is aimed at creating innovative solutions that are valuable for the users to such an extent that they become a driver towards building competitive advantage and new sources of value creation [50].

Table 2. Co-creation in different organizations.

Type of Organization	Key Stakeholders for Co-Creation Process	Co-Creation Task
For profit (enterprises)	clients, employers (staff)	Business innovation, blue ocean market creation, value creation
Hybrid organizations (energy communities, housing communities)	clients–community members, other clients, employers (staff), solution suppliers, executives	Social innovation, social transformation, improvement of quality of life, decrease costs, limit externalities in environment (air, water, land pollution, CO_2 emission)
Non-profit organizations	Participants, volunteers, employers	Solidarity, égalité, social transformation, improvement of quality of life,
Public organizations (municipal offices, schools, universities)	Clients, participants, inhabitants, students	Improvement of quality of life, city logistic, public service, development

Source: Own work.

The co-creation process is run in a different way in organizations from the public sector. In the last 40 years, this sector has adopted many concepts from business management that strive for efficiency improvement. Among these are Total Quality Management, Six Sigma and Lean Management. According to Gouillart and Hallett (2015), organizational leaders, in order to increase the efficiency and efficacy of their tasks, should focus on the process of engaging people and opening their value chain to their stakeholders. Co-creation, in contrast to ordinary public participation, involves spending time and resources to willingly enable local citizenry to participate in the redistribution of resources and to designing processes to improve the effectiveness of public service delivery [51]. In the case of public sector organizations, co-creation is being employed to better utilize resources and to manage public funds in a way that is more aligned with citizen's needs (e.g., civil budgets). Implementing co-creation, however, generates a plethora of challenges. Public organizations are usually large entities, where managers are used to top-down management. Therefore, few directors are ready to apply a new model that is based on the bottom-up engagement of employees, clients, citizens and other stakeholders. An additional barrier is posed by legal regulations that make the changes difficult [40].

In our paper, we focus on Poland's housing cooperatives. These can be tagged as hybrid organizations. They are private organizations that have a defined ownership structure, they function similarly to typical companies, but at the same time their activities are not for profit. Furthermore, they combine selected characteristics of companies and public organizations, therefore they face similar limitations in implementing co-creation. At the same time, they have specific features that make them predisposed to introducing the co-creation approach. This results from the fact that in cooperatives, key customers are the members of the cooperative (that is, the combination of customer and owner). In addition, the legal regulations of cooperative law are more egalitarian, democratic and inclusive than in the case of that of other legally recognized entities intended to generate profit.

In housing cooperatives, energy co-creation can have various forms depending on the number of inhabitants and the professionalization, as well as knowledge of management.

Based on the case studies analyzed in the Scalings project, in cooperatives with relatively small numbers of inhabitants, the scale of operations is too small to hire a professional management team. Therefore, in such organizations, as in the case study of The Energy Collective Svalin in Denmark (a small community with 20 families) and Nautilus at Zeeburgereiland in Amsterdam (43 families), a bottom-up and co-creative approach is rather natural. The key tasks of the designated management team are to put forward jointly accepted solutions, justly divide costs and benefits, as well as evenly distribute risk and responsibilities among community members.

For larger communities, where the number of inhabitants reaches several hundreds of thousands—such as in case of Bürgerwerke, a macro-level coalition of over 15,000 individual citizens organized in 92 local energy cooperatives across Germany, or large housing cooperatives in Poland that potentially could conduct RE projects—professionalization of management is indispensable. Along with the employment of professional management, all the decisive entitlements are transferred, and community members regain the time they would have to sacrifice for the community's good. Therefore, the co-creation model that can be applied in big cooperatives is both top-down and bottom-up. In such entities, the professional management team should act in the best interest and for the good of the community. Hence, a co-creation approach could be used depending on the applied management and leadership style, and despite the type of organization, co-creation transforms citizens from passive consumers of green products or services into active sustainability value co-creators through behavioral change [52].

Qualitative change connected with co-creation, in comparison to traditional management systems, is related to citizen and customer empowerment. These individuals contribute lay or local knowledge to a process of change, which is alongside, but not of lower status, to expert knowledge. Such input is required so as to truly implement energy transitions [52]. To enable co-creation, one has to create and put in place an institutional setup and communication infrastructure, along with a process that involves parties having input at equal levels [53]. Thus, public authorities, managers and decision-makers are not leaders, rather they are brokers or advisers who use their competencies and their network in leveraging citizen initiatives, or offering public spaces and infrastructure to be used by citizens, social entrepreneurs, artists and other actors of urban change [3]. The co-creation process is, hence, connected with participative leadership [54] and with the participative decision-making [55] transformation of the public sector [56].

2.4. DART—Co-Creation Dimensions

Prahalad and Ramaswamy posit value co-creation as the new outline of competitive advantage. The researchers state "the meaning of value and the process of value creation are rapidly shifting from a product and firm centric view to personalized consumer experiences" [47]. The authors introduced a four-dimensional conceptualization of value co-creation that reflects the building blocks necessary to feed value to a product, service or process. The DART model they proposed is a key concept in the understanding and analysis of co-creation. In the DART model, the authors put forward elements that represent dialogue, access, risk assessment and transparency, the intent being to disarm the conventional information and power asymmetry between customers and organizations (Table 3). It could be said, then, that the DART model applies the concept of value co-creation in the business field.

Studies emphasize that dialogue is a better form than one-way top-down communication. In the scope of value co-creation, it is better understood as two-way constructive interactivity, deep engagement and propensity to act rather than a simple exchange of information [57]. Herein:

- Access refers to customers being allowed to offer experience and information via tools and means of communication, infrastructure and organizational culture.
- Risk assessment assumes consideration and informed consent of stakeholders to a certain level of risk in relation to benefits.

- Transparency represents clarity motivations and goals, lack of information asymmetry and an open communication model.

Table 3. DART dimensions.

Constructs	Measurement Items
Dialogue	HCW has demonstrated a pioneering approach to participatory practices, exceeding the legally required obligations and habits/customs of Polish housing co-operatives.
Access	From passive to active. The project involved local activists, informal opinion leaders, who mobilized residents (including seniors) to support the project. Traditional means of communication, as well as new media and e-services were used.
Risk/Benefit	The dialogue included doubts and concerns about project risks. Common values and principles were developed which were used in the implementation of the project-minimizing financial and technical risks and ensuring the security of the technical solutions used in the project.
Transparency	Wide access to information, an atmosphere of trust and recognition of community concerns as important, risk mitigation and mutual interaction of entities facilitated the symmetry in relations.

Source: Own research.

The DART model has been developed for the corporate environment and it is mainly used in it. It has not been introduced into the field of energy cooperatives extensively. This situation might have resulted from the fact that energy cooperatives are bottom-up initiatives by their nature, where organizational limitations do not exist. The DART model can, however, be easily applied in organizations (such as housing cooperatives) where the top-down co-creation approach is applied, and where infrastructure and culture are opened to stakeholder initiatives (bottom-up). The DART model will be applied in this paper, as it will set the framework of the conducted analysis.

3. Co-Creation in Energy Transformation Projects

The involvement of citizens, stakeholders and other actors in the creation of products and services is one of the major topics in current public administration and management research. Regarding civil co-creation, academics from various backgrounds have collaborated in national and international scientific networks in conducting research in this field. There are also studies tackling bottom-up, prosumer energy projects based on participatory public management models, collaborative governance, social innovation and grassroot innovation [58].

In recent years, there has been growing interest in researching the co-creation process in energy projects. Selected application studies are related to the act of implementing the co-creation process in energy transformation and they draw attention to co-creation success factors. One of the studies deals with solar photovoltaics in Sweden. Here, the authors "explore the co-creation in the context of local energy transitions, using a model" [4]. They argue that often the term "co-creation" is not used in energy transition projects, but many local energy transitions are indeed co-created. The factors of success are the active participation of actors and the ownership of the co-creation process. Furthermore, the key to success lies in the judicious choice of the actors filling the spaces and places in co-creation—especially in different urban projects.

Another interesting study wherein co-creation is described is sustainable district heating in the project SHIFFT/Interreg in four European countries: The Netherlands, France, Belgium and The United Kingdom [3]. The partners in the project decided to use the bottom-up co-creation concept, in contrast to traditional policy-making processes. In this project, it was found that successful co-creation is based on engagement and empowerment of local communities as this allows them to co-design or even co-decide the planning and implementation of sustainable heating strategies.

Another related study, entitled "Transforming the Public Sector Into an Arena for Co-Creation" focused on co-creation being perceived as a new public administration paradigm [56]. The paper indicates that the public sector is currently being transformed from a legal authority and a service provider to an arena of co-creation. In the work, the authors use examples of cases in different locations to show that co-creation replaces public service monopolies and public–private competition with multi-actor collaboration. Moreover, in so doing, it transforms the entire perception of the public sector. According to the authors, co-creation can be seen as "self-government of the people" and at the same time needs new institutional design and new forms of public leadership adequate to the bottom-up co-creation process (distributed leadership, horizontal leadership, integrative leadership) [56].

In German studies about co-creation in mobility and renewable energy projects, the researchers draw attention to one practical application of co-creation that is commonly exercised in German—the so-called "mini-publics". This term covers randomly selected samples of citizens who then participate in decision-making processes. The study underlines that mini-publics increase and accelerate the legitimacy of public decision [5]. In each case, these have led to the establishment of new social configurations: The iterative process of government and civil society working together to generate material responses to the interest constellations rooted in civil society. Hence, new energy cooperatives, municipal utilities, farmers or private individuals have contributed to the democratization of energy supply.

It can be said, hence, that society–policy collaboration can be supported by the co-creation concept, where "normal" citizens who do not represent any organized interest are able to provide highly valuable insights into possible and desirable options for action. Researchers, therefore, stress the following transformational effects of co-creation:

- Co-creation can contribute to the "displacement" of corporatist collaboration by shifting the focus towards civic constituencies (mini-public, citizens' councils).
- Co-creative processes capture the attention of diverse fractions of society, and create transparency, facilitate the emergence of mutual trust among the different actors involved, the co-creative process and enable civic perspectives to be incorporated.

Based on the above cases, the following factors of success can be identified: The importance of citizen participation and collaboration (human capital), the relevance of social engagement, that public authorities and leadership must take on new roles, that decision-making must be democratized, communication and dialogue must be emphasized and transparency and trust must be established.

4. Methodology of the Research

4.1. Research Questions

Taking into account the presented theoretical framework, the following research questions were identified. They were developed in correspondence with the research problem, which concerns the key conditions of co-creation in the process of RE project implementation in Poland. This is built upon the example of the Housing Cooperative Wroclaw South. The research questions encompass:

1. To what extent, if any, does the Wroclaw Solar Power Plant project at HCWS constitute a co-creation project? If so, which of the implementation stages and project areas were most affected?
2. To what extent, if any, does the implementation of the project Wroclaw Solar Power Plant HCWS fit into the elements/dimensions of the DART model?
3. Are there any other important dimensions (stimulators and inhibitors) of the co-creation process that had influence upon the implementation of the project Wroclaw Solar Power Plant HCWS?

4.2. Research Methods and Procedure

The study has been carried out using quantitative and qualitative research methods. The applied triangulation of research methods [59] allowed for obtaining more comprehensive and reliable results. Moreover, the results were more comprehensively analyzed and could be compared and combined. Thus, it became possible to determine the relationship between the assessed phenomena and their determinants.

By means of the application of quantitative research, objective criteria for describing the phenomena were obtained, while the qualitative approach allowed data interpretation to relate to subjective criteria for description [60]. The quantitative research was carried out using the Computer-Assisted Telephone Interview (CATI) technique [61]. In total, 30 completed questionnaires were collected. The qualitative research included in-depth interviews and the analysis of desk research materials-publications and press interviews presented in local media and other publications. The analysis used transcriptions from 10 conducted Individual In-Depth Interviews (IDIs) and news materials, the content of which addressed issues related to the project. The sourced press materials were published between 2017 and 2020.

We also employed the desk research method. During the indicated period, more than 100 publications were released into public media. The keyword "Wroclaw solar power plant" generated ca. 202,000 results in the Google search engine. Furthermore, the analysis included notes from two group meetings of local residents with representatives of the cooperative. Additionally, materials describing the project, including brochures, etc., were assessed in a qualitative analysis. Table 4 provides a summary of the research methods used in the study.

Table 4. An overview of the data collection methods in this study.

Data Types	Qualitative	Quantitative
Primary	10 interviews Discussions	30 CATI (Computer Assisted Telephone Interviews)
Secondary	Project descriptions-brochures and other HCWS material Media publications	

Source: Own research.

All the methods employed, as indicated in the table above, constitute a case study on the HCWS. The presented case study comes under the category of relevant case studies, which results from the fact that the subject of analysis is unique. It is the first initiative of this kind in Poland and thus it is interesting in itself and worth a detailed analysis. The analysis also has a slightly broader ambition, going beyond this particular project and thus referring to other more general phenomena, such as co-creation. From this perspective, the case study provides an instrument for explaining a broader theory (the process of co-creation), which is characteristic of an instrumental case study. This makes the case study somewhat "mixed" in nature [62].

The individual activities undertaken in the project, the statements of the respondents obtained during the in-depth interviews and other qualitative research materials were assigned to the four criteria of the DART model—Dialogue, Access, Risk and Transparency (presented in the theoretical part of this article). Activities that relate to these factors were identified as success factors in the co-creation process. In addition, analysis of the qualitative materials identified further dimensions that are also relevant to the co-creation process and its success.

The in-depth qualitative analysis (qualitative interviews, desk research of press materials) and the subsequent quantitative analysis (CATI survey) revealed that social capital and the related motivation and leadership are among the factors generating success in the co-creation process.

These analyses were also complemented by the identification of barriers present in the co-creation process concerning the social environment in which the Wroclaw Solar Power Plant project was implemented, and which were identified on the basis of the field research.

Qualitative data assessment was conducted using the NVivo program. According to the methodology of qualitative research analysis, a coding key was created that corresponded to the structure of the research questions, and then the analysis of available data was carried out. In the following part of the article, the most important results are presented.

4.3. Case Study of Housing Cooperative Wroclaw South

Housing Cooperative Wroclaw South (HCWS) is one of the largest housing cooperatives in Wroclaw—the fourth largest city in Poland. HCWS operates on the basis of Polish Housing Cooperatives Act. The history of HCWS dates back to 1946 when the Wroclaw Housing Cooperative was established as the main housing cooperative in the city. After 1989, the Wroclaw Housing Cooperative was divided into five smaller entity-housing co-ops, including HCWS—which manages 102 buildings and almost 11,000 apartments with approximately 30,000 homeowners. In 2018, the HCWS initiated the Wroclaw Solar Power Plant (WSPP) project, which is currently the largest rooftop photovoltaic system in Poland. The solar power plant was developed by inhabitants' engagement. A total of 2771 solar panels were installed on the rooftops of 35 buildings. The plant generates almost 0.75 MW of electricity, and its solar panels cover a roofed area of 0.5 hectares. The production of electricity saves 614 tons of CO_2 emissions per year. HCWS, like other housing cooperatives in Wroclaw, Lower Silesia and other regions of Poland, and large and medium-sized cities in Central European countries such as the Czech Republic, Slovakia, Hungary, Lithuania, Latvia, Estonia, Bulgaria and Romania is characterized by large-scale activities (thousands of members), professional management and organization, compact development of multi-family buildings, access to technical infrastructure and a significant percentage of people in retirement age. HCWS is distinguished by consistent activities undertaken for many years in the field of reducing operating costs, such as insulation of buildings improvement, heat management in buildings and heating nodes. After exhausting the possibilities for further improvements in the above-mentioned areas, HCWS concluded that new opportunities to reduce the operating costs of residents could be found in the field of renewable energy sources technologies. Hence, both the elements of the co-creational approach as well as the results obtained by HCWS may be a good benchmark for other cooperatives in the Central European region (taking into account the situated nature of legislative solutions). The dissemination workshops carried out in March 2021 as part of the Scalings research project, in which 120 representatives of housing cooperatives from various parts of Poland participated, confirmed the interest of housing cooperatives in the implementation of renewable and sustainable projects with the co-creation approach.

4.4. Research Participants

In the quantitative CATI research undertaken as part of this study, the respondents were people linked to the Housing Cooperative Wroclaw South (mostly end-users) and were both its members (60% of respondents) and staff (20%). Among the respondents, more than 80% have at least secondary education, and almost ⅔ are men. As a result, the profile of the respondent is very specific, and thus significantly differs from the national or Wroclaw average, or even from the profile of an average resident of the HCWS. The selection of the sample for the survey was therefore not representative (representativeness), but purposeful (also due to the size of the sample).

The respondents constitute a group of active citizens, the so-called "well-informed citizen" (Schutz 1946), which means that more than ¾ had intentionally come into contact with information about the Wroclaw South Solar Power Plant project. Moreover, as many as 17% of all the respondents were directly involved in the project. Among the forms of involvement indicated by the respondents, mainly those of a formal nature dominated.

These result from the standard rules of operation of housing cooperatives: (i) Participating in voting during meetings; (ii) participating in voting during the general meeting of cooperative members; (iii) actively participating in discussions about the project; (iv) promoting or sharing concerns with other residents; and (v) submitting ideas for modifying the project. As a result of the above, the results of the quantitative survey constitute important, although only supplementary, data in relation to the qualitative and desk research analyses.

The qualitative research consisted of interviews with 10 people who represented typical residential members of the cooperative (7 people), or staff of the cooperative (2 people), and included one person who represented the Provincial Fund for Environmental Protection and Water Management in Wroclaw, the institution that financed the project.

5. Results

Regarding DART and co-creation in the example of Wroclaw Solar Power Plant of Housing Cooperative Wroclaw South, the activities undertaken during the project and the results of the qualitative research were analyzed from the perspective of the building blocks of the DART model. Table 5 presents a summary of the various constructs of the model, with the activities and actions carried out by the main actors involved in the project—residents of the affected buildings, cooperative members and the board of directors assigned to the various DART categories.

The study was developed as a result of a first preliminary case study based on the cooperative's documents, interviews with management and participant observations. The elements of the project preparation and execution procedure were then assigned to the different segments of the DART model. The analysis was further enriched with the results from the primary research, which has enabled the researchers to present a complete picture of the HCWS co-creation process and to identify the real role of the individual elements of the DART model in this.

In the remainder of this article, we present detailed analyses of each element of DART (Dialogue, Access, Risk/Benefit, Transparency).

5.1. Dialogue

It should be emphasized that the Management Board has done much more than is required by the Cooperative Act for participatory practices. The first step was to gather an initiative group among active residents and conduct a series of consultation meetings with them, during which numerous aspects of the project were discussed, including that which was more pressing: Technical and financial. This is an activity not typically employed in the activities of housing cooperatives in Poland. In addition, the residents of the initiative group themselves undertook actions aimed at activating other people (Table 5). For example, they actively sought information about the project and inquired about it among members of the Supervisory Board or other informed people. Moreover, people from the initiative group conducted conversations and individual meetings with their neighbors. The Management Board, in contrast, pursued an active information policy—sending information about the project and individual invitations to meetings and project information sessions. Therefore, it can be stated that not only the Management Board, but also the residents themselves wanted to increase interest in the project and have an impact on its implementation.

External groups were also involved in the dialogue. A technical dialogue was conducted with the main contractor and relations based on open dialogue and communication were established with the project financing institution. Due to the nature of the project, the public was informed during its implementation, but were not consulted directly.

Table 5. Juxtaposition of the DART model elements with activities and actions implemented as part of the project.

Constructs	Measurement Items
Dialogue	Use diversified communication channels to have dialogue sessions with residents: • meetings in buildings • notice boards in buildings • correspondence sent to residents. Conduct frequent dialogue sessions with consumers (residents, community members, other stakeholders): • meetings with community leaders • 35 meetings with residents, community members • 1 general meeting with community members • dissemination meetings. Most pressing issues that were the subject of dialogue with inhabitants: • technical issues • safety • financing mechanisms • consent/consensus. Stakeholders included in the dialogue: Internal: • residents • management team • administration. External: • contractor (PV) • Voivodeship Environmental Protection Fund • NGO (passive role) • municipal representative (passive role) • community members from other housing cooperatives (passive role).
Access	Diversified communication channels: • meetings, in particular, buildings/general meetings • notice boards in buildings • correspondence sent to residents • I-mieszkaniec website • HCW website • local newspaper for cooperative members-Gazeta Południowa • Open entry for willing participants • Encouragement for joining the process.
Risk/Benefit	Financial risk • liquidity risk • personal risk Technical risk Safety risk Benefits: • Financial • Environmental • Social.
Transparency	Consensus based decision-making. Formal consent of: • Residents of the buildings • Supervisory Board • General Meeting Broadly distributed Information about the project Formal and informal means of communication employed.

The cooperative's formal and legal formula assumes democratic procedures and decision-making in the form of voting. Of course, the mere fact of voting does not constitute fairness in the whole procedure—had support been only slightly above 50%, one could doubt whether such support was too low in relation to the risk. However, the cooperative members demonstrated massive support for the project. At in-building meetings, voting in favor of the initiative was almost 100%, and in Supervisory Board meetings, the vote was 100% in favor, and in the Common Meeting of 2015, the result was 97% in favor. The consensus demonstrated that the dialogue was successful. The quantitative survey has shown that the respondents rated communication in the project highly. This was defined as informing the residents of the cooperative about the project activities (almost three-quarters of all the respondents rated the communication strategy on the part of the cooperative as good or very good). However, it should be emphasized that such activity was perceived by respondents much less well than other elements of the project, among which are: (i) General impression, (ii) achieved results of the project, (ii) way of project management and (iv) way of project tasks implementation.

Overall, in the evaluation of the project (undertaken through interviews with members of the housing cooperative in the qualitative research) with regard to the process of dialogue, communication was rated high. The respondents emphasized the importance of effective and efficient communication between residents and the cooperative administration at each stage of the project. In addition, the residents stated that communication during project implementation strengthened the process of engagement: "Besides, it was the whole decision making process and these talks, this cooperation, that made it worthwhile to carry out such a project".

According to the respondents, the use of simple messages using the "language of benefits" contributed to good communication: "(...) Generally, the communications are just that simple... we rely on our management, when they find out something, to let us know and present us with options". As stated by a resident: "The project is an example for central institutions to follow in terms of implementing flexible, participatory projects, characterized by direct communication with beneficiaries".

The respondents rated the fact that the board held regular meetings as important. These provided a forum for residents to discuss and exchange information: "Anyone can always participate in a meeting. But I think it is crucial, yes. But the most important thing is that the resident is notified and has the opportunity... A chance to express themselves and make decisions. A chance to express themselves, to be heard".

According to several respondents, the direct cooperation between themselves and management contributed to their positive assessment: "The best are the annual meetings. Then a really big group comes. We also elect the authorities. And this is the most direct form of cooperation, expressing one's opinion, satisfaction or dissatisfaction". The use of modern communication tools to inform residents of the cooperative about the project was also important for the positive assessment: "(...) there is a website of the cooperative, where information also appears on this topic. There is also an i-resident application. So there are many channels". Moreover, the respondents assessed the attitude displayed by the president of the cooperative as positive, that he was visible and informed and showed confidence and competence: "From my point of view, it was so that... such trust in the president, so that he knows what he is doing, he knows what he is proposing... that it is well thought out and actually, sort of presented... and the bid and sort of the whole process, because the president presented what contractors he was talking to, why".

Semantic analysis of the words included in the interviews allowed us to create a cloud of the most frequently used phrases that built the Dialogue category (Figure 1). These refer, first of all, to the most important actors involved in it, while at the same time have the status of keywords (residents, cooperative). There are also word categories present that are related to the procedural character of dialogue, such as 'communication', 'conversation', 'meetings', 'online', 'information', 'direct', or to characteristics related mainly to the environment in

which it is realized, 'project', 'application', or values related to it, 'trust', 'cooperation', 'interest'.

Figure 1. Word cloud of phrases that make up the Dialogue category. Source: Own research. The more often a word appears, the larger the font.

The qualitative analysis of the obtained material allows us to conclude that the process of communication between the cooperative's authorities and residents was perceived as a continuous, direct process that was based on cooperation, meetings, conversation, transfer of current information and use of internet communication. The activities undertaken in this area contributed to the residents' interest in the project and strengthened their trust in the organizers. The meaning of the words expressed is in line with the understanding and definition of co-creation in the literature.

5.2. Access

At the general meeting, which de facto decided to implement the project, each resident had (could have had) the same level of impact, the same opportunity to vote in favor or against but did not have the same level of benefit. Had the project failed and, for example, the residents of a given block covered by the project ceased loan payment, the entire HCWS would have been liable.

Various information access channels and communication channels with stakeholders were used in the project. Residents were welcomed at local building meetings, technical specialist meetings and general meetings. The management team encouraged opinion leaders to take an active part in the project. These leaders also made attempts to involve the inhabitants in informal measures (see Table 5).

In the Access area, the CATI quantitative survey confirmed the active involvement in the project of a relatively small group of residents (less than 20% of all respondents). This involved formal activities related to co-determination of the final shape of the project. This manifests itself first of all in taking part in voting at the block residential meetings, in participation in voting at the cooperative general meeting, as well as in active participation in discussions about the project and in promoting/sharing doubts about the project with other residents of the cooperative. The respondents we polled positively evaluated the fact of involvement in the project, which may have had a stimulating effect on the project's co-creation mechanisms. Among the positive effects of resident participation, the respondents most often indicated (i) residential sense of empowerment in the project, (ii) better adjustment of the project to the residents' needs and (iii) shorter time implementation. However, in the opinion of some respondents, it is more difficult to agree on a common position when a large group of people are involved in a project.

In light of the qualitative research, in assessing the area related to accessibility, the importance of participation for residents in the project activities was emphasized, including, in particular, that the decision-making process was transparent: "the form of involving residents in the decision-making process, as well as the course of the project itself, the process was (...) transparent... transparent." The authorities of the cooperative, by taking the initiative in the project, enabled the residents to implement an innovative process to which they had not have access before: "(...) the cooperative came up with an initiative in general, which the government or even at the level of local governments, mayors of cities, in general, rarely think to enter into just such innovations".

Interviews with residents and press materials subjected to semantic analysis indicate the most frequently used phrases that built the Access category (Figure 2). 'Cooperative' is the key word referring to the formal institutional structure within which the project was implemented. Semantic meaning was also built up by words oriented around the local community: 'actors', 'all', and to the activities undertaken: 'want', 'involve', 'process'.

Figure 2. Word cloud of phrases that make up the Access category. Source: Own research. The more often a word appears, the larger the font.

The qualitative analysis of the obtained material allows us to conclude that residents saw the project in the context of accessibility as a process in which the cooperative created conditions for involving a wide group of its participants (actors). The meaning of the words expressed is in line with the understanding and definition of co-creation in the literature. Worth emphasizing is the issue of acceptability of decisions, which is part of the process of improving the social legitimacy of decision-making that Yuge Ma [52] points out in the definition of co-creation.

5.3. Risk

In the HC Wroclaw project, besides the project participants (30% of all the buildings of the cooperative were covered by the project) being at risk, all residents of the Cooperative were at risk, as formally, all residents of the Cooperative bore the same risk, despite not having identical benefits in the project. However, this was a minimal risk. Furthermore, the level of this risk in the project was acceptable for both groups—both the affected building residents and non-affected cooperative members, during the many levels of decision-making in the project, were made aware of the risk and gave their support on the basis of democratic voting.

That the risk was thus unevenly spread (in that it was also incurred by people who did not benefit directly from the project) resulted from the very essence of housing cooperatives and legal regulations in Poland: Non-direct beneficiaries who are part of a cooperative also benefit as a community (Table 5). The benefits of such non-direct beneficiaries include:

- Modernizing cooperative resources.
- Acquiring new knowledge and skills in the organization.
- Environmental benefits.

In terms of finances, there was a liquidity risk for the building's inhabitants, and the start of the project presented a liquidity risk that decreased during the project preparation stage. However, over the life of the project, cash inflows (savings on energy costs) and outflows (loan rate and cost of capital) were balanced. Moreover, although, in order to avoid financial risk, there was the need to secure external funding for the project, several least-cost public sources were available. Therefore, various measures minimized the financial risk for the inhabitants.

Furthermore, as costs were divided among multiple members (the cooperative as a whole), single inhabitants did not experience excessive risk—as the risk of a resident of a given building included in the project was spread across all residents of the cooperative-even those whose buildings were not covered by the project.

In accordance with cooperative housing law, each building is financially settled separately, i.e., the project that is the subject of this case study concerned solar installations in specific buildings that are individually separate settlement entities in the cooperative. All

these buildings, as units, are part of the cooperative, which as an entity is responsible for all its members, so the risk inflicted upon the residents of one building is spread over all members of the cooperative.

Thus, a resident participating in the project bore relatively low risk. The cooperative institution has double security layers—the risk of a single resident is spread among all residents of the building, and then on all members of the cooperative. Members of the cooperative did not risk their own assets, i.e., the flats they occupy, because the loan collateral was established on the common assets of the HCWS. This was another risk-reducing mechanism in the project.

Although photovoltaic technology was perceived as innovative and promising (one of the administrative employees had experience with the technology), there was a technical risk. The rooftop installations presented a risk for the fabric of the building in terms of leakage and also in terms of safety with regard to flying debris in stormy weather. Thus, some residents and administrative staff feared that a heavy windstorm could rip off solar panels from the roof, making it dangerous for foot traffic and parked vehicles around the building. Indeed, first trials showed that the mounting system was not suitable and the plans needed adjustment.

With regard to the area of risk, the respondents indicated that project risks were equally borne (43% of indications) by (i) the management of the cooperative and (ii) all members of the cooperative. However, it should be noted that almost half of the respondents did not perceive the problem of risks at all. Those that did first pointed out that the technical risks associated with the project (e.g., damage to the roofs on which the solar panels were mounted) were high or very high—28% of all indications, followed by financial risks at 17% and risks associated with the occurrence of failures during operation at 11%. In the case of risks associated with investment financing, it is necessary to point out that the respondents accepted only selected methods of financing the investment. Accordingly, the respondents mostly agreed on utilizing "safe" and "cost-free" sources of financing projects involving renewable energy generation. These included (i) non-refundable subsidies (87% of all respondents), the renovation fund of individual buildings, followed by bank loans (52%) and additional contributions from residents (22%). In the case of the latter option, however, most of the respondents were against it—almost three-quarters of them, which made it impossible to apply.

In the materials that were taken into account in the qualitative analysis, a positive assessment of the project residents in terms of risk management is evident: "the cooperative was very flexible and responded to these various risks appropriately". The efficient actions of the management reduced the level of risk and contributed to the benefits: "It was planned in such a way that the instalment of this loan is repaid from the surplus energy production. Therefore, this whole system and this risk is minimized", and as a result, the expectations of the members of the cooperative were met: "We have a good team that just worked on this project and that is why everything was successful".

The semantic analysis of the most frequently occurring words in the interviews indicates the most frequently used phrases that built the Risk category (Figure 3). The dominant word is 'financial', which fits with the residents' greatest concerns about risk in the context of the project. The words 'surplus' and 'energy' refer to the energy efficiency of the project, and the remaining words are in the area of risk management and minimization.

5.4. Transparency

To initiate the project, the Management Board had to obtain the formal consent of the residents of the buildings and two bodies included in the HCWS rules of governance: The Supervisory Board and the General Meeting. The Cooperative Supervisory Board consists of residents who are democratically elected during the General Meeting. All members of the cooperative may participate in the General Meeting, alone or by proxy. At the beginning of the preparatory phase, the Management Board identified people/local leaders in buildings who were then invited to discuss the project. This group naturally

expanded to include active residents. This group talked and debated with representatives of the Management Board and experts. By acquiring information and knowledge about the technology, this group quickly became allies and supporters of the project. These residents conducted grassroots initiatives aimed at gaining the support of other tenants of the building-they provided information and collected signatures under the list of support for the project. At the same time, the Board of Directors conducted an official information campaign by, for example, notifying each resident by mail about the project's goals and objectives.

Figure 3. Word cloud of phrases that make up the Risk category. Source: Own research. The more often a word appears, the larger the font.

It can be stated that this initiative group lobbied among their neighbors for the implementation of the project in a bottom-up manner. One of such steps aimed at obtaining the consent of co-residents for the establishment of the project was to collect signatures on the list of support for the project among all residents of the building (see Table 5).

The residents, therefore, had an impact on whether the project would be implemented. Their official agreement was crucial and was sought and generated through meetings amongst the residents of individual buildings that made up the cooperative. The decision to approve the project go-ahead was made by the voting of those present at such meetings. It should be noted that commonly, block meetings were not very popular. Yet, with regard to this initiative, according to several observers, twice as many people attended the meetings as usual. Overall, voting in individual buildings showed great support for the project. Indeed, in most such votes, decisions were taken unanimously.

After obtaining permission to participate via residential project meetings of the inhabitants of individual buildings, for the purposes of formal and legal correctness of the process, it was necessary to obtain the support of the Supervisory Board for the resolution on the implementation of the project, and then to adopt this resolution at the General Meeting of the entire Cooperative. Therefore, even people who were not directly affected by the project had input on its implementation, because they were part of the Supervisory Board and the General Meeting.

Financial matters were another important issue for residents. The management was made aware that among residents there was a fear of the need to obtain loans on commercial terms in order for this project to go ahead. This was often raised at meetings and conversations. Therefore, the Management Board chose to accept this as a binding project guideline and began to look for preferential sources of project financing.

In the analysis of qualitative materials, transparency appears in relation to two stages of project implementation—the initial implementation stage (basically, preparation for implementation) and the effects stage. It should also be noted that this area is also present in the accessibility factor. As indicated by the residents of this cooperative, transparency was especially evident in the decision-making process: "The form of involving residents in the decision-making process, as well as the course of the project itself, the process was (...) transparent and transparent."

Semantic analysis of the most frequently occurring words indicates that the most frequently used phrases that built the category were words referring to the cooperative as the managing entity (Figure 4). Transparency in this project initiative was implemented on an ongoing basis and was manifested by the inclusion of cooperative residents in the decision-making process. The words: 'application' and 'website' refer to the effects

developed in the project, the verification of which was possible through the energy meter available in the application and on the website.

Figure 4. Word cloud of phrases that make up the Transparency category. Source: Own research. The more often a word appears, the larger the font.

In an analysis of the DART model for cooperatives, we see that although co-creation was not the intended approach used in the project, it became part of it. However, since its application was not planned, not all elements and components of co-creation were properly performed. The analysis of the results obtained indicates that while the process of co-creation was present at all stages, to the highest degree, it concerned the stage of generating the decision to initiate the project. Moreover, the most intensive aspect of co-creation can be seen in the cooperation between the project implementer (the cooperative's authorities) and the residents, and co-creation was most intensive in relation to monitoring project elements.

5.5. Stimulators and Inhibitors of Co-Creation on the Example of Wroclaw Solar Power Plant of the Housing Cooperative Wroclaw South

The analysis of the results indicated that beyond the elements of the DART model, other (indirectly related) dimensions influencing the co-creation process appeared. Qualitative research was the basis for the initial identification of such stimulators and inhibitors. The conclusions of the research were deepened in the next research phase within the framework of quantitative research. It showed that among the respondents, there is a relatively low assessment of the inhabitants' motivation to become involved in project activities (57% of all replies state that the inhabitants were rather and definitely reluctant to get involved in project activities). This confirms that the respondents did not rate the social capital of the cooperative's inhabitants very highly in general, especially in that the main reason for their passive approach to project activities was low interest in the project (62% of all responses), followed by a lack of time to engage in such an initiative (46%).

In this case, participation in the project refers to the bridging capital—the so-called 'bridging social capital' (which is the opposite of bonding capital) that was pointed out by R. Putnam [63]. In this type of social (bridging) capital, exclusive ties are directed outward, linking diversity and allowing the use of external assets and the spread of information. They therefore form exclusive social capital. Herein, exclusive ties are generated in heterogeneous groups, connecting people from different institutionalized structures, e.g., friends, neighbors. The existence of these ties means that people are open to the formation of relationships between diverse social categories, despite the differences in professed values and different life roots. These are emotionally weak ties, but they can play an important role, e.g., in the process of changing life situations [64].

In the case of social capital, the literature distinguishes between social capital and individual capital. The former [65,66] is understood as a network of relationships defined by norms, trust and values and beliefs that facilitate cooperation between individuals and groups. The latter includes an individual's stock of knowledge, qualifications, experience, skills, motivations, psychological resources and physical resources.

Our quantitative study analyzed the individual social capital component related to motivation resulting in involvement (or lack thereof) in the Wroclaw Solar Power

Plant project. As part of the quantitative study, the reasons for project participation were considered on three levels, which, it should be emphasized, interpenetrate each other and thus are not disconnected. These are:

- Motivations of local character (referring to the closest social environment of the respondents—such as the community inhabiting each 10-storey buildings belonging to the Housing Cooperative Wroclaw South where solar panels were installed, or the whole cooperative or the city of Wroclaw) versus motivations of global character (going beyond the local perspective e.g., nationwide or even worldwide);
- Collective motivations (based on the category of public good and public interest) versus individual motivations (referring to one's own particular benefits);
- Financial (tangible) versus non-financial (intangible) motivations.

The quantitative survey showed that mixed local and global motivations dominate among the respondents (see Table 6), as do individual motivations (see Table 7) and those based more on non-financial (intangible) values.

Table 6. Respondent motivation matrix—material–non-material values and local/global values.

	Local	Global
material/financial	• Project benefits related to the use of generated energy for the common parts of 10-storey buildings of the cooperative—100% of all respondent indications • financial benefits (for the cooperative and related to becoming independent from electricity price increases)—13.3% of all respondent indications	
non-material/financial	• reduction of air pollution in Wroclaw)—91% of all respondent indications • benefits from the project for the residents of each 10-storey blocks of flats and all residents of the cooperative)—65% of all respondent indications	• reduction of CO_2 emissions)—91% of all respondent indications • the beneficiaries of the project are the inhabitants of Poland)—57% of all respondent indications, and all people in the world)—35% of all respondent indications.

Source: Own research.

It should be stressed that motivation is one of the key factors influencing the process of co-creation. If the goals of the project (or the messages formulated by the implementers, concerning the adopted goals of the project) are coherent with the expectations of the inhabitants, motivation becomes an important stimulator for the whole project (it can strengthen not only its initiation, but also its efficient course). When the opposite process takes place (e.g., expectations do not coincide or the messages do not emphasize the values and goals that are most important for the inhabitants, even if they actually occur) the lack of motivation will not only not contribute to the inactive participation of the project participants, but it will not ensure even a passive acceptance of the project. Motivation may then become a barrier to its progress. However, in the case of the project of Wroclaw Solar Power Plant of HCWS, the message contained in the frequent and transparent communications of the management of the cooperative, as well as the assumptions of the project coincided to a significant degree with the expectations/values of the majority of residents. This applied, among others, to the ways of using the energy from solar panels within the common parts of the affected 10-storey apartment blocks or the emphasis of the ecological character of the entire project.

Table 7. Respondents' motivation matrix—material/intangible and individual/collective values.

	Individual	Collective
material/financial	• savings on electricity bills)—78% of all respondent indications	• energy project as a catalyst for other projects implemented by the cooperative (natural landscaping, heat pump heating of 4-storey buildings)—65% of all respondent indications
non-material/financial	• positive change in individual attitude towards environmental issues)—environmental protection (air pollution (65% of all respondent indications), climate change (61%), environmental pollution (57%) and implementation of projects using renewable energy sources (57%)	• activation of cooperative residents)—45% of all respondent indications
	• feeling of pride in the project)—65% of all respondent indications	

Source: Own research.

6. Discussion

The case study presented in this paper provided an opportunity to see and analyze the co-creation process, as it enabled insight into the whole process and allowed us to look at the mechanisms related to the described intervention. The study of the Wroclaw Solar Power Plant project that is one of the pioneering projects in the field of energy and eco-creation research. It is worth noting that in this part of Europe, similar projects are not often undertaken due to the lack of appropriate legislation or experience, and, to a large extent, due to the weakness of social capital [67]. The described housing cooperative provided an opportunity to implement a project that, during its duration, turned out to be a co-creation project, although initially, in its assumptions, it did not show such features and ambitions.

Considering the different areas of the DART model it should be noted that the process of co-creation did not affect all areas equally. Co-creation was most visible in the area of dialogue-communication between cooperative authorities and its members, while it was least visible in the area of transparency. At the same time, in characterizing the mechanisms of co-creation, it should be noted that it fits all four dimensions of the DART model. The conducted analyses show that their fulfilment guarantees the efficient and effective course of projects constructed around such an assumption.

On analyzing the context of the project, we can state that it was implemented in a moderately positive social environment. This is evidenced by practically no negative opinions or critical assessments being identified during the field survey (both quantitative and qualitative). This does not mean that some risks that this initiative might have generated were not perceived. These were primarily related, as is evident from the nature of this energy initiative, to concerns about ensuring regular electricity supply to the blocks.

The community of the HCWS, however, showed low civic activity. This testifies to the generally low level of social capital of the residents, which manifested itself in the lack of sufficiently developed exclusive ties formed amongst its heterogeneous groups that normally connect people from different institutionalized structures—such as a neighborhood structure. The existence of these ties means that people are open to the forging of relations between diverse social categories, despite differences in professed values and different life roots. These are emotionally weak ties, yet they can play an important role e.g., in the process of life situation changes [64]. The consequence of this state of affairs is that, to a

large extent, the residents were passive observers or even unaware of the existence of such an initiative. It is estimated that the latter group may include even more than one-quarter of the cooperative's residents. Despite this, successful implementation of a project using co-creation mechanisms proved possible even in such a situation.

In this case, it was guaranteed by a strong and trusted institutional leader (the housing cooperative authorities) supported by a small group of active informal leaders recruited from among the most aware members of the cooperative. They controlled the project to some extent and seeing the sense in the goals and ways of realization, legitimized it by building trust around this initiative.

The above considerations show that the DART model, although it provided a basis and structure for analysis, did not exhaust it. Such an effect especially concerned the social capital identified in the field research, which directly and indirectly influenced the motivations of end-users, as well as the nature of leadership of the project leader. This means that in the case of co-creation projects, it is necessary to take into account the local conditions in which it takes place, hence such initiatives should be run in a community-specific manner.

There is also a very important conclusion for organizations from this research and analysis. In the implementation of co-creation projects, in which the representation of a wide range of people involved plays a supporting role in this process, a participatory management leadership model orientation is necessary. This style then becomes a tool to strengthen social entrepreneurship [68]. However, for this type of leadership, the leader must be mature and wise enough in order for power and responsibility to be shared, and to enable cooperation, as well as to understand the needs of all participants in the process, to build trust and to generate true partnership.

Among the declared motivations for participating in the project, those of individual and financial (savings in electricity bills), intangible (reduction of air pollution in Wroclaw) and local (benefits from the project enjoyed primarily for the occupants of the affected buildings in the cooperative, and secondarily for all members of the cooperative) natures dominated. Certainly, however, the motivations gradually changed among the residents. This was indicated by the results of the quantitative survey, which illustrated in particular the positive growth of the ecological aspects of the project.

Based on the results pertaining to the implemented project, the researchers postulate the inclusion of factors beyond the DART model that further shape the co-creation process. The identified factors—social capital and related motivation and leadership—constitute a significant set of influence factors. In the perspective of further research, we recommend the continuation of analyses aimed at their further identification.

Moreover, one of the important reflections that can be drawn from the conducted research and analysis is that a relatively small group of several percent of engaged residents is needed to make a change and launch a RE project. The analysis of the quantitative research leads to the conclusion that the project (although effectively implemented) took place with a low level of so-called "local citizenship". However, as the literature analysis shows, this is a typical situation and does not constitute a key barrier affecting the success or failure of a given initiative. According to Chenoweth, the involvement of 3.5% of the population is sufficient for social change to become realistically possible (Chenoweth, 2013). Nevertheless, although only a narrow group of residents was involved in the project, project activity for the benefit of the local community was positively evaluated by the respondents, which indicates a favorable perception of co-creation mechanisms (it should be emphasized that although the residents may not have been familiar with the term at all, they identify with the values defining it in the project activities undertaken).

Looking at the broader context of the problem of the energy transformation, we notice opportunities for international comparisons. Despite the rapid development of Energy Cooperatives in Europe, there is no CEC in Poland—regulations in Poland do not create legal possibilities for the development of the civic movement. While REC (energy clusters without citizen participation) is present in the Polish landscape [69], citizens living in Polish

multi-family houses are not subject to systemic incentives from policy actions, and as a result are excluded from the energy transformation process. Hence, in Polish conditions, the policy actions are lacking a mix of monetary and non-monetary incentives to stimulate CEC and finally support the development of a decentralized energy system. Fortunately, there are bottom-up initiatives—social innovations, based on the existing regulations in the field of housing cooperatives, create the actual CEC. Co-creation activities carried out at HCWS resulted in community member acceptance of the project at the level above 90% thanks to the mix of financial and non-financial incentives. Finally, at the local level, these contribute to the development of a decentralized energy system. Hence, these experiences should be transferred to the level of policy actions, where financial and non-financial incentives ought to be co-shaped by officials, experts and citizens.

Many countries have implemented financial incentives to support households to adopt renewable energy technologies [70]. European research showed that about two-thirds of the respondents would be willing to install a photovoltaic system and that the majority of respondents are interested in investing in community energy projects [71]. Preferences for financial incentives varied significantly across citizens. About a third of respondents were sufficiently sensitive to costs and incentives [70]. Younger people and those knowledgeable about renewable energy policies preferred low installation costs and were more likely to install PV independently of incentives. Research indicates that the main motivation for participation in energy communities seems to be concerns about environmental and climate impacts. Simultaneously, the reasons "lower energy costs" and "local income generation" were pointed out by the participants as two of the least important factors [72]. On the other hand, the interviews we have conducted show that for people excluded for economic reasons from the processes of establishing CEC, it is important that the charges for the implemented RE generate savings until the start of the project, and the example of a cooperative shows that such financial engineering is possible.

According to Zander et al., policy actions based on a mix of monetary and non-monetary incentives like income, education, knowledge about renewable energy policies and believing in environmental benefits of solar energy all positively influenced the willingness to install a photovoltaic system while age had a negative effect. In the case of older people, who are the dominant group among HCWS members, financial incentives (multi-year payback period of 8–10 years) are less effective than incentives referring to environmental values, in particular to care for clean air (worries about their kids' and grandchildren's health problems caused by air pollution). This is confirmed by the European Commission research, which shows that in Poland, Malta, Bulgaria and Belgium, clean air is among the most important environmental issues (58–66% in contrast to 46% European average). In other countries such as Germany, the Netherlands and Denmark, climate change is of the greatest importance (56–62% in contrast to 53% European average) [73]. The data indicate that non-monetary incentives should be varied and adjusted to the perception of citizens in particular countries.

The HCWS project as a social innovation, which emerged despite regulatory adversities, met with great interest from both local authorities, other housing cooperatives and policymakers. As a result of consultations with HCWS, new regulations were created, establishing a collective prosumer and a virtual prosumer. It is a good example of how bottom-up social innovations can shape effective policy actions in terms of the incentive mix. Hoffman, Adelf and Meyer [16] draws similar conclusions, indicating that end-user contributions to collective problem solving are an integral part of non-monetary incentives, which fits into a mixed governance model involving 'soft control' and coordination.

The above experiences can be used in other countries of the region, in particular in the Czech Republic and Hungary, where there is a similar housing and legal structure [34].

7. Recommendations and Conclusions

The publication presents the most important recommendations formulated by the authors of the study, which at the same time are a voice in the discussion on the need

for implementation of co-creation power projects in Poland and in other countries of the region. The purpose of developing these recommendations is to point towards the Wroclaw South Solar Power Plant initiative as an example of good practice for such projects. In this context, it is important to note that as many as 87% of all those involved in this case study believe that such projects should definitely be implemented in other housing cooperatives, which means that there is a significant potential for using the experience gained.

Our recommendations refer to four basic areas including DART indicators and additional factors that influence the co-creation process:

In terms of dialogue:

- It is recommended to communicate with tenants on a regular basis, hence ensuring their inclusion in project activities (thus ensuring the participatory character of the project). Such behavior especially concerns local leaders (according to the "3.5% rule"), as their inclusion may turn out to be decisive for the success of the entire undertaking;
- It is recommended that project implementers employ simple messages that so-called end-users understand, as so-doing will allow the realization of the empowerment principle (it guarantees the possibility of all participants joining in with the dialogue—even those individuals or even whole groups characterized by a lower level of social capital). Moreover, such messages should use the language of benefits, which should result in greater interest in joining the process;
- It is worth ensuring effective communication with actors within the project (although communication is assessed highly, it is the most poorly perceived dimension of the Wroclaw project implementation—with regard to the way of informing HCSW residents about the project, 52% of all respondents rated this positively, while as much as 13% rated this negatively);
- Various tools should be used in the dialogue—both traditional (e.g., meetings, assemblies) and modern (e.g., websites, instant messaging).

In the area of access:

- Project implementers (cooperative authorities) should accentuate the positive effects of participation in their communications; respondents indicated in this regard that (i) residential sense of empowerment in the project should be emphasized, (ii) the project should be well matched to perceived and real needs, and (iii) the project implementation should be undertaken rapidly;
- The issue of project acceptability among the so-called end-users should be emphasized.

In terms of transparency:

- It is worth implementing project activities with full transparency to all residents (in particular those who are genuinely involved in such an initiative); transparency should concern both the project initiation stage (in this case study, cooperation of residents with the cooperative) and the monitoring of its effects (in this case study, applications measuring electricity consumed and saved).

In the area of risk assessment:

It is recommended to minimize residents' concerns regarding individual project risks by clearly informing residents that (i) in the field of lack of electricity (78% of residents' concerns), the PV installation is connected to the power grid and does not increase the risk of power failure. In addition, when the system will be expanding with energy storage, this risk will be significantly reduced. Concerning the (ii) safe use of the installation (i.e., solar panels) (63% of residents' concerns), all devices have appropriate safety certificates, including fire safety, and the entire installation is designed and audited by certified specialists and approved by the fire department. Furthermore, residents are informed of the (iii) occurrence of operational failures (61% of residents' concerns) by indicating appropriate human, financial and material resources and the use of professional project management methods such as Agile, Scrum, Critical Path Method, Gantt Chart and Six Sigma, as well as by regular and transparent information on such to all residents of the cooperative, and especially to those deeply involved in the project.

It is recommended to look for the sources of project financing acceptable by the majority of stakeholders—the main concerns regarding financial risks were dismantled by social acceptance for the use of (i) non-refundable subsidies (in this case study, 87% respondent acceptance) and (ii) renovation funds for individual buildings (70% acceptance); optionally, there is the involvement of own funds (70%) (at the optimum level for residents) if this reduces electricity bills.

In terms of social capital:

- It is worth strengthening the awareness among the project implementers (cooperative authorities) about the implementation of projects in a relatively passive social environment (characterized by low social capital) with the involvement of a small group of active residents (who are, however, a guarantee of successful project implementation using co-creation mechanisms).

Within the framework of motivation/motivation (specifying three pairs of dimensions—local versus global, individual versus collective, tangible versus intangible):

- It is worth successively building a sense of empowerment among the stakeholders thus increasing their involvement (in this case study, 17% of all respondents in the context of the project believe that nothing depends on the residents, anyway);
- It is worthwhile for the implementers at the project initiation stage to refer to the benefits and solutions (in this case study, including e.g., use of the energy produced), which are assessed positively and are commonly accepted by the tenants. In the case of the HCWS's Wroclaw Solar Power Plant project, these were the allocation of energy to the common parts of the building, ecological benefits (in particular, reduction of air pollution) and financial benefits (reduction of electricity bills).

In the area of leadership:

- Actions should be implemented by a leader who enjoys high public trust and who strengthens the participation of stakeholders as partners in the decision-making process, by creating an egalitarian space for teamwork, information flow and responsibility. This leadership style contributes to strengthening social relationships, increasing participation and social entrepreneurship.

Apart from the DART recommendation, we formulate policy actions recommendations.

To support the development of a decentralized energy system and to adjust to RED II directive, policy actions based on a mix of monetary and non-monetary incentives ought to be:

- Open for existing and future social innovation in scope of CEC creation.
- Co-shaped by citizens.
- Cafeteria system with the mix of incentives, including different citizens, age, motivations and situation.
- Promoting local success stories (CEC as agents of change).

With regard to the implementation of future research, it is recommended that researchers pay more attention to the barriers and difficulties that accompany the co-creation process in energy projects. More in-depth research could be carried out on financial barriers and co-creation of new solutions by the cooperative.

Future research could focus on creating the necessary conditions for co-creation at each stage of project implementation: Before the project—needs analysis, awareness of long-term goals, initial project assumptions, concerns and risks; project implementation, project communication and management, dialogue, feedback opportunities and project completion and evaluation. In business, online co-creation platforms are used, and in social/public activities, for example, citizen panels and mini-publics can be applied. The research shows that in the case of cooperatives implementing RE projects, there is lack of such co-creation infrastructure and tools.

From the perspective of the utilitarian goals of the article, the authors hope that the included recommendations will be a guideline for all parties involved in the co-creation of energy projects.

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