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Emerging Trends in Social Entrepreneurship and Social Economy

New global challenges such as climate change, inequality, poverty, and globalization are reshaping social entrepreneurship and social economy. Social entrepreneurs are increasingly embracing solution-driven innovations that enhance well-being despite serious global constraints and challenges, which the United Nations (UN) Sustainable Development Goals (SDGs) aim to address. These innovations encompass climate change adaptation and mitigation strategies, including eco-friendly business models that promote renewable energy, climate-smart agriculture, industrialization, and waste recycling techniques. Social entrepreneurs are also adopting digitization and artificial intelligence to improve efficiency, productivity, and global reach.

Additionally, there is growing interest in fields such as decarbonization, circular economy, short food chains, energy cooperatives, and other areas with significant social and environmental impact. Many social enterprises have integrated policy-driven objectives such as "green policy," poverty reduction, and environmental sustainability into their business models, aligning with the SDGs. Emphasis is placed on how social enterprises and social economy contribute to the shift to low-carbon economy and innovations in waste recycling. Other emerging areas include short food chains, local food systems, and digitization.

This edition of the *Social Entrepreneurship Review* explores new and emerging trends in social entrepreneurship and social economy, covering various aspects such as sustainable development, social innovations, decarbonization, and the resilience of social enterprises in the face of crises. Other issues discussed include historical and theoretical perspectives of social entrepreneurship and the role of empathy in designing social innovation.

The issue begins with "Decarbonization Obstacles in the Context of the Photovoltaic Market Development in Poland From the Social (Prosumers') Perspective," which examines the challenges Polish prosumers face in adopting solar energy. The study highlights financial, technical, and legal barriers, emphasizing the need for targeted government subsidies. This article reflects a growing focus on grassroots decarbonization, underlining the importance of local collaboration in promoting renewable energy. The authors suggest further research to better support prosumers in the green energy transition.

Next, "The Role of Empathy in Designing Social Innovation for Blind and Visually Impaired People in Public Transportation in Poland" emphasizes the value of empathy in understanding

user needs and using design thinking to create effective solutions. Through a case study within the Silesian Innovation Space incubator, the research shows that empathy leads to innovations that significantly enhance value. The study calls for more research to deepen the application of empathy in social innovation design.

"Social Enterprises in Poland in the Face of Recent Crises" explores the resilience of Polish social enterprises during the COVID-19 pandemic and the war in Ukraine. Despite facing challenges, a significant percentage of social enterprises provided crucial support to beneficiaries and refugees. The study highlights the need for increased support and policies to empower social enterprises during crises.

Continuing with sustainable development, "Multiscalar Institutional Work of System-Building Sustainable Entrepreneurs in Transitioning Coal Regions: A Case of an Energy Cluster" examines how sustainable entrepreneurs in coal regions can drive energy transitions through innovative practices. Focusing on the Polish energy cluster ZKlaster, the study identifies the key factors that influence the success of sustainable entrepreneurs in shaping transition pathways. It offers insights into the role of embedded agency in regional energy transitions.

Expanding the geographical scope, "Decarbonization Efforts in Africa: Successes, Opportunities, and Challenges for Promoting the Use of Renewable Energy by Social Economy" explores the intersection of decarbonization and social economy in Africa. The study highlights the strategies and challenges faced by African governments and social economy sectors in promoting renewable energy, calling for comprehensive policies and investments to overcome these barriers.

"Investigating the Phenomenon of Social Entrepreneurship" delves into the evolution of social entrepreneurship theory since the 1980s, highlighting the need for a standardized framework. The study emphasizes the importance of understanding social value creation and calls for policies that support both entrepreneurial processes and societal impact.

Finally, two varia documents are included. The first, "Measuring Social Economy in Public Statistics: Introduction to the Polish Experience," discusses the evolution of social economy research in Poland. The author highlights the methodologies used to gather data on nonprofit organizations, cooperatives, and social enterprises, stressing the importance of reliable data for sustainable development and policy-making.

The second document, "Evaluating Evidence-Based Ecosystems-Based Adaptation for Food Security Assembly (EBAFOSA) and Nasarawa State University (NSUK) Initiatives: Decarbonization, Clean Cooking Energy Promotion, and Cassava Food Chain Entrepreneurship in Nigeria," showcases successful initiatives in promoting clean cooking energy and entrepreneurship in Nigeria. It emphasizes the potential for scaling these efforts across Africa, with key recommendations for policy and finance.

As we face unprecedented global challenges, the evolving field of social entrepreneurship and social economy offers innovative pathways to address pressing issues such as climate change, inequality, and sustainable development. The articles in this edition of the *Social Entrepreneurship Review* underscore the critical role of social enterprises in driving decarbonization, fostering resilience in crises, and promoting social innovation. By exploring these emerging trends, we gain valuable insights into how social entrepreneurs can continue to lead the way toward a more equitable and sustainable future. It is essential that we support these efforts with robust policies, targeted investments, and a commitment to scaling solutions that benefit both society and the environment.

As you explore the articles in this edition, we encourage you to reflect on the pivotal role social enterprises play in addressing our world's most pressing challenges. We hope you find the insights as inspiring and thought-provoking as we do. Enjoy your read!

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Decarbonization Obstacles in the Context of the Photovoltaic Market Development in Poland From the Social (Prosumers') Perspective

Izabela Jonek-Kowalska

Abstract: **Background:** Decarbonization of economies is a key development priority of the European Union. As nonrenewable fuels prevail in Poland's energy balance, the country has faced serious problems regarding priority implementation for many years.
Research objectives: Given the said circumstances, the objective of this article is to identify obstacles to using renewable energy sources (solar energy) from the prosumers' perspective.
Research design and methods: During the research, I used the results of surveys conducted on a representative sample of 754 Polish prosumers. The results underwent an analysis based on descriptive statistics and nonparametric statistical tests, including Kruskal-Wallis test and Mann-Whitney U test.
Results: The major obstacles to the development of photovoltaics in Poland from the prosumers' perspective include financial difficulties, mainly the costs of photovoltaic system installation and insufficient state subsidies for such products.
Conclusions: Hence, the state activities aimed at promoting decarbonization must consider extending the financial support for photovoltaics, simplifying the procedures to apply for RES funding, and stabilizing the conditions of transaction cost settlements on the photovoltaic market.
Keywords: decarbonization; photovoltaic market in social research; prosumers' decisions and behavior; renewable energy sources
JEL Codes: E71; E21; F64; G50

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Introduction

Contemporary economies, including but not limited to the European Union ones, must face the challenge of decarbonization. The effectiveness of this process is crucial not only for the quality of life of today's and future generations, but also for the state's economic image and standing internationally.

Decarbonization means the need to reduce greenhouse gas emissions by systematically lowering the consumption of fossil fuels (Galvin, 2020). Therefore, it applies to both industry and households using such energy sources (Businge & Mazzoleni, 2023). Decarbonization

poses a particularly difficult problem for emerging and developing economies, where the use of nonrenewable energy sources still dominates.

Systematic decarbonization is one of the key conditions for sustainable development. Progress in its implementation affects not only the climate, but also, above all, the future societies' quality of life (Liao et al., 2023). For these reasons, striving for a zero-emission economy is important both on a macro scale and at the level of regional and local communities formed by economic entities. Without grassroots social initiatives building understanding and acceptance of the decarbonization idea, effective and quick implementation of decarbonization goals will not be possible.

Currently, the literature is paying increasing attention to the bottom-up approach to promoting decarbonization, emphasizing the role of local communication, partnership, and synergy in the use of renewable energy sources (Rodin & Moser, 2022; van der Horst, 2008). The overall effect of decarbonization depends on the acceptance, attitudes, and behavior of individual energy consumers (Véliz et al., 2023), which decision makers often forget when creating holistic energy policies. In this context, the role of local social entrepreneurship is systematically growing: the phenomenon serves as a catalyst for local low-emission energy transformation (Wronka-Pośpiech, 2023). Social enterprises belong to the third sector and have a unique ability to combine economic and social benefits. One can successfully use this ability to shape more sustainable attitudes and behaviors. This, in turn, can significantly support the green transformation and decarbonization (Hillman et al., 2018).

In emerging and developing economies, green energy transformation encounters numerous obstacles. Those include macroeconomic difficulties, which refer to the inaccessibility of technology and funds for energy sector modification and modernization (Deka et al., 2023; Isah et al., 2023; Kumar & Majid, 2020; Raza et al., 2020; Yousaf et al., 2021; Bratnicka-Myśliwiec et al., 2019) or the unstable energy policy (Amoah et al., 2020; Uddin et al., 2010). They may also refer to low environmental awareness and education (Asif et al., 2023; Štreimikienė & Baležentis, 2015).

Other obstacles are microeconomic: they concern business entities and households, which need not only to accept the changes in the energy balance, but also to participate in the decarbonization costs, modify the energy habits, and modernize the systems supplying energy and heat (Pavlowsky et al., 2023; Higueras-Castillo et al., 2019; Süsser & Kannen, 2017).

In societies with low or average residual income, this poses a truly serious challenge which is difficult to face without any state subsidies. For these subsidies to be effective, the state must identify the expectations of end users of renewable energy sources (RES) and draft a profile of their typical characteristics. This enables one to effectively design and implement initiatives for the green transformation and decarbonization of economy.

Given the said circumstances, the objective of this article is to identify obstacles to using RES (solar energy) from the prosumers' perspective in the Polish economy. To achieve this objective, I present the results of a survey conducted on a representative sample of 754 Polish prosumers. They enable one to address the following research problems:

1. What are the obstacles which hinder the prosumers' decision to install a photovoltaic system and what is their priority order?

2. Are there any differences in perceiving obstacles to photovoltaic system development between groups of prosumers? If so, what are they?

Answering the above questions makes it possible to fill in the research gap relating to the assessment of the social and behavioral aspects of decarbonization. What is more, it provides

grounds for a precise adaptation of the government subsidies for RES development to prosumers' needs, which is important for green transformation effectiveness.

Further on, I discuss literature studies of decarbonization aspects in emerging and developing economies as well as the existing results of prosumers' behavior research. Next, I describe the research methodology, considering the rules of survey questionnaire design and the statistical methods of results analysis. Later, I present and discuss the research findings, and then offer recommendations toward increased efficiency of Polish economy decarbonization. Finally, I formulate the most important conclusions and describe study limitations and directions for further research.

Literature Review

The socioeconomic trend of research on the solar energy use by prosumers includes many publications on photovoltaic market functioning. This stems from the specific nature of the peer-to-peer (P2P) market model which can be used to settle distributed transactions. Nonetheless, the majority of existing studies concerns optimization and settlement mechanisms (Fernandez et al., 2023; Zeng et al., 2023; Forcan & Forcan, 2023).

In this trend, scholars also analyze the financial benefits of photovoltaics use. Those may refer to individual prosumers, as mentioned by Moghadam and Javidi (2022) and Mensin et al. (2022). They may also apply to the entire local communities, as described by Umer et al. (2023) and Espadinha et al. (2023). Economists study the prices and the demand-supply alignment on the photovoltaic market; for these aspects, see An et al. (2022), Huang et al. (2022), and Li et al. (2020).

This means that researchers focus primarily on the macroeconomic aspects of the photovoltaic market mechanism connected with RES and the green transformation. Few works tackle the problems of the macroeconomic perspective referring to individual prosumers, even though certain authors stress the need to carry out such research (Xiang et al., 2023).

Prosumers' opinion polls usually take place in the context of incentives encouraging households or entrepreneurs to install photovoltaic systems. They produce the following conclusions:

1. Prosumers' decisions are most strongly and frequently affected by financial incentives, i.e., the opportunity to reduce energy costs. Prosumers in emerging and developing economies experience incentives to a greater extent (Jonek-Kowalska, 2023; Zdonek et al., 2023; Mularczyk et al., 2023).

2. Beside the financial incentives, photovoltaic systems are used because of the need for economic self-sufficiency (Ecker et al., 2017; Korcaj et al., 2015; Römer et al., 2015), willingness to protect the climate (Georgarakis et al., 2020), and the opportunity to reduce energy poverty (Paudel et al., 2019, Tushar et al., 2019).

3. Prosumers' opinions highly differ in the international and national context (Bruine de Bruin et al., 2007). The opinions change over time as photovoltaic systems develop. This implies a continuous and individualized necessity to identify prosumers' needs.

The analysis of obstacles to photovoltaics development which form the subject of this article appears in the literature mainly from the macro perspective. In this context, the aspects of designing and modifying energy strategies to increase RES use are analyzed primarily in developing and emerging economies.

Thus, Osorio-Aravena et al. (2021), who studied the Chilean economy, notice that the major obstacle to photovoltaics development is low income and the high cost of photovoltaic system

installation. According to the authors, decarbonization and RES development in Chile would not be possible at all without state incentives.

Similar conclusions result from the research by Sotnyk et al. (2023), who studied Ukraine. The authors stress the role of financial obstacles and pay attention to the energy storage aspects. In both cases, they believe that the solution to the financial problems can be state initiatives, which is similar to Botelho et al. (2022), who analyzed photovoltaic development in the Brazilian economy.

One should add that, in practice, prosumers do not possess any tools which would enable them to analyze the costs and benefits of photovoltaic systems. Hence, they find it difficult to assess the long-term profitability of such investments, and this may discourage them from using RES – as described by Yang and Zou (2016).

Another problem in photovoltaics development is the distrust toward the state and the institutions who organize energy trading in the grid. This reduces the prosumers' agency and increases the risk accompanying RES investments – a phenomenon discussed by Patterson-Hann and Watson (2022).

In this context, one should add that Poland has been building the society's trust in the state in free-market economy conditions for less than three decades, which certainly hampers photovoltaics development. Moreover, the energy policy is highly unstable and there are no clear directions of low-emission energy source development (Skjærseth, 2018; Lis & Stankiewicz, 2017). Following a period of developing wind energy systems, the state reoriented its support toward solar energy (Solorio & Jörgens, 2020). Moreover, significant efforts regarding nuclear energy commenced only two years ago. The changing energy conditions increase the risk of both macro- and microeconomic RES investments (Wronka-Pośpiech et al., 2016), which is likely to discourage people from any decarbonization efforts.

The literature review indicates that the photovoltaic market has been analyzed from a relatively unilateral perspective which focuses on the macroeconomic approach. There is no research oriented toward social aspects to a higher degree, or considering the micro perspective of individual prosumers. However, such an approach is important and valuable as the development of RES in the entire economy results from attitudes and behaviors of individual business entities. This means that there is a research gap concerning the identification and assessment of obstacles to using solar energy from the prosumers' perspective. This article attempts at filling the gap in question.

Research Method and Material

As already mentioned, I used a survey questionnaire for the research. The questionnaire contained four groups of questions concerning obstacles which hinder the use of photovoltaic systems or discourage people from such use. Given the above literature review, the question groups referred to the following obstacles:

- financial – most frequently mentioned in the discussions concerning RES;
- legal, which determine the photovoltaic market frameworks;
- administrative, which translate into the complexity of formal measures required from prosumers to get subsidies;
- technical, which concern the conditions of photovoltaic system installation and guarantee.

The list of survey questions is presented in Table 1.

Table 1. Groups of Survey Questions About the Obstacles to Photovoltaics Development in Poland

Question group	Question
financial	cost of photovoltaic system installation
	insufficient state subsidies
legal	legal amendments regarding subsidies for photovoltaic investments
	legal amendments regarding the settlement of photovoltaic energy production and consumption costs
administrative	complexity of procedures to obtain state subsidies
technical	necessity to fulfill the technical requirements for solar panel installation
	limitations of the guarantee for photovoltaic system installation and use

Source: own elaboration.

The respondents assessed the obstacles in Table 1 using a five-point Likert scale, defining their inconvenience as follows:

1 – very low;
2 – low;
3 – medium;
4 – high;
5 – very high.

The sample size was determined based on the following assumptions:

– fraction size: 0.5;
– 4% maximum error defining the scale of difference between the results obtained in the sample and the population;
– 97% confidence percentage that determines the certainty of the results obtained.

The research was conducted in early 2023.

I used descriptive statistics to analyze the results at the first stage of the research. This enabled me to answer the first research problem, namely: What are the obstacles which hinder the prosumers' decision to install a photovoltaic system and what is their priority order? In this respect, I used central tendency measures, including arithmetic mean, mode, and median value, as well as variation measures, including standard deviation and the coefficient of variation. Moreover, I calculated skewness and kurtosis to illustrate the distribution of responses when compared to normal distribution.

The second stage of research included nonparametric statistical tests to assess the differentiation of the studied groups which enabled me to answer the second research problem, namely: Are there any differences in perceiving obstacles to photovoltaic system development between groups of prosumers? If so, what are they? The analysis considered the property owners' age and place of residence (as defined in the particulars). The identification of the prosumers' behavior typology in those groups produced more accurate recommendations to make decarbonization more effective. The results analysis entailed the following nonparametric statistical tests comparing the distributions of several variables:

– Mann-Whitney U test for two unrelated samples comparing the median value of distributions – used for the place of residence, i.e., village/city;
– Kruskal-Wallis test for more than two unrelated samples comparing the variance of distributions – used for the age of the surveyed property owners.

Results and Discussion

At the first stage of research, I identified the intensity of obstacles to photovoltaics development of Poland using descriptive statistics. The results of this step are shown in Table 2. According to the information presented, the financial obstacles – more specifically, the costs of photovoltaic system construction and insufficient state subsidies – are the most important for prosumers. The responses have the highest arithmetic mean and median value, and the respondents are consistent in their assessment, as confirmed by the lowest values of the coefficient of variation and standard deviation.

The prosumers' responses point not only to financial difficulties, but also to the high score awarded to the complexity of procedures to obtain state subsidies. This may be an important obstacle to RES development in Poland and may slow down the decarbonization process.

Among the other obstacles – including technical, organizational, and legal ones – the respondents indicated the significance of legal amendments regarding the settlement of photovoltaic energy production and consumption costs. Those are rated as more burdensome than legal amendments regarding subsidies for photovoltaic investments. This means that Polish prosumers are able to accept the initial cost of photovoltaic investments but fear the risk connected with their use and the unforeseeable rules of transaction settlements with the energy grid operator.

According to the respondents, the technical obstacles are less inconvenient than the financial or regulatory – that is, organizational and legal – difficulties described above, as proved by the lower average assessment and median value. However, in this case, the prosumers are less consistent than for the financial aspects: the responses yield lower coefficients of variation and lower standard deviation.

The obtained priority order of obstacles to RES development in Poland points to insufficient state subsidies for photovoltaic development. The prosumers' reservations refer primarily to financial and regulatory – that is, legal and organizational – aspects. The research reveals that the respondents would expect higher subsidies for photovoltaic systems and simpler procedures to obtain them. The prosumers' fears refer not only to the conditions of making the decision to invest in photovoltaics, but also to future rules of the energy market, such as transaction settlement costs. Moreover, the variability of those conditions in the last decade has resulted in negative experience of both existing and prospective prosumers, encumbering the investment in photovoltaics with a higher risk. This may reduce their willingness to opt for RES and slow down the decarbonization pace in Poland.

At the subsequent research stage, I focused on assessing the variability of the responses provided by the studied groups based on their place of residence and age. The aim of such an approach was to adapt the aid instruments better to the prosumers' expectations in case any significant differences in the obstacles' perception were found.

Hence, Table 3 presents the results of Mann-Whitney U test for the interdependency between obstacle assessment and the prosumers' place of residence (village/city). Table 4 contains group descriptive statistics for the analyzed variables. The analysis covered solely the obstacles where statistically significant differences were found ($p < 0.05$).

Table 2. Descriptive Statistics to Assess the Obstacles to Photovoltaics Use by Households

Obstacles	Statistical measures									
	Average	Median	Mode	Mode size	Minimum	Maximum	Standard deviation	Coefficient of variation	Skewness	Kurtosis
cost of photovoltaic system installation	3.5995	4.0000	3.0000	254	1.0000	5.0000	1.0378	28.833	−0.3633	−0.3635
insufficient state subsidies	3.5676	4.0000	3.0000	254	1.0000	5.0000	1.0442	29.269	−0.3416	−0.4025
legal amendments regarding subsidies for photovoltaic investments	3.1300	3.0000	3.0000	304	1.0000	5.0000	1.0781	34.445	−0.2220	−0.3768
legal amendments regarding the settlement of photovoltaic energy production and consumption costs	3.2533	3.0000	3.0000	303	1.0000	5.0000	1.0221	31.417	−0.2981	−0.1817
complexity of procedures to obtain state subsidies	3.3289	3.0000	3.0000	275	1.0000	5.0000	1.0959	32.922	−0.2481	−0.4688
necessity to fulfill the technical requirements for solar panel installation	3.1817	3.0000	3.0000	302	1.0000	5.0000	1.0550	33.158	−0.2249	−0.3275
limitations of the guarantee for photovoltaic system installation and use	3.2095	3.0000	3.0000	312	1.0000	5.0000	1.0377	32.333	−0.1557	−0.3034

Source: own elaboration.

Table 3. Results of the Mann-Whitney U Test for Obstacle Assessment Depending on Place of Residence

Variable	Rank sum for the city	Rank sum for the village	Z	*p*
legal amendments regarding subsidies for photovoltaic investments	164,038.5	120,596.5	2.2265	0.0259*
necessity to fulfill the technical requirements for solar panel installation	164,301.0	120,334.0	2.3147	0.0206*
limitations of the guarantee for photovoltaic system installation and use	164,089.5	120,545.5	2.2436	0.0248*

*$p < 0.05$

Source: own elaboration.

Table 4. Descriptive Statistics for the Obstacles to Photovoltaics Development in Villages and Cities

Group	Average	Median	Mode	Mode size	Standard deviation	Coefficient of variation
Legal amendments regarding subsidies for photovoltaic investments						
all	3.1299	3.0000	3.0000	304	1.0781	34.44%
city	3.2110	3.0000	3.0000	182	0.9944	30.97%
village	3.0296	3.0000	3.0000	122	1.1671	38.52%
Necessity to fulfill the technical requirements for solar panel installation						
all	3.1816	3.0000	3.0000	302	1.0550	33.15%
city	3.2661	3.0000	3.0000	171	1.0017	30.67%
village	3.0771	3.0000	3.0000	131	1.1100	36.07%
Limitations of the guarantee for photovoltaic system installation and use						
all	3.2095	3.0000	3.0000	312	1.0377	32.33%
city	3.2925	3.0000	3.0000	175	0.9858	29.94%
village	3.1068	3.0000	3.0000	137	1.0913	35.12%

Source: own elaboration.

According to the data presented in Tables 3 and 4, the differences between the assessment by the residents of cities and villages refer to three obstacles: one financial and two technical. The city residents considered the legal amendments regarding subsidies for photovoltaic investments more burdensome than did the village residents, which is quite surprising as the income levels in Polish cities are higher than in Polish villages. This assessment difference may stem from the more critical attitudes to the Polish government of the time – the one formed by Prawo i Sprawiedliwość (PiS) – in urban areas. This context may explain why amendments to energy policy received less favorable assessment from this group.

The city residents perceive the technical burdens relating to photovoltaic systems as more difficult as well, including the necessity to fulfill the technical requirements for solar panel installation and the limitations of the guarantee for photovoltaic system installation and use. The first of these two differences naturally stems from the shortage of space where photo-

voltaic systems can be installed in urban areas. The second may arise from the need to meet higher technical requirements when installing solar panels. In both cases, the identified differences seem reasonable and justified by the different conditions of installation in the village and urban areas.

One should add that the city residents offered less differentiated assessments of the obstacles to photovoltaics development than did the village residents. This may make it more difficult to adapt any incentives and subsidy programs to the latter group's needs.

At subsequent stages of the research, I analyzed the interdependency between obstacle assessment and the age of the property owner where the photovoltaic system is used. Table 5 shows the results of the Kruskal-Wallis test for statistically significant interdependencies, whereas Table 6 includes descriptive statistics for the age groups.

Table 5. Obstacle Assessment Depending on the Property Owner's Age (Kruskal-Wallis Test)

Means of promotion	Kruskal-Wallis test	*p*-value
cost of photovoltaic system construction	7.8943	0.0139*
complexity of procedures to obtain state subsidies	7.9054	0.0396*
limitations of the guarantee for photovoltaic system installation and use	7.2287	0.0269*

$p < 0.05$*

Source: own elaboration.

Table 6. Descriptive Statistics for Obstacle Assessment Depending on the Property Owner's Age

Age group	Average	Median	Mode	Mode size	Standard deviation	Coefficient of variation
Cost of photovoltaic system construction						
up to 30 years	3.5098	4.0000	4.0000	16	1.1202	31.91%
from 31 to 50 years	3.5337	3.0000	3.0000	171	0.9903	28.02%
over 51 years	3.7297	4.0000	4.0000	80	1.0909	29.25%
Complexity of procedures to obtain state subsidies						
up to 30 years	3.3529	3.0000	3.0000	22	0.9343	27.86%
from 31 to 50 years	3.1058	3.0000	3.0000	188	1.0560	34.00%
over 51 years	3.2779	3.0000	3.0000	92	1.0674	32.56%
Limitations of the guarantee for photovoltaic system installation and use						
up to 30 years	3.4117	3.0000	3.0000	24	0.9203	26.97%
from 31 to 50 years	3.1396	3.0000	3.0000	194	1.0293	32.78%
over 51 years	3.2895	3.0000	3.0000	94	1.0661	32.41%

Source: own elaboration.

The analysis revealed three obstacles displaying statistical sensitivity to the respondents' age:

– financial: cost of photovoltaic system construction;
– organizational: complexity of procedures to obtain state subsidies;
– technical: limitations of the guarantee for photovoltaic system installation and use.

Hence, the oldest respondents experience the photovoltaic system cost the most acutely, as proved by the highest average, median, and mode for their assessment. This cost is also highly burdensome for the youngest prosumers (the highest median and mode). Such a distribution of responses in age groups most probably stems from income differences. For middle-aged owners, at the height of their career development, the photovoltaic system cost may be relatively lower when compared to the income than for those starting or ending their careers.

The complexity of procedures to obtain state subsidies hampers access to photovoltaics the most for the youngest prosumers, which may stem from their short experience and aversion to bureaucracy. For the other age groups, this factor is less burdensome.

For the youngest group of prosumers, the limitations of the guarantee for photovoltaic system installation and use are more difficult to overcome than for the other age groups. This technical difficulty is the least important for respondents aged 31–50.

The results permit a claim that prosumers aged 31–50 have lower financial, organizational, and technical expectations than the other two age groups – i.e., the youngest and oldest prosumers. The major problem for the oldest age group is the financial costs of the photovoltaic system. On the other hand, the youngest respondents expect simplified administrative procedures and more favorable conditions of photovoltaic system installation and use. Thus, the middle-aged group seems to best accept the existing organizational, legal, and financial conditions.

Further Discussion

The research results confirm the weight of economic priorities in prosumers' decisions to use RES (Zdonek et al., 2023; Mularczyk et al., 2023). This is a typical phenomenon in emerging and developing economies, as described, for example, by Osorio-Aravena et al. (2021), Sotnyk et al. (2023), and Botelho et al. (2022). Nonetheless, one should stress that the financial aspects are not equally important for all age groups. According to the research, it is the oldest group of respondents who most strongly experience the economic obstacles to photovoltaics development – a phenomenon certainly supported by the regular development of the Polish economy and increasing wealth of younger generations. This is confirmed by the changeability and variability of prosumers' expectations noticed by Bruine de Bruin et al. (2007).

Polish prosumers are significantly affected by intensely experienced effects of unstable energy policy (Skjærseth, 2018; Lis & Stankiewicz, 2017). The changing legal conditions of settling the transactions in the energy grid discourage them from investments in photovoltaics. The complexity of administrative procedures accompanying the process of applying for photovoltaic system subsidies is another factor which hinders their decisions.

In Poland, the development of nonrenewable energy sources is progressing very slowly. So far, the state has not taken advantage of the opportunity to develop nuclear energy. As a result, the decarbonation efficiency remains very low. Therefore, it is worth using the obtained results to create favorable conditions for solar energy development. This primarily means providing financial support and enabling satisfactory settlement of the energy produced. The stabiliza-

tion of energy policy and certainty of the conditions for the functioning of prosumerism is also important for its participants.

Responses of the surveyed prosumers clearly point to the state's leading role in RES development and economy decarbonization (Patterson-Hann & Watson, 2022). The state is obliged to provide subsidies for the green transformation and organize the administrative and legal conditions required for the solar energy market operations. Even though one cannot expect or require increased capital to subsidize RES investments because of the insufficient Polish national income, the simplification of procedures and stabilization of legal conditions presents a feasible task for a modern state.

As emphasized in the introduction, local and regional initiatives in the form of social entrepreneurship play an increasingly important role in today's energy transformation (Rodin & Moser, 2022; van der Horst, 2008). Thus, it is certainly worth using them in two directions. The first is to disseminate the importance of decarbonization and ecological education (Véliz et al., 2023). The second, more immediate, concerns the use of social enterprises and energy cooperatives to improve transactions on local energy markets. The sharing and synergy effect achieved through such activities can encourage the use of RES and demonstrate their efficiency and climate friendliness (Wronka-Pośpiech, 2023; Hillman et al., 2018).

This means that the research can form a basis for recommendations fostering the development of photovoltaics in Poland and accelerating the decarbonization of Polish economy:

- stabilized energy policy of the state;
- reduced risk related to the changing conditions of RES energy settlements;
- minimized procedures required to obtain funds for photovoltaic systems and/or organized administrative help for those applying for such funds;
- development of photovoltaics investment support forms;
- provision of tools to calculate the benefits and costs of long-term solar energy use.

Conclusions

The major objective of this article was to identify the obstacles to photovoltaics development in Poland from the social (prosumers') perspective. Those obstacles hinder and slow down the Polish economy decarbonization process. According to the findings, the major obstacle to RES use by prosumers is the cost of photovoltaic system installation and insufficient state subsidies for such investments. Moreover, complex procedures of applying for funds and legal amendments to the rules of energy settlement with the grid operator present a significant burden. Technical obstacles concerning the conditions of photovoltaic system installation and use are not as important for the prosumers as the above-mentioned financial, organizational, and legal difficulties. However, one should emphasize that residents of urban areas perceive the technical obstacles as more painful than do village residents, which stems from the natural shortages of urban space.

When analyzing the research findings in terms of the need to adapt the solutions supporting RES development to the needs of prosumer age groups, one can claim that the youngest prosumers (up to 30 years) expect simplified administrative procedures of obtaining the subsidies for photovoltaics. The oldest group of respondents (over 51 years) believes that photovoltaic system cost reduction is the most important. The medium age group (from 31 to 50 years) seems to accept the existing financial, organizational, and technical conditions.

The main limitation of the research is narrowing down the analysis scope to Polish prosumers. Nonetheless, such an approach ensures a focused assessment of needs and an improved adaptation of the RES support policy to the Polish economy's needs, which is a highly important and topical task given the slow progress of its decarbonization.

The future research of prosumers' behaviors should investigate their assessment and attitude toward the individual RES support instruments. It would also be interesting to learn the incentives which encourage prosumers to modify their energy consumption behaviors oriented toward energy market optimization (balancing).

Bearing in mind the role of social entrepreneurship in decarbonization, it is also worth deepening the research regarding its impact on accelerating the low-emission transformation on a regional and local scale. In this trend, an important research direction is the identification of barriers and opportunities for including social enterprises in local prosumer initiatives. Another interesting topic would be to assess the role of energy cooperatives in shaping sustainable energy consumption.

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The Role of Empathy in Designing Social Innovation For Blind and Visually Impaired People in Public Transportation in Poland

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Abstract: **Background:** The design thinking method is one way of modern service and product design. It encompasses various stages but places particular empathy. Trying to understand the customer's needs and "stepping into the shoes" of the product user is the key.
Research objectives: The article aims to present the process of developing a social innovation using the design thinking method with particular empathy. It also indicates methods for supporting blind and visually impaired people in public communication and presents the developed social innovation as a case study.
Research design and methods: The article presents a literature review on design thinking, empathy, and social innovation. The case study presents the process of creating a social innovation. Key research questions concern the impact of empathy in the process of creating a social innovation. The research component also included interviews with blind and visually impaired people and a bus driver.
Results: We conducted a literature review was conducted. Based on it, we described the process of social innovation creation and the developed diagram. We presented the developed and tested innovation, as well as conclusions from the implementation and guidance for business practice.
Conclusions: empathy plays a key role in the design of modern services and products.
Keywords: social innovation; design innovation; design thinking
JEL Codes: O31; O35; L3

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Introduction

Design thinking is becoming increasingly important in creating social innovations. Social innovations involve the development and implementation of new solutions to address social and environmental challenges, characterized by a creative approach to resolving complex social issues. The article highlights one of the key stages of design thinking, namely empathy. Empathy is the stage of finding emotional understanding by observing pain points in a live context around a stakeholder's problem. The innovation designer must focus on observing the user's living environment and thus gain insight and speculate on potential needs. The goal of social innovation is to bring about benefits, particularly for society. Moreover, through empa-

thy, social enterprises can better understand the needs and challenges of the communities they aim to serve. However, empathy is not an unambiguous concept. B. Azar distinguishes empathy as the emotional part, which involves empathy, and the rational part, which in turn allows one to understand the feelings of another person. There is also a distinction between empathy in the form of phenomena – taking another's point of view as one's own, compassion, and empathy understood as sympathy (Siemieniako, 2010). Design thinking focuses on users and their experiences, resulting in more effective and sustainable solutions. This helps social enterprises better meet community needs, enhancing their effectiveness and impact on improving quality of life. The article aims to identify the role of empathy in the creation of social innovations. We conducted the research in several stages. In the first stage, we conducted desk research. Then, we based the inference on qualitative research using the method of in-depth interviews. We based the research on the case of designing a social innovation within the framework of a project implemented at the Silesian Innovation Space incubator in partnership with the Cooperation Fund Foundation Center for the Development of Social Initiatives (CFFCDSI). The basis for starting the research grant was the preparation of an innovation card containing a proposal for a solution to the problem, as well as the solutions used to date. The article sheds light on understanding the inclusion of empathy, the involvement of representatives of the innovation audience, and attempts to identify with the target group in the context of innovation design. The research findings show that integrating empathy into the creation of social innovations helps accurately identify audience needs and design solutions that add value. The literature on the subject is poor in case studies on the use of the design thinking method in designing social innovations. When working on solving the problem, we focused on the knowledge acquired during training, while the literature on the subject provided only support. The article fits into the research gap by creating a theoretical base for those who want to implement social innovations or are scientifically engaged in empathy, social innovation, or the design thinking method.

Literature Review

The Theory of Social Innovation

The concept of social innovation began to develop in the 1990s when scholars noticed that traditional forms of addressing social problems were starting to fail, and new ones needed to be generated to prevent the deepening of existing social issues, such as unemployment, an aging society, climate change, inequality, or social exclusion (Wronka-Pośpiech, 2015). Despite the recent interest in social innovations, there is no single cohesive definition for them. This is mainly because it is a practical field, leading most definitions to emerge empirically (TEPSIE, 2014).

Most definitions share common elements at a fundamental level. Scholars assume that social innovation emerges to solve a social problem (also described as a challenge or social need) or to improve an existing solution to a social problem. Scholars also give attention to "increasing society's capacity to act" (Schwarz, 2019), which is motivated by a desire to address a certain social need (Li & Bacete, 2022). Another common element is innovativeness. Every social innovation should be characterized by some innovative element, such as a product, process, technology, idea, principle, intervention, legislative or regulatory provision, or social movement (Sandu & Anghel, 2016). According to Schwarz (2019), only after implementation

can we classify a social innovation as such. Typically, socially oriented organizations disseminate and widely adopt it (Li & Bacete, 2022).

Differences arise when defining the adjective "social" in the expression "social innovations." The Stanford Social Innovation Review and BEPA (2008, 2010) emphasize the added value obtained by society through social innovation. The Social Innovation Exchange and Murray et al. (2010) highlight the importance of societal needs. Gillwald (Neumeier, 2012) talks about the impact on society, particularly considering the consequences. Others also emphasize the well-being of individuals and the collective (CSTP, 2011; TEPSIE, 2014).

Another debate among theorists concerns the holistic of social innovations. The reductionist approach presents social innovation as a new idea aiming to achieve social goals, emphasizing the purposefulness and scalability of models (Mulgan et al., 2007), or as an innovative solution to a social problem that is more efficient, more sustainable, or more just than already existing solutions (Phills et al., 2008). On the other hand, the holistic approach presents social innovations from a broader perspective, emphasizing their three characteristics: meeting social needs, redefining social relations, and strengthening and empowering communities (Moulaert et al., 2013).

Another discrepancy lies in the level of objectivity when defining social innovation. The normative approach to social innovation assumes from the outset that they have a positive impact on the environment since the main goal of social innovations is to improve the living conditions of society. In this approach, it is also described how social innovations should look and what they should do, unlike the positive approach, which deals strictly with facts — how a given social innovation looks and what it does in practice. In this approach, there is no evaluation of whether the phenomenon positively or negatively affects the environment (TEPSIE, 2014).

The team defined social innovations within the Silesian Innovation Space project as solutions aimed at addressing social problems through innovative approaches on a national scale, with a strong focus on improving living conditions and meeting the specific needs of the target group. We adopted a holistic approach when designing the innovation. Due to the project's nature, the implementation of the innovation was not required, and the focus remained on the testing phase.

Design Thinking as a Creative Method for Designing Social Innovations

In the field of social innovation, more people are using the creative problem-solving method known as design thinking. Originally, scholars associated this term exclusively with design in architecture, industrial production, urban planning, and craftsmanship. However, over time, the theory of design thinking has become more generalized, as scholars have recognized its multidirectional application in various fields (Cankurtaran & Beverland, 2020; Kimbell, 2009). Currently, design thinking is widely employed in business, public, cultural, and social spheres, resulting in innovative products, services, business strategies, and social and educational systems (Brown, 2013; Dunne, 2018; Liedtka, 2013; Pande & Bharathi, 2020). Broadly speaking, we can define design thinking as an open problem-solving process that utilizes both analytical and creative thinking processes along with intuition, while focusing on human beings and their real needs (Lockwood, 2009; Rudkin Ingle, 2013; Rösch et al., 2023).

Design thinking is characterized by flexibility, fluidity, and non-linearity. The entire process is based on several stages aimed at mobilizing creative and unconventional thinking, enabling the adoption of different perspectives, and leading to the discovery of new opportunities and

original solutions within the environment (Rudkin Ingle, 2015). The ability to consider different perspectives in understanding needs and problems was made possible through the application of heuristic methods at each stage of the process, as well as continuous collaboration in multidisciplinary teams (Baran & Bąk, 2017; Brown, 2013; Sobota & Szewczykowski, 2014). The design thinking process is iterative, driven by the consistent realization of newly formed ideas through prototyping and testing at each iteration (Arabasz & Sińczuch, 2016; Brown, 2013). A holistic approach to innovation is also employed in design thinking, which states that the key to success lies not only in creating a novel product or service but in developing a comprehensive and systemic solution that practically serves the innovation's recipients (Brown, 2013).

The concept of design thinking is based on four fundamental rules: the ambiguity rule, redesign rule, tangibility rule, and social (human) rule. By embracing the ambiguity rule, the design thinking method demonstrates a propensity for experimentation, adopting different perspectives, and shedding any mental barriers. The redesign rule emphasizes the importance of analyzing past solutions and consistently drawing conclusions from them. The tangibility rule asserts that visualizing proposed ideas in the form of solution prototypes is an essential element of the method. The social rule, which is the final and most significant one, asserts that designing innovations based on well-defined target group needs is the key factor in generating relevant innovations (Meinel & Leifer, 2011). However, the priority in making breakthrough discoveries lies not in recognizing well-known needs, but in identifying those that have not been previously identified (Brown, 2013).

The Role of Empathy in the Design Thinking Process

Design thinking encompasses three dimensions of innovation: inspiration, ideation, and implementation. Inspiration refers to the ability to accurately identify needs, problems, and opportunities in the environment. The ideation dimension allows for the transformation of observed phenomena into potential solution proposals. The best ideas undergo in-depth analysis and development during the implementation stage, aiming to create a final solution that will be implemented in the intended environment (Brown, 2008). The design thinking process is guided by the Stanford model, an iterative sequence of five key stages: empathy, problem definition, idea generation, prototyping, and testing (Arabasz & Sińczuch, 2016; Chomątowska et al., 2019; Meinel & Leifer, 2011; Rudkin Ingle, 2015).

The first and most crucial stage is empathizing. In other words, understanding or discovering is based on deepened recognition and understanding of the needs and problems of the recipient of the designed solution. This part of the process should be conducted in accordance with the principles of understanding, observation, and empathy (Brodnicki, 2015; Brown, 2013). It is not advisable to limit oneself solely to engaging specialists familiar with the target group's issues or conducting analyses based on previously gathered research data. What is far more important is making an effort to personally and emotionally identify with the recipient in their natural environment, recognizing their habits, experiences, motives, and ways of perceiving reality. The researcher's approach should be characterized by a high level of empathy, which involves "putting oneself in the user's shoes" and is demonstrated through active listening, attentive observation, direct interaction, and performing daily activities (Brown, 2013; Michalska-Dominiak & Grocholiński, 2019; Sońta-Drączkowska, 2020).

In conducting the empathy stage, it is recommended to utilize specific heuristic methods and techniques. Conducting a cognitive survey and ethnographic interviews may also be useful for acquiring relevant knowledge about potential users of the solution. Moreover, preparing

an empathy map and a persona can help organize the gathered information (Brodnicki, 2015; Chomątowska et al., 2019; Michalska-Dominiak & Grocholiński, 2019; Helman & Rosienkiewicz, 2016). An empathy map is a widely known and utilized method, particularly in designing business models, which helps researchers gain a deep understanding of the customer's perspective. As the name suggests, this method is based on getting to know the user with the highest level of emotional involvement and empathy (Ferreira et al., 2015). The map consists of six areas that allow for a comprehensive focus on understanding the research subject – see Figure 1.

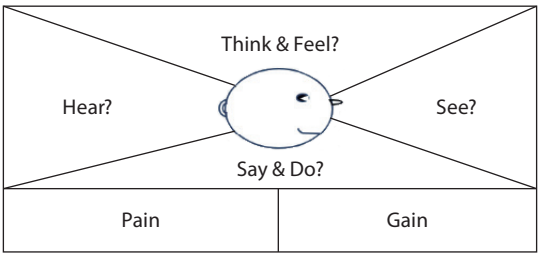

Figure 1. Empathy Map

Source: Ferreira et. al. (2015, p. 2).

The empathy map should include answers to the following four key questions:

- What does the user hear?
- What does the user see?
- What does the user think and feel?
- What does the user say and do?

In addition to these key questions, a complete understanding of the user should also consider their pain points (fears and frustrations) and their gains (needs and desires). Creating an effective empathy map hinges on providing detailed and precise answers to these questions. Supplementary guiding questions can be helpful in this process, as shown in Table 1.

Another useful technique used in the understanding stage is persona. It represents an archetype, which is a fictional character representing specific recipient groups in innovations, characterized by similar behavioral profiles. The persona description goes beyond obvious demographic information, socio-economic status, or occupation and includes details about life goals, motivations, and frustrations. Moreover, to create a realistic depiction of a user with a specific identity, a persona assumes a specific appearance and has a few most characteristic quotes associated with them. All the information is visually presented and often accompanies designers throughout the entire design thinking process. However, creating a persona should be based not on stereotypical assumptions but on actual research findings (Michalska-Dominiak & Grocholiński, 2019). Similarly to empathy map creation, the purpose of creating personas is to compile information collectively, enabling the researcher (designer) to empathize with the user and understand their real needs and problems. Scholars consider personas to be reference points that accompany designers at each subsequent stage of the process and facilitate making further design decisions (Dahiya & Kumar, 2018; Michalska-Dominiak & Grocholiński, 2019).

Table 1. Guiding Questions for the Empathy Map

Field	Guiding Questions
Do	What is common for him/her to say?
	How does s/he normally act?
	What are his/her hobbies?
	What does he like to say?
	How is the world in which s/he lives?
	What do people around him/her do?
	Who are his/her friends?
	What is popular in his daily life?
	What people and ideas influence him/her?
	What do the important people in his/her life say?
	What are his/her favorite brands?
	Who are his/her idols?
Think	What are some important ideas that s/he thinks and does not say?
Feel	How does s/he feel about life?
	What bothers him/her lately? Why?
Pains (Difficulties/Frustrations)	What is s/he afraid of?
	What are his / her frustrations?
	What has disturbed him?
	What would s/he to change in his/her life?
Needs	What does s/he need to feel better?
	What is success? What does s/he want to achieve?
	What has s/he done to be happy?
	What would end his/her pain?
	What are some of his/her dreams?

Source: Ferreira et. al. (2015, p. 2).

Research Method and Material

In the article, we posed the following research questions:
RQ1: Does empathy play a role in designing social innovations?
RQ2: How does incorporating the empathy stage impact the design of social innovations?

We aimed to identify the role of empathy in the creation of social innovations. Comparing the stages of designing social innovation, one involving empathizing, helped us to achieve the goal and answer the research questions. We designed social innovation within a project conducted in the Silesian Innovation Space (Śląska Przestrzeń Innowacji) incubator in collaboration with the Cooperation Fund Foundation (Fundacja Fundusz Współpracy – COFUND) and in partnership with the Social Initiatives Development Center (Centrum Rozwoju Inicjatyw Społecznych – CRIS).

We conducted the project in several stages outlined in Figure 2.

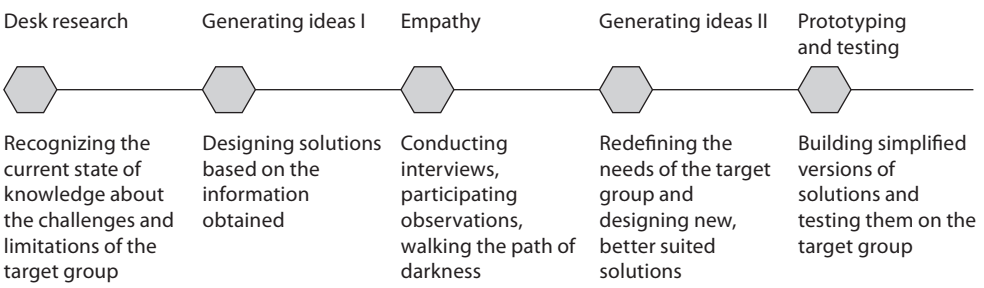

Figure 2. Stages of Project Implementation

Source: own elaboration.

The first part involved developing a social innovation idea in response to the challenge presented by the ordering organization within the project. The innovation idea served as the basis for preparing the innovation card. An expert panel conducted a two-level analysis of the submitted innovation card. Obtaining a positive opinion qualified the innovation card for receiving a grant to design a prototype of the social innovation. We conducted the second part of the project after the innovation card was approved for implementation. Upon receiving the grant, we tasked the innovation team with designing the actual prototype of the social innovation using design thinking.

We based the first part of the research on the desk research. It aimed to gather information on a less-known topic (Bednarowska, 2015). In this case, we used desk research to identify the specific requirements and needs of blind and visually impaired individuals in the process of using public transportation. The analysis aimed to recognize the current state of knowledge regarding the challenges and limitations faced by visually impaired individuals and to identify existing solutions adapted for this group in public transportation. At this stage, we utilized secondary data such as statistical data, press articles, literature, industry websites, and legal documents. The research began in April 2022. It lasted for a week and resulted in a collection of articles that underwent critical analysis. We used Google and Bing search engines. We employed keywords such as urban communication, the blind, the visually impaired, eyesight, train, bus, stop, city, and station. We reviewed the solutions in Polish and English.

In the second part, given its multidimensional subject, we employed a qualitative approach using individual in-depth interviews and observations. This method contributes to a better understanding of social realities, highlighting processes, and meaning patterns. Moreover, this approach is more open to the phenomena under investigation compared to other methods that rely on strictly standardized questionnaires (Flick et al., 2004). We made audio recordings of all interviews and transcribed them. After a detailed familiarization with the transcripts by all authors, we conducted content analysis. The analysis involved identifying recurring themes and potentially relevant fragments in the responses. In this research phase, we also compared the information obtained during desk research with the findings from the interviews. Therefore, the chosen research methods were appropriate for the established goal and research problem. The research scope in the second part included a group of blind and visually impaired individuals and bus drivers from ZTZ Rybnik. We conducted the research sampling using the snowball sampling method (Sęk, 2015). The research had a social nature and required selecting visually impaired individuals who expressed willingness to provide answers regarding their

limitations, needs, challenges, personal experiences, and feelings. Initially, we made contact with two blind individuals. We then asked them to recommend other participants. Because we conducted the research within the Silesian Innovation Space project, the territorial scope of the respondents primarily covered individuals from the Silesian Voivodeship. Seven individuals agreed to participate in the study. To select drivers from ZTZ Rybnik for interviews, we made contact with the person responsible for accessibility at ZTZ Rybnik. We also obtained contact with transport companies that operate routes for ZTZ Rybnik. We received interview consent from one driver appointed by the transport company he was employed in. To conduct individual in-depth interviews, the research team directly contacted the respondents who were blind and visually impaired individuals and a bus driver from ZTZ Rybnik. The team interviewed the respondents using two scenarios with one tailored for the group of blind and visually impaired individuals and the other for the bus driver. The individual interview scenarios consisted of open-ended questions, introductions, requests for recording consent, and metric questions. The team conducted face-to-face interviews with three participants and contacted four participants remotely using Google Meet, Skype, or telephone platforms. The team conducted interviews in a conversational format, as the flow of conversation largely depended on the respondent (Cope, 2011). The interviews lasted between 40 to 60 minutes and the team recorded the interviews for content analysis in the subsequent phase.

Results and Discussion

The team consisting of five individuals conducted the first part of the research during the preparation of the innovation card, while the second part, consisting of interviews, took place after the selection of the innovation card for implementation and involved four team members. We held the initial project meeting on December 21, 2021, with a representative from the Social Initiatives Development Center in Rybnik using the Google Meet platform. During the meeting, we presented the Silesian Innovation Space initiative and basic recruitment principles. Among the participants, three students and two academic employees expressed their willingness to participate in the program. Due to geographical distances between team members' locations and pandemic-related restrictions, we conducted subsequent meetings using the Google Meet platform. The first meeting of the five-member team took place on December 30, 2021. In the meeting, the team chose the challenge to focus on. The list of challenges included 23 problems assigned to seven categories: development of white job positions, development of green job positions, alleviation of social effects of energy poverty, low employment rate of people aged 50+, low employment rate of women, depopulation, and social revitalization of cities. A total of 15 entities submitted challenges. Using brainstorming methods, the team selected the following challenge: "How to help visually impaired individuals solve the accessibility problem related to public transportation schedules so that they can use public transport without additional difficulties and function normally in urban spaces?" Public Transport Authority (Zarząd Transportu Zbiorowego – ZTZ) in Rybnik submitted this challenge as a part of the "Social Revitalization of Cities" area. The selection of this topic was based on the team members' familiarity with urban transportation, two team members' knowledge of Rybnik's transportation issues, and one academic employee team member's experience in working with people with disabilities.

The first stage of the research, which lasted one week, involved desk research focused on reviewing articles related to visually impaired individuals in urban transportation and process improvements. Figure 3 illustrates the course of the first stage.

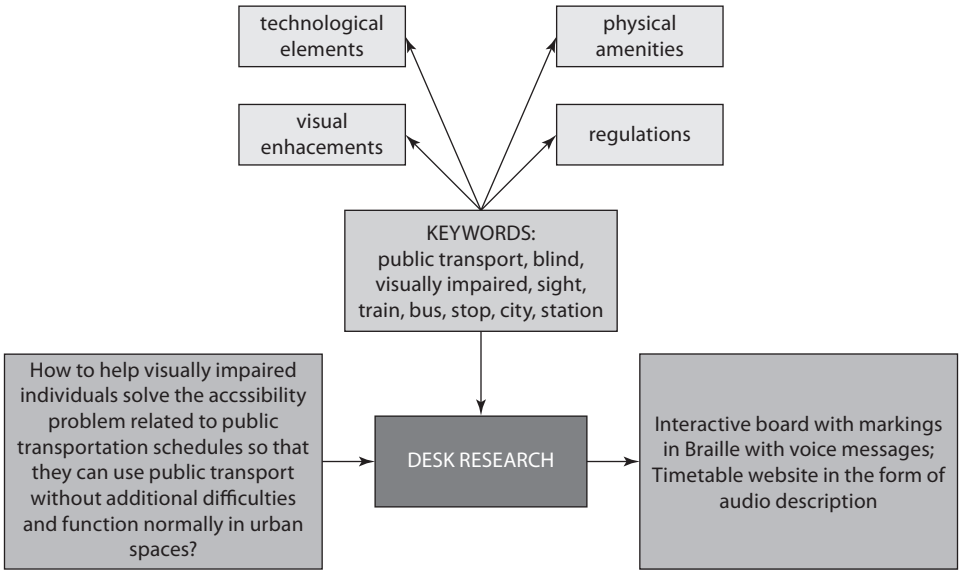

Figure 3. Implementation of the first stage

Source: own elaboration.

As indicated by Figure 3, after reviewing the materials, we identified the following solutions and grouped them into categories:

- Physical amenities: Braille signage on boards, tubes, and buttons; typhlographic markings on buses and at bus stops; creation of pathways between main points at stations.
- Regulatory measures: Driver obligation to stop at a bus stop where a visually impaired individual (person with a white cane) is waiting; requirement to approach the front edge of the bus stop; assistance for visually impaired individuals; automatic door opening.
- Visual enhancements: Orange bus pass wallet (identification informing the driver that a person is visually impaired); set of yellow bus hailers with bus numbers written in Braille (a blind person selects a bus number, flips the hailer to that number, and the driver, approaching the bus stop, sees that the person is waiting for that particular bus) and communication indicators held by visually impaired individuals at bus stops; use of contrasting colors in buses for visually impaired individuals; contrastive numbering of buses.
- Soft-skill elements: Training for drivers and fellow passengers.
- Technological elements: Audiovisual information system (stop sequence, departure times); loudspeakers; special remote controls connected to GPS.

After identifying these groups, the team focused on creating a solution that encompassed each type of solution. They developed a Comprehensive Support System for Public Transportation Travel for Visually Impaired Individuals, which incorporated solutions from each identified group into a cohesive whole. The team proposed an interactive board marked with the

Braille alphabet, connected to a website containing bus schedules; typhlographic markings at bus stops in distinct colors; voice announcements outside the bus; and bus driver training. On March 15, 2022, a commission composed of representatives from the Silesian Innovation Space and the ordering institution conducted a high-level content-related assessment of the innovation card and the team's presentation, qualifying the idea for implementation.

In the second part of the research, which took place from June to the end of July 2022, we conducted interviews with visually impaired individuals and a bus driver. The research included individual in-depth interviews, participation in a "Path of Darkness," and participant observation. The research tool consisted of two developed interview scenarios. The tools were consulted with experts collaborating with the Cooperation Fund Foundation and conducting workshops for the grant-winning teams. The first scenario directed at visually impaired individuals consisted of 11 questions regarding their experiences with traveling by public transportation. The questions inquired about the frequency of travel, purpose, independence, stages of the journey, challenges, driver behavior, familiarity with schedules, passenger behavior, attitudes towards assistance from third parties, and spatial orientation during travel. We conducted the interviews with seven blind or visually impaired individuals, yielding similar conclusions from each participant. Respondents highlighted three significant issues: technology, passenger behavior, and driver behavior. The research design, specifically the snowball sampling method, limited the selection of respondents, as all participants exhibited a high level of visual rehabilitation, and independence, and traveled independently. The conclusions regarding technology indicated that the research group was well-prepared to use public transportation due to the use of dedicated applications in most major Polish cities, the use of buttons on posts presenting schedule information (synthesized voice reading), and limitations if the solution was only limited to a single city. Regarding fellow passengers, respondents indicated a lack of awareness among traveling third parties about the needs of visually impaired individuals, their inability to assist, and confusing communication from such individuals. Respondents agreed that driver behavior varied depending on the individual and that drivers often lack knowledge or fail to exercise appropriate care. We conducted the interviews in a relaxed atmosphere, allowing respondents to express their opinions. Some respondents expressed interest in the solution proposed by the team, while others were negative towards the interactive board, claiming it was unnecessary and indicating that visually impaired individuals often do not understand Braille. The last interview was with the bus driver and consisted of 10 questions and two supplementary questions. The driver conducts courses for the ordering institution during work breaks. The questions pertained to regulations and training at ZTZ Rybnik, voice announcements on buses, driver behavior when transporting visually impaired individuals, how drivers react when they see someone with a white cane at a bus stop, whether they have experience transporting such individuals, whether they have such passengers on their routes, what the most challenging obstacle is when transporting visually impaired individuals, how they identify them at bus stops, whether the carrier provides training on serving individuals with visual impairments, and what is the biggest problem in providing services for visually impaired individuals. The conclusions from the interview indicated a lack of training and regulations, the absence of enabled announcements, and the fact that everything depends on the driver and their level of empathy, as indicated by the driver.

As part of the second stage, the research team utilized the "Path of Darkness" at the Important Place Foundation (Fundacja Ważne Miejsce) in Katowice to empathize with and better understand the target group. Walking along the "Path of Darkness" had the character of "step-

ping into the shoes" of people with visual impairments, as it took place in a completely darkened room, specially prepared for this purpose. Participation in the "Path of Darkness" had a cognitive character, increasing the level of empathy and preparing the team for participant observation, which took place in Rybnik on buses and at bus stops used by the ordering institution. It involved traveling by bus with a visually impaired individual who was accompanied by a guide dog. The public transportation journey included checking the bus schedule at the main station, finding the departing bus stop, boarding the bus, and making a transfer to another bus at Plac Wolności, which also required checking the departure time of the next bus and moving to the appropriate platform. The observation process resulted in recorded videos that we later discussed with representatives of ZTZ. Figure 4 presents the course of the second stage of the study, which involved empathy.

Figure 4 presents the conclusions from this stage. They allowed for a swift modification of some irregularities in serving blind and visually impaired individuals at ZTZ Rybnik.

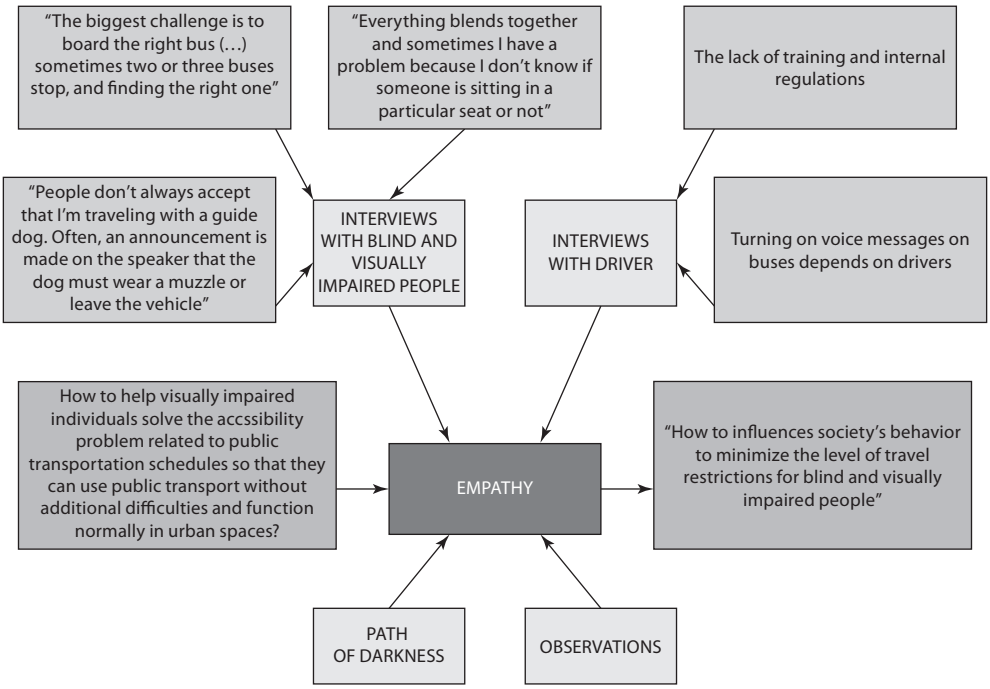

Figure 4. Implementation of the second stage

Source: own elaboration.

Based on the conducted research and the experience gained from the "Path of Darkness," the team modified the solution in the second stage, focusing on driver training with elements of empathy and organizing a competition for the youth using the TikTok platform to engage them in raising awareness and sharing knowledge about assisting visually impaired individuals (as young people represent a group that frequently uses public transportation and have a great possibility of informing their parents and grandparents).

Based on the conducted research, we can conclude that the team designing the social innovation, relying solely on secondary data analysis in the first part of the project developed a solution that was based on an interactive board that would inform the blind and visually impaired individuals about the current bus schedule through voice messages. However, after conducting in-depth individual interviews with people with visual impairments, we reformulated the assumptions of the innovation and changed them because of the different needs of this group, which had emerged during the interviews. The interviews revealed statements such as: "The biggest challenge is to board the right bus (…) sometimes two or three buses stop, and finding the right one;" "Everything blends together, and sometimes I have a problem because I don't know if someone is sitting in a particular seat or not;" "People don't always accept that I'm traveling with a guide dog. Often, an announcement is made on the speaker that the dog must wear a muzzle or leave the vehicle;" "If there is no display board (…) the fastest way for me to find out the schedule is to ask people at the bus stop." The conclusions from the interviews showed that the lack of empathy and awareness among society – fellow passengers and drivers – on how to support and communicate with visually impaired individuals to facilitate their access to public transportation is the biggest challenge. Furthermore, the research revealed that bus drivers lack training or knowledge on how their work and practices affect the accessibility of public transportation. Participatory observations indicated that visually impaired individuals do not allow themselves to be spontaneous during public transportation trips. Applications that are common on the market allow them to plan routes, but they do not help in random situations or when the infrastructure of the bus stops does not meet the requirements of accessibility laws. During a public transportation trip at the Main Station in Rybnik, if there had not been any other passengers, a visually impaired person would not have been able to check the schedule, because it was only available in article form. Moreover, we observed a lack of reactions among fellow passengers and bus drivers when buses arrived at the stop where a visually impaired person was waiting.

Based on the created persona that emerged during the empathy stage in social innovation design and the newly defined needs, we significantly reformulated the solution project significantly reformulated. The innovation took the form of understanding the perspective of blind and visually impaired individuals. The innovation aimed to raise awareness among society – fellow passengers and drivers – on how to support them in bus travel. We based the innovation on evoking empathy and kindness. The innovation's products include training for drivers in the form of experiencing the perspective of a blind passenger and a competition regulation for young people to record a video showing support for blind and visually impaired individuals during bus travel and sharing it on TikTok. The direct recipients of the innovation were young people from Rybnik, Katowice, and the surrounding areas, as well as drivers. The effects of the innovation will indirectly impact blind and visually impaired individuals who use public transportation.

The conclusions from the conducted research allowed us to achieve the article's goal, namely to identify the role of empathy in creating social innovations and to obtain answers to the research questions. Based on the analysis of the described case of social innovation design, we can state that empathy plays a crucial role in this process. Adopting an active attitude of identifying with the users of social innovation by the research team enables them to understand their problems and challenges. Therefore, the empathy stage allowed us to design the social innovation by properly defining users' problems and needs.

Conclusions

Both in the scientific realm and in economic practice, the subject of empathy and social innovation is important and insufficiently explored, especially in Poland. According to the literature, designing social innovations should involve recognizing experiences, motivations, perceptions of reality, and the emotional connection between the innovation designer and its recipients. Empathy plays a significant role not only in the process of creating social innovations. Being a key element of the design thinking process used in various fields of economic practice, it should also effectively contribute to problem-solving in the business, public, or cultural spheres. Research indicates that incorporating the empathy stage is crucial in the context of the final product of social innovation. Adequate recognition of the real needs and limitations of social innovation recipients already at the design stage is essential, yet still not widespread. The high level of social rehabilitation of the subjects was also a limitation of the study. Therefore, to increase interest in the role of empathy in designing social innovation, further research in this area is necessary. However, the publication has its limitations. Above all, we conducted the study on a small sample which constitutes its limitation. However, it provided grounds for the validity of the research problem undertaken. Therefore, future research should aim at expanding the study to a larger number of recipients of social innovation. An intriguing direction for further research in this area may involve exploring the perspectives of experts and social innovators related to the incorporation of empathy into the design of social innovations. The article could contribute to innovation theory by highlighting issues that should be the focus of future research. The study results may also serve as a guide for economic practice, suggesting that a concentrated emphasis on and integration of empathy can significantly enhance the effectiveness and sustainability of projects by better understanding the actual needs of communities. The article can also serve as a guide for the implementation of research with the blind and visually impaired in the preparation of products and services.

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Social Enterprises in Poland in the Face of Recent Crises

Tomasz Gardziński

Abstract: **Background:** The research problem addressed in this study concerns the activities of social enterprises (SEs) within the framework of the social market economy (SME) in Poland during the crises triggered by the COVID-19 pandemic and the war in Ukraine.
Research objectives: The article aims to verify the hypothesis that SEs situated within the SME can mitigate the negative effects of crises by undertaking additional actions for recipients during the pandemic and Ukrainian refugees.
Research design and methods: An interdisciplinary research model helped examine the stated problem. It synthesizes both the concepts of SME and SE. Moreover, part of the research was a nationwide quantitative study using the CAWI method supported by the CATI method and Dilman's prompting method (mixed mode).
Results: During the pandemic in Poland, 56% of SEs took additional actions for recipients, even though the situation worsened for 41% of them. During the war in Ukraine, 68% of SEs took action for refugees, while the situation worsened for 29% of SEs.
Conclusions: Social enterprises experiencing the consequences of crises are also able to minimize their effects. Simultaneously, to an equal extent, they support environmental issues and sustainable development.

Keywords: COVID-19; war in Ukraine; refugee crisis; social enterprise; economic order; social market economy
JEL Codes: L31; H12; I18

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Introduction

Among social enterprises (SE) in Poland, as well as in the EU and globally, we can observe new trends expanding engagement in solving social issues related to ecological matters aligned with the goals of sustainable development, such as climate change, decarbonization, circular economy, short food supply chains, and renewable energy. These appropriate directions of development are very important and necessary. However, particularly, and perhaps above all, in times of crisis, survival becomes the most crucial aspect. Especially since, for a market-oriented enterprise, this is the primary goal in management practice (Drucker, 2011, pp. 67–88). Furthermore, for a SE with a social mission ingrained in its DNA, reacting to pressing social problems should be the primary focus. By approaching these problems in a broader context defined as crises, I identified a research gap and a relatively limited knowledge on this subject in Poland. Hence, the justification for addressing this undoubtedly relevant topic

is the recent crises associated with the COVID-19 pandemic and the war in Ukraine. Despite a significant deterioration in their condition due to the aforementioned crises, SEs in Poland are taking additional actions to support recipients during the pandemic and refugees from Ukraine. While pursuing these priority goals, 68% of SE organizations in Poland simultaneously support actions for ecology, clearly indicating the need to investigate the impact of the crisis on SE and vice versa.

The motivation for undertaking this topic was also the existing research gap in the literature regarding the integration of the concepts of SE and social market economy in the context of evaluating how a social enterprise can complement the shortcomings of the social market economy in Poland (Gardziński, 2021a, pp. 97–152). Hence, this study continues considerations from the article "Social enterprises in Poland during the pandemic" (Gardziński, 2022, pp. 23–47) and the article "Social enterprises in Poland during the war in Ukraine" (Gardziński, 2023, pp. 92–126). I aimed to verify whether SEs located in the social market economy order can eliminate the negative effects of crises by taking additional actions for recipients during the pandemic and for refugees from Ukraine.

The research investigated the activity of social enterprises during the COVID-19 pandemic and the war in Ukraine, which I define with a broader American approach according to J. Brdulak and E. Florczak. This approach focuses on the criterion of directing profits towards social purposes while allowing for any institutional and legal form of such an enterprise. Therefore, we can define a social enterprise as an enterprise that pursues social goals[1] within its appropriate share of profit – significant due to the pursued goal (Brdulak, Florczak, & Gardziński, 2020, p. 34).

The European definition by the European Research Network EMES recognizes a social enterprise as an activity primarily oriented toward social goals, with profits intended to be reinvested in its objectives or the community, rather than for profit maximization or increasing the income of shareholders or owners (Gardziński, & Łabenda, 2020, p.18). They are defined by economic, social, and management criteria.

Currently in Poland, the legally binding definition of social economy and social enterprise stems from the Act of August 5, 2022 on the social economy. Consequently, I adopted this definition for the research. Social economy is the activity of social economy entities for the local community, encompassing social and vocational reintegration, job creation for those at risk of social exclusion, and the provision of social services. The entities conduct it in the form of economic activity, public benefit activity, and other paid activities. Social enterprises can have the status of a social enterprise, as specified in Article 2, points 5a and d–f, as well as a unit creating a social economy entity, engaging in 1) paid public benefit activity, as specified in Article 8, paragraph 1 of the Act of April 24, 2003, on public benefit activity and volunteering; 2) economic activity, as specified in Article 3 of the Act of March 6, 2018 – Entrepreneurs Law (Journal of Laws of 2021, item 162 and 2105, and of 2022, items 24 and 974); 3) other paid activity – provided they meet the conditions specified in Article 4, paragraph 2, Article 5–9 (Act on the social economy, 2022, Article 3, point 1). Social enterprises can also have the status of a social enterprise, as specified in Article 2, points 5a and d–f, as well as a unit creating a social economy entity, if the State Treasury, a territorial self-government unit, a state or self-government legal person, or a natural person do not exercise control over the social economy entity as defined

[1] Social goals reduced to five groups of goals: 1. Economic (enabling functioning in market conditions); 2. Human (quantitative, qualitative); 3. Environmental; 4. Scientific and technological progress; 5. Legal, constitutional, and international.

in Article 4, point 4 of the Act of February 16, 2007, on competition and consumer protection, except for social cooperatives founded by individuals specified in Article 4, paragraph 2, point 2 of the Act of April 27, 2006, on social cooperatives (Act on the social economy, 2022, Article 3, point 2). Chapter 2 of the law on social economy defines the rules for obtaining and losing the status of a social enterprise, as well as supervision over a social enterprise.

The following entities are eligible, to apply for the status of a social enterprise: social cooperatives, cooperatives for disabled and blind individuals, labor cooperatives, agricultural production cooperatives, non-governmental organizations, church legal entities, joint-stock companies, limited liability companies, and sports clubs operating in the form of companies – provided they do not operate for profit – and the unit creating a social economy entity. The activity of a social enterprise serves local development and aims at the social and vocational reintegration of individuals at risk of social exclusion or the provision of social services. A social enterprise must employ a minimum of three workers (under employment contracts or cooperative employment contracts). Moreover, at least 30% of employed individuals must be those facing the risk of social exclusion. However, this condition applies only to entities classified as conducting activities in the field of vocational and social reintegration. A social enterprise must have a consultative and advisory body composed of all employees. The profit or balance surplus generated by the social enterprise through economic and paid activities is not subject to distribution among members, shareholders, stockholders, and employees. In the case of employees at risk of social exclusion, the entity must have an individual reintegration plan, and the employment requires support through funds from the State Fund for Rehabilitation of Disabled Persons (PFRON), the Labor Fund, or actions taken by the Social Economy Support Center (OWES). There is also an obligation to inform employed individuals about the possibility of losing the right to special care allowance. Moreover, the law imposes certain limitations on social enterprises, such as the inability to provide loans. It also specifies detailed criteria and requirements.

Finally, through a survey, the study aimed to demonstrate that the activity of a social enterprise situated in the framework of a social market economy can mitigate the effects of crises, including the effects of the pandemic, by undertaking additional actions for recipients in connection with the pandemic, as well as the effects of the war in Ukraine by taking additional actions for refugees. The research questions also aim to assess how the COVID-19 pandemic and the war in Ukraine have affected the activity of social enterprises and their overall condition.

Literature review

The existing research on social enterprises in Poland posed interpretative difficulties due to the lack of a legally adopted definition of social enterprises. However, on August 5, 2022, the authorities enacted. a law on social economy providing a specific definition. Until then, among the reports on the COVID-19 pandemic and the war in Ukraine in the context of the social economy, we can distinguish the report "Non-Profit Organizations during the COVID-19 Epidemic (March–August 2020)," which I discussed in the article "Social Entrepreneurship in the Pandemic Economic Order." Statistics Poland (GUS) released information on the impact of the COVID-19 pandemic on social economy entities (SEEs) in a signal report: "Activity of associations and similar social organizations, foundations, social entities of religious denominations, as well as economic and professional self-government in 2020 – preliminary results." From this report, we learn that in 2020, organizations took additional measures in response to the COVID-

19 epidemic, benefiting 5.0 million individuals and providing financial and material support worth 850.0 million PLN. The COVID-19 epidemic affected the activities of 74.9% of non-profit organizations (GUS, 2020, pp. 1–4).

Regarding the activities of social economy entities (SEEs) following the onset of the war in Ukraine by Russia, GUS published a signal report "Involvement of Social Economy Entities in Aid Related to Military Actions on Ukrainian Territory (February 24 – March 31, 2022)." The report indicates that from February 24 to March 31, 2022, 28.8 thousand (29.6%) social economy entities engaged in providing aid related to military actions on Ukrainian territory. They provided tangible support to those in need, estimated at a value of 511 million PLN, as well as financial assistance amounting to 140 million PLN.

During the period between February 24 and March 31, 2022, 28.6 thousand non-profit organizations (29.8%) and 0.2 thousand cooperatives (16.9%), belonging to the social economy sector undertook additional actions to assist those in need due to the war in Ukraine. Among the 28.8 thousand engaged social economy entities, 98.1% operated within Poland, and 7.8% operated within Ukraine (GUS, 2022, pp. 1–5).

The primary beneficiaries of the aid provided by social economy entities in connection with the military actions on Ukrainian territory were individuals. The support extended to 67.1% of non-profit organizations and 99.1% of cooperatives declaring involvement in aid efforts. In total, social economy entities provided support to approximately 8.0 million recipients (the same individual could receive assistance multiple times), who were individuals. In total, over 7.9 million recipients benefited from the support of non-profit organizations (GUS, 2022, pp. 1–5). On average, a non-profit organization assisted 477 individuals with the primary forms being tangible aid and provision of meals.

In the context of the crisis caused by the COVID-19 pandemic, the most significant research from the state's perspective is the study titled "Study of the condition of social enterprises, including social cooperatives, in the context of the effects of the COVID-19 pandemic." These studies consist of two parts containing a summary of conclusions, namely "Analysis part I" with a qualitative study (Sowa-Kofta & Wróblewski, 2021a, pp. 4–7) and "Analysis part II" with a quantitative study (Sowa-Kofta & Wróblewski, 2021b, pp. 3–4). The Department of Social and Solidarity Economy (DES) of the Ministry of Family and Social Policy (MRiPS) ordered the research at the Institute of Labor and Social Affairs (IPiSS).

Klon/Jawor Association, represented by B. Charycka and M. Gumkowska conducted the most comprehensive non-governmental research regarding the impact of the pandemic on social entrepreneurship. In three publications, they present the most significant facts. The first report is titled "2020. Non-governmental organizations in the face of the pandemic: Research Report" (Charycka & Gumkowska, 2020, pp. 6–7). The next publication is "Work during the pandemic: Research report on non-Governmental organizations 2020/2021." The following publication by the Klon/Jawor Association was "A year in the pandemic: Research report on non-governmental organizations 2020/2021" (Charycka & Gumkowska, 2021, pp. 6–7).

In the context of the refugee crisis triggered by the war in Ukraine, one of the important reports from research is the report from the Chair of Social Policy at the Faculty of Political Science and International Studies at the University of Warsaw (WNPiSMUW) entitled "Russian invasion of Ukraine: Society and politics in the face of the refugee crisis in the first month of war – Working paper from the chair of social policy" (Firlit-Fesnak et al., 2022, p. 3). This report encompasses research conducted from the beginning of the Russian invasion of Ukraine on February 24, 2022, to the last days of March 2022.

Economic order		Social market economy						
Type of order		Management – the result of decisions					Type of order	
		Institutional governance entities	Planning	Steerage	Financing	Organization	Cooperation policy	Competition policy
Established order (created law economic)	State	Decentralized EU strategy National development strategy Social policy strategy Centralized (socialism) Central planning	Price policy Pay policy Tax policy Monetary policy and currency Market open policy (export policy) Property policy private Employment policy Social policy Social economy social policy Ecological policy	Adoption of the budget Sustainable policy budget Role of the Central Bank Structural funds EU funds Government bonds	Competition policy (anti-monopoly policy) persistence of policy economic income policy Balance policy (2nd and 4th governing principle) freedom to conclude contracts Social dialogue promotion responsibility economic		
	Local government	Strategic planning voivodeship development strategy County development strategy municipal development strategy	Own tasks Ordered tasks Tasks assigned	Task budget of LGU European funds	–		

Policy of order

	Spontaneous order (behavior of business entities)	Social enterprise	Management by objectives strategic planning tactical planning operational planning long-term planning short-term planning	Price policy Implementation of social services Democratic management Priority of work before capital Employee participation Limited distribution profits distribution of innovation creation of jobs Social integration and professional of the local people	Commercial sources: Sales of products and services credits Sureties and guarantees Capital investments Noncommercial sources: Local government funds Government funds Structural funds Eu funds private sources foundations Business Sponsoring	Legal forms Permanent operation Autonomy of operation Bearing risk economical Minimum paid staff	Cooperation order	

Figure 1. A Research Model of the Management Decision-Making Grid of SE and the Ordoliberal Governance of Social Market Economy

Source: own elaboration.

The researchers examined the problem posed at the outset using an interdisciplinary research model, which is a synthesis of both SME and SE concepts. Pro-social concepts combine the macroeconomic dimension with the microeconomic dimension in which SEs can mitigate crises. The investigators created the research model of the decision-making grid[2] inspired by the work of the Polish economist P. Sulmicki (1978), in which there are couplings, i.e. flows of inter-sectoral interdependencies between the entities of the institutional order: the state, local government, market enterprise and social enterprise. For the purposes of examining pro-social issues, the author includes only social enterprises in the model and does not take into account households and individuals, which does not mean that it cannot be extended, including to an international organization such as the EU. The interdisciplinary decision-making grid is an institutional matrix, in which the author, in the theoretical-methodological layer, adopts the synthesis of the theory of economic order with institutional economics and considers the complementarity of the ordoliberal economic order of W. Eucken with the SME of L. Erhard (Mączyńska & Pysz, 2010, p. 66), as well as the proven hypothesis of the feedback loop between the statutory and spontaneous order in the approach of F. A. von Hayek (Pysz, Grabska, & Moszyński, 2014, pp. 14, 66) demonstrated by Polish researchers. The grid, along with its determinants, contains all the ordoliberal principles of the social market economy (Mączyńska & Pysz, 2003, pp. 73–103), namely: constitutive principles, where prices serve as an indicator of the scarcity of goods and resources, the second principle is a stable currency policy, the third is an open market for the "entry" and "exit" of economic entities, the fourth principle is private ownership of means of production, the fifth is freedom of contract, the next is material responsibility for the results of the conducted activity, the sixth is the stability of economic policy, and the last is the coherence of principles understood as their interdependence. The regulating principles are (Eucken, 2005, pp. 295–330): controlling monopolies to ensure competition order, income policy considering income redistribution when glaring differences arise between economic entities, economic accounting, where external effects of enterprises often transferred to society are taken into account, and counteracting abnormal behavior on the supply side.

Researchers conduct a study of the model at the detailed level of detail through reduction by the method of isolating abstraction, i.e. for interdependent sub-orders of the ideal type (e.g. services, industry, agriculture) in a specific place of the managerial decision-making grid. In a logical sense, the interpretation occurs based on the "euckenian" morphological approach, i.e. examining an isolated fragment of socio-economic reality. In the case of studying to solve the research problem posed at the beginning, I limited myself to the place in the grid where only the social enterprise exists, considering the general crisis situation in socio-economic terms. Consequently, I combined methodological individualism with methodological holism, which in the opinion of P. Pysz enables the theory of economic order.

> Methodological individualism proves to be suitable for the analysis of horizontal interactions between market entities realizing individual interests in the process of exchange. On the other hand, the application of methodological holism becomes necessary in considerations related to existing and/or desired economic rules of the game, which together constitute the economic order. (Pysz, 2012, p. 14)

From this perspective, a social enterprise lies within the framework of the social market economy.

[2] A broader description of the research model of the decision-making management grid in: "Methodology of the theory of socio-economic order in the management of a social enterprise" (Gardziński, 2021b).

Research Method and Material

The study conducted from July 22, 2021, to October 29, 2021, focused on 379 entities out of 1630 social enterprises listed in the database of the Department of Social Economy. Figure 2 illustrates them on the left side, quantitatively divided by voivodeships. At that time, the statutory definition was not yet in force. Hence I adopted the definition outlined in the National Program for the Development of Social Economy (KPRES) – a government development program according to the Act of December 6, 2006, on the principles of development policy.

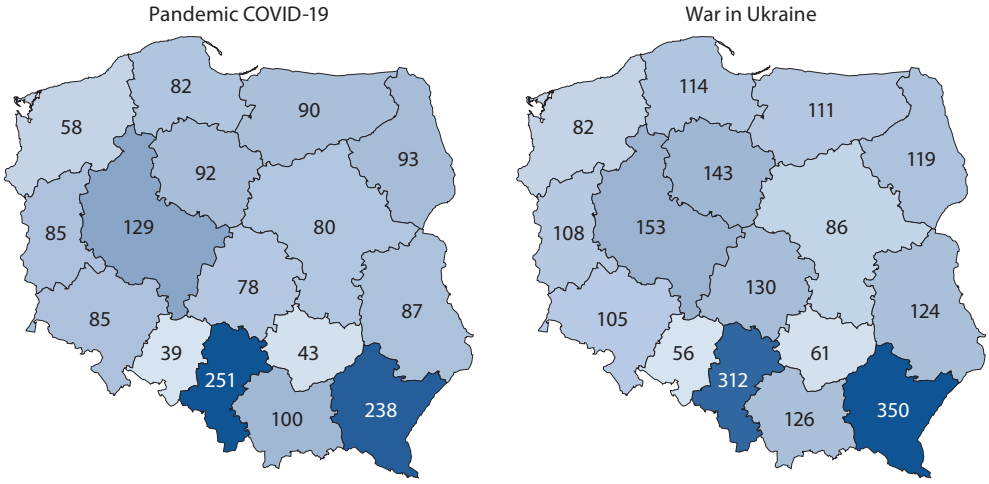


Figure 2. The number of SE on the map of Poland during the pandemic and war in Ukraine

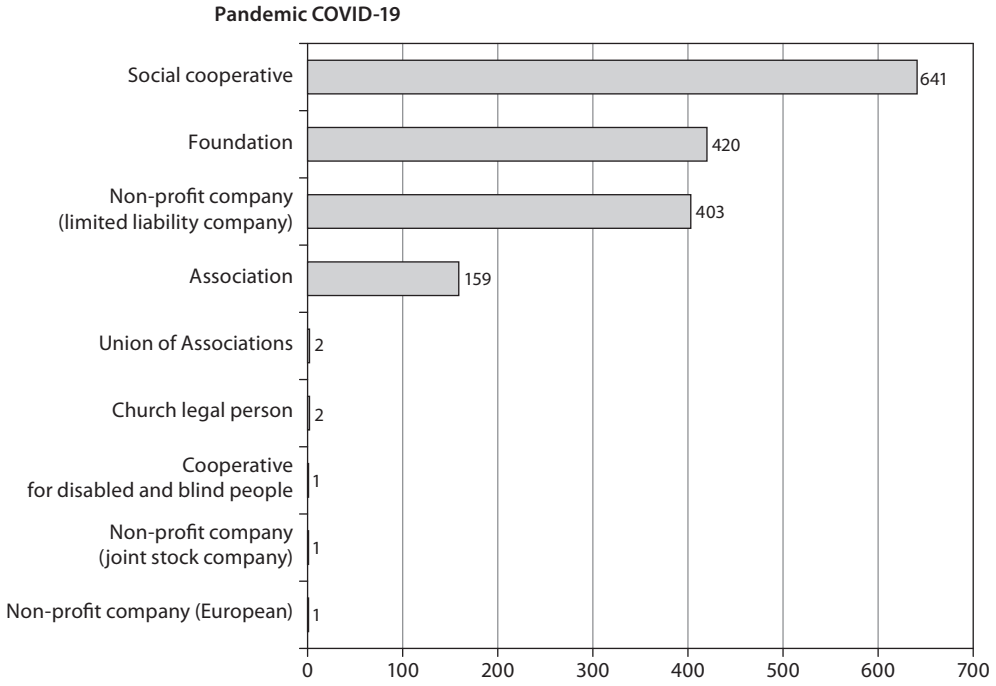
Source: own elaboration based on the DES social enterprise database.

In 2019, the Council of Ministers adopted a document entitled the National Program for the Development of Social Economy until 2023, also known as the Solidarity Social Economy (KPRES until 2023). For the purposes of the study, I adopted the definition provided by the Ministry of Family and Social Policy, which states that non-governmental organizations, social cooperatives, and church entities can attain this status by meeting specific criteria. These criteria include, among others, allocating all profits to social or reintegration activities for employees, employing at least 30% of workers from socially excluded groups, and being managed in a participatory manner (MRiPS, 2021). As of July 22, 2021, the Silesian Voivodeship had the highest number of entities with SE status, with 251 SE, followed by the Podkarpackie Voivodeship with 238 SE. The Opole Voivodeship had the lowest number of SEs, with only 39 entities holding this status.

I conducted the study during the war in Ukraine. Therefore, since the list of Social Enterprises (SEs) – established according to the Act on the social economy – included 550 SEs, I could not include it in my research due to the obvious lack of comparability to the study on SEs during the pandemic, which involved 1630 entities. To address this research problem, I utilized a database of social enterprises containing data on entities operating based on CT9 Guidelines (http://www.bazaps.ekonomiaspoleczna.gov.pl/) active until the end of the project implementation period, i.e., until the end of 2023. The study conducted from April 2nd, 2023, to July 31st,

2023, focused on 378 entities from the database. Figure 2 illustrates this fact on the right side, quantitatively divided by voivodeships. Ultimately, I used the same database in both studies. Moreover, the SE database involved a drawback as authorities remove SEs from the list after the allotted time for their status expires. This does not necessarily mean they cease operations, but rather they choose not to undergo re-verification. This suggests that for some reason, they were not interested in renewing their SE status. For example, among entities that obtained SE status in 2017, 67% had already lost it, and for those that obtained it in 2018, 54% had lost it (Gajewski 2020, p. 35). In summary, between the crisis associated with the pandemic and the war in Ukraine, 550 new social enterprises entered the SE database – Register of Social Welfare Units (https://rjps.mrips.gov.pl/RJPS/RU/start.do?id_menu=59).

Meanwhile, as we can observe in Figure 3, among all Social Enterprises (SEs), four legal forms dominate. The most popular is the social cooperative, with 641 entities during the pandemic on the right side, and 731 entities during the war in Ukraine. Next is the foundation, with 420 and 678 entities respectively. Non-profit company (limited liability company) follows with 403 and 562 entities, and then there are 159 versus 198 associations. The remaining five legal forms had marginal significance, as the quantities range from 1 to 3. This means that in Poland, with the statutory definition of a social enterprise already in place, they most commonly exist in practice in four legal forms: social cooperatives, foundations, non-profit companies (LLC), and in the form of associations.



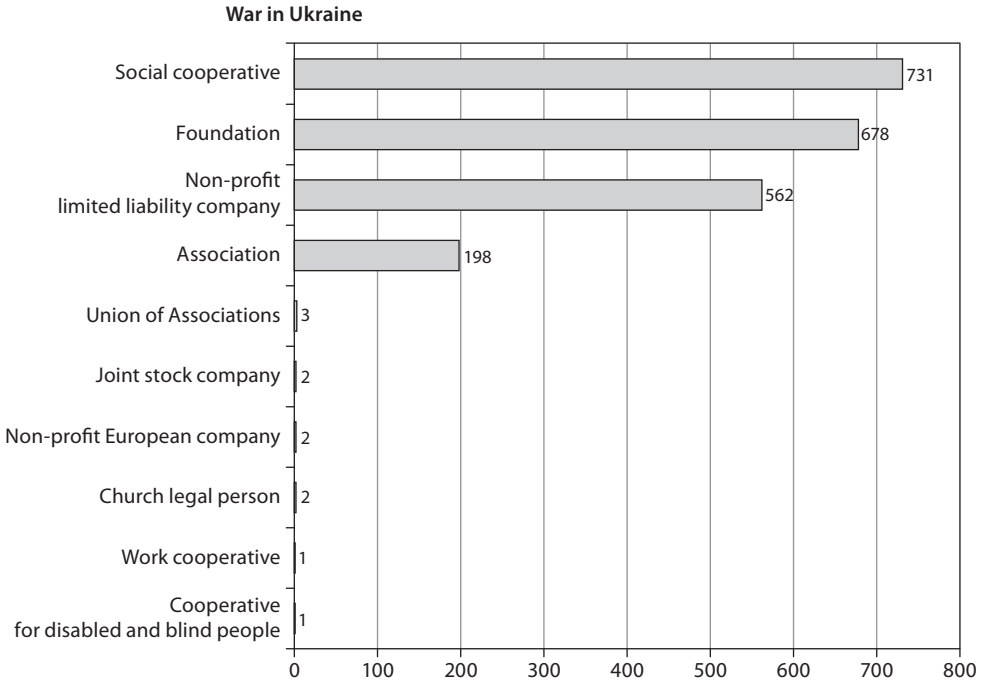


Figure 3. Number of SEs due to legal form during the pandemic and war in Ukraine

Source: own elaboration based on the DES social enterprise database.

The description of the research methods pertains to the study conducted during both the COVID-19 pandemic and the war in Ukraine. I conducted the nationwide study knowing that it may not encompass all social enterprises operating in the economic reality, as some may not be listed in the database or may have been listed but did not return due to a lack of interest in re-verification. Despite this limitation, the research objectives and hypothesis validation justify the selection of the research sample, as well as the adoption of the legal definition and data from the database of social enterprises based on the CT9 Guidelines, due to the small number of social enterprises listed under the provisions of the Social Economy Act. I employed both quantitative and qualitative research methods. Due to the report's constraints, I narrowed down the presentation of results to the most significant outcomes of the quantitative research. I conducted the nationwide quantitative study using the CAWI[3] method, involving individual email invitations to complete an online survey supported by the CATI[4] method following a scripted conversation scenario, known as "mixed mode."[5] I also employed the prompting method by Dilman.[6] To avoid inaccurately filled questionnaires, I conducted preliminary pilot

[3] CAWI – Computer Assisted Web Interview. Method of collecting data among respondents using an online questionnaire.

[4] CATI – Computer Assisted Telephone Interviewing. Method of collecting data among respondents using a telephone interview. The author used the method in the case of the Podkarpackie and Lublin voivodeships due to the geographical location of the voivodeships near the front.

[5] Mixed-mode – using more than one method of collecting data among respondents in one study.

[6] By using Dilman's helping procedure through sample telephone interviews or sending follow-up emails, an average increase in surveys of around 74% can be achieved.

studies in both cases. These allowed for verification, correction, and supplementation of questions included in the survey. The research was multi-stage, beginning with the analysis of existing data through desk research, enabling the preparation of a research questionnaire to verify the research hypotheses. Furthermore, I applied a comparative method, comparing the research results during the war in Ukraine to those from the period of the pandemic. I also used the content analysis method in the case of legal acts regarding the social economy in Poland to assess the possibility of the functioning of the SE in the economic environment.

Complementarity of the Concepts of Social Enterprise and Social Market Economy

In public discourse, scholars often use the words "modern world has derailed" or "jumped off the tracks" from the socio-economic order (Mączyńska & Pysz, 2021, p. 11). Undoubtedly, the event that triggered this after the pandemic was the war in Ukraine, which caused a series of negative macroeconomic phenomena mentioned at the beginning. The refugee crisis is affecting not only social entrepreneurship but also other entities. According to the Kiel Institute for the World Economy (2023, p. 1), the Polish government's aid to Ukraine in January of this year amounted to 3.56 billion EUR, of which 2.4 billion EUR were in the form of military equipment. Meanwhile, Poland's humanitarian aid for refugees from Ukraine, according to the OECD, ranks first among EU countries, with estimates for 2022 amounting to 8.36 billion EUR. Following Poland are Germany (6.8 billion EUR), the Czech Republic (1.96 billion EUR), Spain (1.36 billion EUR), and Romania (1 billion EUR) (OECD, 2022). Moreover, Poland received 700 million PLN from the EU to support Ukrainian refugees and has applied for another 200 million (MSWiA, 2023). Simultaneously, Poland hosts the largest number of Ukrainian refugees among European countries, with over 1.52 million refugees.[7] Germany follows with 1.02 million, the Czech Republic with 464,000, and Italy with 165,000 Ukrainian refugees.

The war in Ukraine and such large waves of refugees impact not only the economic order but primarily national security, upon which the latter is dependent. Despite many justified contemporary reservations from economists, especially regarding fiscal and monetary policies, it is more challenging to shape the economic order when there is a war happening in a neighboring country. However, this does not exempt us from efforts to build an economic order outlined in Article 20 of the Constitution of the Republic of Poland (1997), which states: "The social market economy, based on the freedom of economic activity, private ownership, as well as solidarity, dialogue, and cooperation of social partners, constitutes the foundation of the economic system of the Republic of Poland."

In accordance with the principles of the social market economy and the subsidiarity principle, citizens should receive assistance from the state only when all possibilities of self-help have been exhausted (Dahl, 2015, p. 57). In the case of the war in Ukraine, incoming refugees received assistance and support from the non-governmental sector, local governments, and the Polish society faster than from the Polish state. However, the state created a framework for refugees to access social protections, such as the "500 plus" program, and provided small grants to Polish citizens who opened their homes to refugees.

In practice, all of this means that the concepts of social market economy and social entrepreneurship are complementary. Based on freedom, responsibility, social justice, human dig-

[7] 95% of refugees in Poland are women and children

nity, competition, and the rule of law, the goals of the social market economy largely pertain to the functions of social enterprises operating both within and outside the classical framework of the social market economy (Florczak & Gardziński, 2019, p. 140).

The results of aid provided to recipients during the pandemic, as well as to refugees, indicate a relative leveling of social disparities, and thus a realization of social justice to some extent. In this context, within the framework of the research model being the decision-making grid, social enterprises (SE) in their micro-level functioning realize the macroeconomic goals of the social market economy, among which we can distinguish the following similarities (Brdulak, Florczak, & Gardziński, 2021, pp. 153–164):

- Social aspect – emphasized both in social market economy and SE, with a particular focus on human subjectivity.
- Competitiveness – the social market economy operates within the pursuit of full (effective) competition, hence the importance of also considering the commercial aspect in the case of SE, which, to survive in the market, must maximize the profit necessary for their sustainability.
- Partnership and co-decision-making in SE, manifested in democratic management and cooperation, and in the social market economy understood as genuine partnerships in the workplace.
- The issue of social inequalities is equally emphasized in both the social market economy and SE.
- Subsidiarity and subsidiarity as the central axis uniting both concepts of social market economy and SE.[8]

Results and Discussion

As shown in the figure below (Figure 4), in the overall situation of SEs in relation to the war in Ukraine, we can observe that 238 companies, accounting for 64% of respondents, believe that the situation has remained unchanged. However, for 107 companies, or 29% of SEs, the overall situation has worsened, while 21 companies, constituting 6% of respondents, reported an improvement in their situation. Considering the unfavorable macroeconomic indicators, the overall situation of SEs should be assessed relatively well, as 70% of these entities maintain their status quo. This is an improvement compared to the survey conducted during the pandemic, where 28% of respondents stated that their situation remained unchanged. However, 41% of respondents during the pandemic reported that their situation had worsened, compared to 29% during the war. Nevertheless, one-third of respondents still indicate a deterioration in their situation, driven by successive crises. This should serve as a clear signal to governmental institutions that this sector requires more support than currently provided.

In light of the overall situation of social enterprises in Poland, the outlook for future development appears pessimistic. As Table 1 shows, 58.9% have a more negative assessment compared to 41.1% who see no change or have a more optimistic outlook. Comparing this to the survey conducted during the pandemic, where 85.8% were either optimistic or saw no change, and only 14.1% had a more negative outlook, we can observe a 50% decrease in optimism and an over fourfold increase in pessimism. The crisis triggered by the war in Ukraine directly influenced this significant shift.

[8] A social enterprise is an entity of the "social economy," which we should not identify with the social market economy.

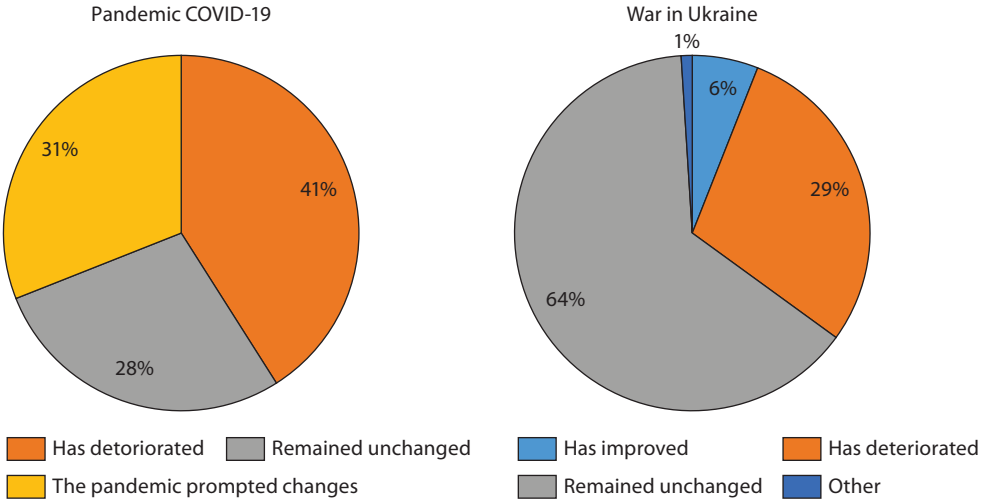


Figure 4. The general situation of SE depending on the period examined

Source: own elaboration based on the results of the CAWI quantitative study.

Table 1. Assessment of Development Opportunities in the Coming Years

Rating	Pandemic COVID-19	War in Ukraine
Negatively	1.5%	13%
Rather bad	12.6%	45.9%
Without changes	13.2%	22.8%
Rather good	48.5%	12.2%
Optimistic	24.1%	6%

Source: own elaboration based on the results of the CAWI quantitative study.

The research has shown that social enterprises took additional actions to support refugees in connection with the war in Ukraine. Figure 5 shows that when asked whether they undertook such actions, 68% of respondents answered affirmatively, while 32% responded negatively. Comparing this to the survey conducted during the pandemic, where 56% of social enterprises took additional actions for their beneficiaries, we observed an increase of 12% during the wartime crisis.

Noteworthy, the lack of engagement in additional activities for refugees by social enterprises primarily resulted from either limitations in their business model (34% of SEs) or insufficient resources (33% of SEs). Some social enterprises focused on social activities unrelated to the wartime events, deeming the assistance provided to be sufficient already (13% of SEs).

Comparing the reasons for not undertaking additional actions during the pandemic period, 43% of respondents did not consider taking actions for their beneficiaries in relation to the COVID-19 pandemic. Moreover, 21% pointed to a lack of sufficient resources and 14% cited insufficient external support. This indicates a significantly greater mobilization and involvement of social enterprises during the war in Ukraine.

However, it is important to note that not every social enterprise should necessarily address the refugee crisis during the war in Ukraine or undertake additional actions for their beneficiaries during the pandemic. Often, their activities focus on other pressing social issues. Social enterprises most commonly emerge in areas where (Florczak & Gardziński, 2020, p. 26):

- the unemployment rate is higher and the permanently unemployed have no chance of finding a job;
- faulty economic structures are unable to modernize on their own;
- defective demographic structures indicate difficulties in the labor market;
- degradation of the natural and cultural functions of the region's resources is recorded;
- poorly developed technical and social infrastructure blocks development processes.

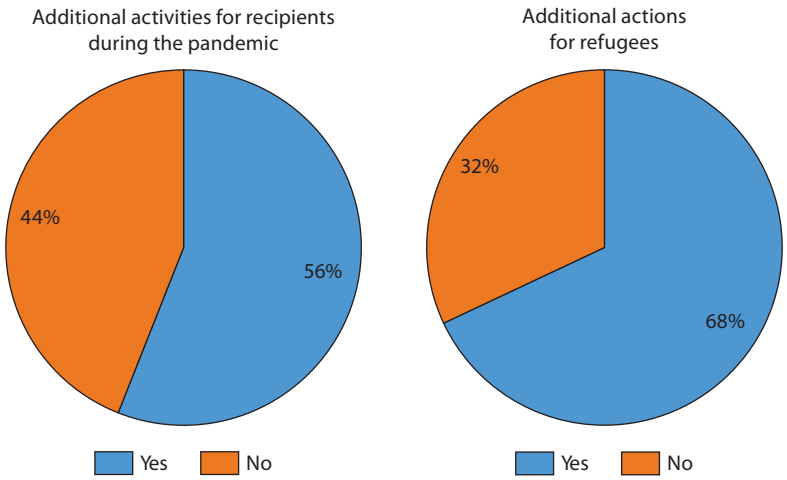


Figure 5. Social entities that took additional actions during crises

Source: own elaboration based on the results of the CAWI quantitative study.

The distribution of entities that assisted refugees from Ukraine as a result of taking additional actions on their behalf is similar to the engagement of the entire society in helping refugees immediately after Russia's attack on Ukraine. Within the first three months of Russia's invasion of Ukraine, 70% of Poles got involved in assisting refugees (Baszczak et al., 2022). Major global media outlets described this as a worldwide phenomenon. This means that in the case of SEs situated in the research model within the spontaneous order, they phenomenally fulfill their social mission by acting to minimize the crisis of the influx of Ukrainian refugees to Poland due to the war instigated by Russia. This also confirms that by providing support to refugees during the war in Ukraine, SEs can assist in stabilizing the economic order in Poland, which has been disrupted by the war.

On the question of the financial support received by SEs, during the pandemic study, some entities declined to provide an answer. However, this time, 82 entities responded, resulting in an average value of 90,000 PLN[9] per social enterprise. From the study, it appears that on aver-

[9] Considering the number of SEs from the database (i.e. 2,180), this gives financial aid estimated at PLN 196 million. However, these estimates are subject to a high probability of error due to the small number of responses.

age, one social enterprise provided assistance to nearly 1000 refugees. The SEs listed in the database supported over 1200 other organizations in providing aid to refugees.

In the case of 81% of social enterprises, the assistance provided to refugees took place in Poland, for 17% of them, it was in both Poland and Ukraine, and 2% of social enterprises offered assistance exclusively in Ukraine. Figure 6 illustrates the type of support provided by social enterprises to refugees, showing that the majority of entities offered material support, followed by providing food, offering employment, and providing informational and organizational support.

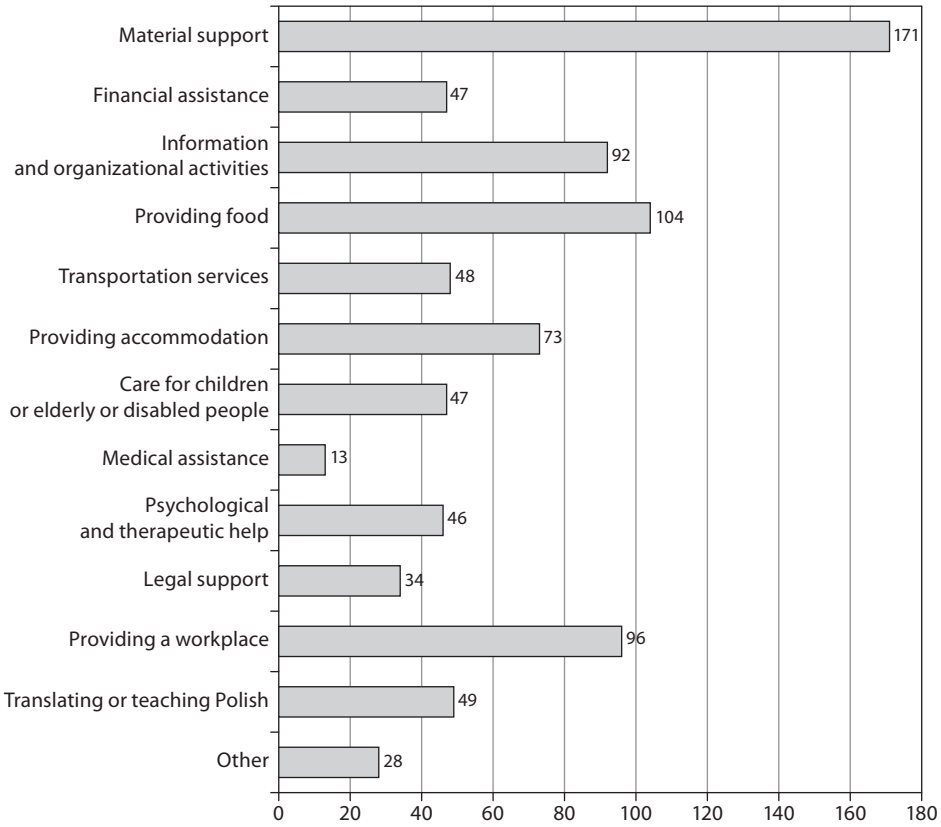


Figure 6. The type of support provided by SEs to refugees

Source: own elaboration based on the results of the CAWI quantitative study.

As shown in Figure 7, in comparison to the pandemic study, social enterprises most commonly indicated providing social services, followed by material support, creating job opportunities, and offering financial support. Noteworthy, both crises involve specific human expectations, and meeting these needs requires specific forms of support to sustain livelihoods.

Ultimately, 64% of respondents confirmed that SEs play an important role in mitigating crises in the modern economic order. This means that social entrepreneurs are aware of their activities that help alleviate crises. However, as the study showed, there is an urgent need for

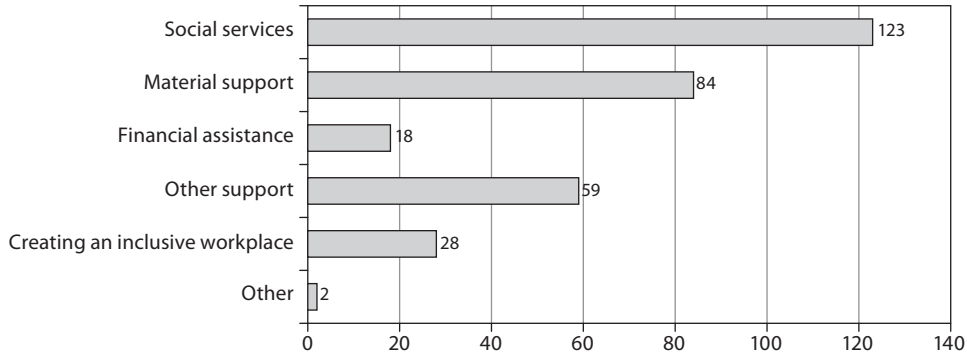


Figure 7. The type of support SE provided to recipients during the pandemic

Source: own elaboration based on the results of the CAWI quantitative study.

further in-depth research on SE in Poland resulting from the growing number of SEs in the database defined in accordance with the Act on the social economy (2022). As of February 11, 2024, there are 862 SEs in the database in accordance with the requirements of the above Act, which is still a small amount compared to the number of the database according to the CT9 guidelines, which at the time of my research was 2,180. In fact, there are more SEs in Poland than in the case of both of the above numerical values meeting the criteria both under the definition adopted by law and under other definitions. The main implication of this is that there is a gap between the theory, practice, and reality of SEs in Poland. To overcome research limitations, we need a broader definition and more legislative work. Thus, research efforts should monitor progress in Poland's social economy sector.

Conclusions

The examined problem constitutes a part of my larger research endeavor. I adopted the main hypothesis that SEs in the social economy sector can minimize the crises' effects. Unexpectedly, I first encountered the period of the pandemic, which began on March 4, 2022. Just when it seemed that the pandemic had caused the largest crisis to date, on February 24, 2022, Russia invaded Ukraine, triggering not only a refugee crisis but also an economic crisis characterized in Poland by an increase in the already high inflation rate, a decrease in GDP, a crisis in the energy market, and a crisis in the agricultural market, starting with grain and recently extending to the fruit market. The scale of the socio-economic crisis would be best captured by assessing the economic order in Poland using the indicator-based method of ordoliberal determinants of SME principles, as the author did in the publication: "Social Enterprise in the Fight Against the Impact of COVID-19 on the Economic Order" (Gardziński 2021a, pp. 246–307). However, due to the limitations of this work, I confined the description of the crisis to a general level. In connection with the stated hypothesis, I could not overlook the largest crisis after the pandemic and conducted another study, which extended the doctoral process but undoubtedly made a greater contribution to the science on this topic. Noteworthy, in the publication "Social Entrepreneurship in the Pandemic Social Market Economy," prior to the outbreak of the war, I warned that the only crisis worse than the pandemic could be war or high inflation (Gardziński, 2021c, pp. 54 and 66). One of the very serious symptoms exacerbating the crisis is

the dangerously evolving conflict in the Middle East. The world is once again threatened by another full-scale war involving "third" countries, and the crisis itself is already revealing its economic effects on the energy market, threatening global recession, and social effects in the form of a humanitarian crisis for the population.

Through the research results, I demonstrated that the situation of social enterprises in Poland during the COVID-19 pandemic, despite causing a deterioration in the overall situation for 41% of them, led to an additional involvement in actions for recipients, with 56% of them participating. During the war in Ukraine, 29% of social enterprises experienced a deterioration in their overall situation. Despite this state of affairs, social enterprises in Poland had a positive impact on minimizing the effects of the refugee crisis, as 68% of them took additional actions for refugees. Furthermore, 64% of respondents confirmed that social enterprises played an important role in mitigating crises in the modern economic order. The above data unequivocally confirms the hypothesis that social enterprises contribute to reducing the negative effects of the COVID-19 pandemic and the refugee crisis during the war in Ukraine. The social economy sector may be gaining increasing importance in the constantly evolving ordoliberal framework of the social market economy in Poland. In this way, supported by the state, commercial social enterprises may become an increasingly important factor in socializing capital and improving socio-economic quality of life. As a result, the effects of self-replicating capital accumulation may gradually undergo socialization (Brdulak, Florczak, & Gardziński, 2019, p. 78). The ecological aspect is also becoming an increasingly important issue (Brdulak, 2014, p. 223). Research shows that 68% support activities for ecology and the same number believe that SE is an element of sustainable development. The same percentage, i.e. 68%, participated in helping refugees from Ukraine, hence the conclusion that the issues of ecology and sustainable development for SE in Poland are equally important. Therefore, socially, economically, and ecologically sustainable social enterprises may be one of the remedies that alleviate crises in the modern economic order.

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Conflict of Interest

The authors declare that the research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

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Multiscalar Institutional Work of System-Building Sustainable Entrepreneurs in Transitioning Coal Regions: A Case of an Energy Cluster

Agata Stasik, Alicja Dańkowska

Abstract: **Background:** Social enterprise is a potential driver of sustainability at the community level in energy sector decarbonization.
Research objectives: We ask how sustainable entrepreneurs' embeddedness in the territorial and institutional contexts of a coal region in transition shapes their ability to exploit sustainable business opportunities, and how they can influence energy transition pathways.
Research design and methods: We introduce the notion of system-building sustainable entrepreneurs, who develop breakthrough niche innovations. Our analytical framework employs a multilevel perspective and multiscalar analysis of institutional work is applied to the case study of an energy cluster.
Results: We identified multiscalar institutional work of SBSEs operating in the niche, presenting the inhibiting and enabling factors at the regime and landscape levels. Although enabling factors created opportunities, they could only be exploited through institutional work.
Conclusions: We identified three key factors shaping the ability of system-building sustainable entrepreneurs to exploit opportunities and shape transition pathways.
Keywords: sustainable entrepreneurs, institutional work, energy transition, multilevel perspective, sustainable opportunity
JEL Codes: D14; G41; G51

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Introduction

Design Nowadays, we face the pressing need to find solutions to the interrelated grand challenges of our times (e.g., Ferraro et al., 2015; George et al., 2016). Thus, there is a growing agreement that the traditional goals of entrepreneurship understood as generating economic growth and financial profit (Kirzner, 1973), albeit often at an environmental or social cost (Pacheco et al., 2010), are no longer viable (Teran-Yepez et al., 2020). These respond to the increasingly widespread recognition that prevailing consumption and production patterns are socially, environmentally, and economically unsustainable, leading to widening social inequalities and transgressing more planetary boundaries (Raworth, 2017). The need to stop climate

change by the joint global effort to decarbonize every area of human activity presents one of the most urgent and complex challenges and thus demands the mobilization of the potential that rests in alternative forms of business and social innovation, including new forms of social entrepreneurship (Wronka-Pośpiech, 2023).

This is of particular significance in the energy sector, shaped by the goal of achieving net zero emissions while preserving and enhancing energy justice (Sovacool & Dworkin, 2015) and creating rich co-benefits for transitioning communities, including members of disadvantaged groups (van der Horst, 2008; Verney et al., 2023). Understood along this line, decarbonization of energy sector encompasses not only socio-technical change, but also creating an opportunity to build more sustainable societies (Wittmayer et al., 2020). Here, social enterprise is recognized as a potential driver of sustainability, particularly at the community level (Hillman et al., 2018; Vernay et al., 2023). While social entrepreneurship focuses on the pursuit of social objectives – e.g., reducing energy poverty – with innovative methods, by creating products, organizations, and practices that yield and sustain social benefits (Austin et al., 2006; Dacin et al., 2011), environmental entrepreneurship connects responses to ecological problems with entrepreneurial activity (Schaper, 2002; Dean & McMullen, 2007). Here, sustainable entrepreneurship, considered as a hybrid of social and environmental entrepreneurship, links entrepreneurs' efforts to resolve societal and environmental problems simultaneously (Shepherd & Patzelt, 2011), and is particularly relevant for actions focused on the transition toward a sustainable and carbon-neutral energy system. The ambition is to tackle both the ecological problem of greenhouse gas emissions and the societal need of energy availability and accessibility for everyone.

One key concept in the literature on sustainable entrepreneurship, and entrepreneurship in general, is the notion of opportunity (Sarango-Lalangui et al., 2018). For innovators and entrepreneurs, sustainable development may be one of the biggest business opportunities in the history of commerce (Hart & Milstein, 1999). In this context, Schumpeterian creative destruction (Schumpeter, 1942) is seen as the ability of entrepreneurs to turn sustainability challenges into entrepreneurial opportunities (Binder & Belz, 2015) to "kick off sustainability transformation" (Hockerts & Wüstenhagen, 2010, p. 488). This has particular relevance in the time of transition toward carbon neutrality.

Against this background, in this study we investigate how sustainable entrepreneurs' embeddedness in the territorial and institutional contexts of a coal region in transition shapes their ability to exploit sustainable business opportunities. Simultaneously, we seek to understand how sustainable entrepreneurs can influence the energy transition pathways through successful development of path-breaking innovations. For that purpose, we introduce the notion of system-building sustainable entrepreneurs (SBSEs) and develop an analytical framework that allows us to follow SBSEs' multiscalar institutional work from a multilevel perspective. We demonstrate how our framework generates new insights on the formation of sustainable entrepreneurial opportunities in the energy transition process by applying it to the case study of a Polish energy cluster operating in a transitioning coal region. To do so, we draw on an extensive analysis of documents, 40 interviews with experts and practitioners in Polish energy policy, and a detailed case study of ZKlaster – an energy cluster operating in the Turów region.

Energy clusters are relatively new initiatives in the Polish energy sector, aimed at creating local energy production and exchange systems (Mataczyńska & Kucharska, 2020). Energy clusters are intended to support hitherto marginalized actors in the energy sector such as municipalities or local entrepreneurs, contribute to optimized local energy management, and develop more environmentally friendly solutions (Dańkowska, 2022). The emergence of energy

clusters, which may be considered an energy community (Horstink et al., 2021), belongs to a relatively recent trend of allowing newcomers to shape the energy system as a means of system decentralization and energy market liberalization.

The concept of SBSEs comes from sustainable entrepreneurship literature, sustainability transition studies, and neo-institutional theory. SBSEs are influenced by shifting institutional conditions and seek to exploit sustainable entrepreneurship opportunities. They aim at influencing the dominant "rules of the game" (Pacheco et al., 2010) by engaging in different types of institutional work. Drawing on the multilevel perspective, we distinguish three levels of analysis: the niche of the SBSEs' efforts, the regime of the Polish coal-based energy system supporting or inhibiting the niche actors, and the landscape containing external factors which influence events and actors at the niche and regime levels (Geels, 2011). By distinguishing between local, regional, and national scales of niche, regime, and landscape developments, we demonstrate the importance of greater spatial sensitivity for a better understanding of the embedded agency of sustainable entrepreneurs (Shrivastava & Kennelly, 2013; Kibler et al., 2015).

The article is structured as follows. In the next section, we discuss concepts that feed into our analytical framework. First, we problematize the concept of opportunity in sustainable entrepreneurship and its institutional embeddedness. Second, we employ the multilevel perspective to differentiate between niche, regime, and landscape levels across local, regional, and national scales. Third, we introduce the concept of system-building sustainable entrepreneurs and discuss the notion of institutional work. This is followed by a description of our study methodology. Afterwards, we present the case study of ZKlaster, showing how system-building sustainable entrepreneurs engage in multiscalar institutional work to build supporting institutional arrangements for their path-breaking innovations. Here, we elaborate on the developments at the regime and landscape levels which hinder and enable SBSEs' efforts. Finally, we offer a discussion by foregrounding how our results advance the scholarly debate on sustainable entrepreneurship and its institutionally embedded agency in the context of regions transitioning from coal. The final section contains the main conclusions of the study.

Literature Review

The Institutional Embeddedness of Sustainable Entrepreneurship

The concept of sustainable entrepreneurship is increasingly examined in the literature (Thompson et al., 2015; Arenas et al., 2020; Ploum et al., 2017), also in the field of renewable energy (Varney et al., 2022; Groot and Pinkse, 2015; Gasbarro et al., 2016). As Hoogendoorn et al. (2019) observe, sustainable entrepreneurs

> start a business to serve self-interests and collective interests by addressing unmet social and environmental needs … [and] fulfil a vital role in society because they offer solutions to complex societal problems that are overlooked, ignored, or unsuccessfully addressed by governments, incumbent businesses, or civil society organizations. (p. 1133–1134)

In line with other sustainability transition scholars, we see energy transitions as complex, long-term, multidomain changes, which require an equal treatment of social, technical, economic, political, and environmental issues (Farla et al., 2012). We argue that sustainable entrepreneurs can significantly contribute to building a transition pathway in the Polish energy sector perceived as a socio-technical system consisting of closely interacting actors such as entrepreneurs, public authorities, and policymakers; institutions, including their legislative, cognitive, and normative pillars; as well as material artefacts and infrastructures (Geels, 2004).

After Munoz and Cohen (2017), we want to move beyond the simplification of portraying sustainable entrepreneurs as autonomous opportunity creators regardless of the relevant conditions and actors influencing the process. Thus, we view sustainable entrepreneurs as territorially and institutionally embedded (de Clercq & Voronov, 2011; Greco & de Jong, 2017; Hoogendoorn et al., 2019), aiming to provide new insights on the formation of sustainable entrepreneurial opportunities in the energy transition process. Drawing on the neo-institutional theory, we ask whether and how institutional conditions can inhibit or foster the discovery, development, and exploitation of opportunities by sustainable entrepreneurs (Lepoutre et al., 2013). In this regard, we build on the existing research on the institutional environment supporting or hampering sustainable entrepreneurship. For example, Groot and Pinkse (2015) analyze institutional barriers perceived by sustainable entrepreneurs in comparison with regular entrepreneurs in terms of financial resources, administrative procedures, and access to information. In turn, Dean and McMullen (2007) focus on market failures such as monopoly power, inappropriate government intervention, imperfect information, and externalities, viewing them as sources of opportunities to make a profit while reducing environmentally damaging economic activities. Munoz and Cohen (2017) introduce the concept of entrepreneurial synchronicity within socio-ecological systems, stressing the vital role of biophysical context as well as informal institutions nurturing the sustainable entrepreneurship process, such as favorable cultural context and social norms supporting the development of new sustainability ventures. Other scholars point to the important role of policymaking (Silajdžić et al., 2015), economic incentives (Clemens, 2006), or government-led knowledge transfer (De Palma & Dobes, 2010).

In this article, we expand the existing research on the institutional embeddedness of sustainable entrepreneurs, recognizing that the institutional structures which frame the opportunity process encompass not only the dominant institutions in the Polish energy sector but also relevant developments in the broader context at the international or global levels. To this end, we employ the multilevel perspective because it allows us to differentiate between three analytical levels of niche, regime, and landscape – discussed in the following section.

The Multilevel Perspective on Sustainable Transitions

The multilevel perspective (MLP) is one of the most important conceptual frameworks in sustainability transition research. The MLP conceptualizes transitions as iterative processes that result from the interactions of phenomena at three analytical levels: niche, socio-technical regime, and exogenous landscape.

First, the niche level can be understood as a locus of radical, path-breaking innovations (Geels, 2011) and a "constellation of culture, practices and structure that deviates from the regime [and] can meet quite specific societal needs, often in unorthodox ways" (van den Bosch & Rotmans, 2008, p. 31). Niches provide a temporary protective space at the initial stages of innovation development, which shields them from prevailing selection pressures (Smith & Raven, 2012). Second, socio-technical regimes encompass specific rules of the game, including all kinds of regulative, normative, and cognitive institutions that represent the deep structure or grammar of socio-technical systems (Fuenfschilling, 2019). The regimes' existence is the reason for the lock-in effect in established systems (Apajalahti & Kungl, 2022), making them stable, path-dependent, and resistant to radical changes (Ruppert-Winkel et al., 2016). Third, the landscape level relates to the wider context, including broader political, economic, and societal trends, which niche and regime actors cannot influence in the short run (Geels, 2011).

The landscape level consists of technical and material artefacts, demographic trends, political ideologies, societal values, and macroeconomic patterns, among other elements (Fuenfschilling, 2019).

Based on this conceptual framework, sustainability transition scholars focus on the interplay of stability and change: on the one hand, they investigate the rigidity and persistence of socio-technical systems, and on the other hand, they examine the evolution and change of those systems. The niche, regime, and landscape levels influence one another in the transition process, which can happen in different ways, resulting in distinct transition pathways.

Importantly, while transition scholars tend to take a conventional view on geography in operationalizing the MLP analytical levels, "equating niche with local, regime with national and landscape with global processes and structures" (Yang et al., 2022, p. 755), a growing number of researchers have recently called for greater spatial sensitivity (Fuenfschilling & Binz, 2018; Hielscher et al., 2022). According to Binz et al., a static approach to the MLP "contradicts state of the art theorizing in human geography, where multi-scalar, relational, and constructivist understandings of scale and socioeconomic processes predominate" (2020, p. 2). In line with this more geographically informed and multiscalar understanding, we analyze the niche–regime interactions at and across different scales, recognizing that institutional arrangements are territorially situated at all levels of analysis (Coenen et al., 2012; Hansen & Coenen, 2015; Murphy, 2015). Such distinct local or regional regime dimensions can play a crucial role in transition processes, opening site-specific windows of opportunity for the possibility of niche innovations to emerge and expand (Longhurst, 2015; Raven et al., 2008).

System-Building Sustainable Entrepreneurs and the Role of Institutional Work

A growing literature on sustainability transitions investigates the enabling role of agency in overcoming the lock-in of socio-technical systems and influencing dominant institutions (e.g., Brown et al., 2013; Farla et al., 2012; van Doren et al., 2020). Recently, scholars increasingly observe that successful sustainable entrepreneurs are able to exert an impact on their institutional environment, as the existing societal norms and values, business environments, public policies, or market regulations inhibit the legitimization and adoption of more sustainable solutions (Thompson et al., 2015; Greco & de Jong, 2017; Munoz & Cohen, 2017; Hoogendoorn et al., 2019). This way, they may play an important role in creating niche innovation and overcoming regime path dependence. However, the ways in which sustainable entrepreneurs engage in changing institutions remain unclear.

In this study, we build on Woolthuis's (2010) distinction between system-following and system-building entrepreneurs operating in niches. Woolthuis argues that the dominant system and market characteristics influence entrepreneurs' strategies for introducing innovations and dealing with regime pressures. System-following entrepreneurs can count on guidance from the government, as well as subsidies for their growth. They comply with the existing regulations and "jump on the bandwagon" of incumbent actors, connecting with vested interests and existing markets. Thus, system-following entrepreneurs do not engage in lobbying, as they largely use proven technologies, adjusting to the widespread norms and values (de Boer et al., 2009). Conversely, when the socio-technical system does not provide niche actors with the needed resources and the dominant market exhibits strong lock-in, system-building strategies become more common.

Hence, we introduce to this study the concept of system-building sustainable entrepreneurs (SBSEs), referring to frontrunners in the Polish energy sector who develop niche innovations, going ahead of the government, anticipating future legislative developments, and moving "beyond what is legally required or accepted as standard practice" (Woolthuis, 2010, p. 511). SBSEs aim to challenge the existing power relations by building networks of politically-savvy players strongly dedicated to lobbying activities and setting new standards. They address the dominant regulative institutions, which they perceive as barriers to the creation and diffusion of more sustainable solutions. Also, they aim to influence cognitive institutions by persuading others to change their mindsets, but also normative institutions by establishing new norms and values to legitimize their innovations (de Boer et al., 2009).

However, to contribute to systemic change, SBSEs' agency must coincide with the opportunities that arise within the broader institutional context (van Doren et al., 2020). In this regard, scholars have recognized that system-building strategies depend on the resources available at the niche level, but also at the level of the socio-technical regime whose institutional structures have a dual nature, able to constrain or enable SBSEs' goals (Farla et al., 2012). According to Geels (2004, p. 907), during transitions "actors interact (struggle, form alliances, exercise power, negotiate, and cooperate) within the constraints and opportunities of existing structures, at the same time that they act upon and restructure these systems." Thus, to better examine what SBSEs could (not) achieve in the energy transition process, we introduce the concept of institutional work, derived from the neo-institutional theory.

After van Doren et al. (2020), we distinguish three main types of institutional work across different scales that mutually reinforce one another: (1) political work aimed at the regulative pillar of the dominant institutions in the Polish energy sector, (2) technical work aimed at the cognitive institutional pillar, and (3) cultural work aimed at the normative institutional pillar. We argue that institutional work is especially relevant for investigating the process of niche evolution and the multilevel dynamics of energy transitions. To support that, we demonstrate how different kinds of institutional work shape the niche actors' ability to impact energy transition pathways across different scales, building both on the innovations developed by SBSEs and the developments at the regime and landscape levels.

Thus, we propose an analytical framework that allows us to understand how SBSEs use their territorial and institutional embeddedness to exploit the opportunities created by sustainable transition processes and to influence the transition pathway. That is possible by focusing on multilevel interactions between the evolving agency of SBSEs and changing institutional environments. We analyze SBSEs' niche-building activities at and across different scales, following the recognition that institutional arrangements are territorially situated at all levels of analysis. This constitutes an important contribution to the sustainability transition literature, as empirical studies of co-evolutionary dynamics between niche sustainable entrepreneurs and institutional change remain scarce (Brown et al., 2013).

Table 1. The Framework: The Multiscalar Institutional Work of SBSEs in the Multilevel Perspective

	Analytical levels		
Scale	Niche	Regime	Landscape
Local	Political work Technical work Cultural work	Inhibiting factors Enabling factors	Changes opening windows of opportunity
Regional	Political work Technical work Cultural work	Inhibiting factors Enabling factors	Changes opening windows of opportunity
National	Political work Technical work Cultural work	Inhibiting factors Enabling factors	Changes opening windows of opportunity

Source: own elaboration.

Research Method and Material

The data gathering and analysis process comprised four essential stages aimed at interpreting the activities of a specific energy cluster at various scales and within the context of multifaceted interactions among niche, regime, and landscape levels. These stages encompassed the following:

- identification and examination of the evolving energy sector in Poland;
- identification and scrutiny of the most active energy clusters in Poland (totaling eight) and selection of ZKlaster (Zgorzelec Cluster for the Development of Renewable Energy Sources and Energy Efficiency) for an in-depth investigation;
- identification and analysis of the actions taken by ZKlaster;
- an integrated analysis of the multiscalar institutional work of SBSEs in the MLP.

Table 2 presents an overview of the data used for stages 1–3 and the most important outcomes for the integrated analysis. The study covered the period of 2015–2022. A detailed description of the data gathering process and a justification of case selection follows.

In the first stage, we gathered data on events that shaped the regime of the Polish energy system and landscape developments relevant to energy clusters' progress. The data included relevant academic, policy, and grey literature, as well as interviews with experts in national energy policy from different sectors. Part of the data was gathered for the SONNET project, serving as the basis for a report on social innovations in the Polish energy transition (Dańkowska et al., 2021). From this data set, for the sake of this article, we included and reinterpreted 13 interviews with experts and practitioners connected to various aspects of the changing energy system. Additional data – 13 interviews with experts in energy policy, as well as academic and grey literature on energy clusters – were gathered for the NCN SONATA project and used for the first time in the analysis presented below. The interviews lasted between 55 and 170 minutes and were conducted between May 2020 and December 2022.

In the second stage, we analyzed data regarding the activity of energy clusters in Poland. The data originated from public registers, scientific publications, industry reports, conferences, industry meetings, materials published by energy clusters themselves, and websites related to energy sector and local development. These data were complemented by 12 interviews with representatives of various energy clusters. The interviews were conducted between April 2020

and November 2022, with durations ranging from 20 to 95 minutes. After the initial analysis of the available data on energy clusters and conducting expert interviews, we identified ZKlaster as an extreme case due to its exceptional level of activity (Patton, 1990) and its location in a transitioning coal region. Thus, an analysis of this case allows us to better understand how SBSEs may exploit opportunities in specific settings shaped by energy transition processes operating in a region that has depended on coal for decades.

Table 2. An Overview of Data Sources for Research Stages 1–3

Stage	Data	Outcome
Analysis of the transitioning energy sector in Poland	Desk research: relevant academic, policy, and grey literature. Expert interviews: 26 interviews with experts and practitioners connected to various aspects of the changing energy system (2020–2022).	Identification of key events on regime and landscape levels creating opportunities for SBSEs.
Analysis of the most active energy clusters in Poland (8); selection of ZKlaster	Desk research: grey literature and reports on energy clusters; clusters' own material (PowerPoint presentations, video materials, public presentations on conferences and industry events). Interviews: 12 interviews with clusters' representatives.	Identification of ZKlaster as an intensive case of SBSE.
Qualitative analysis of ZKlaster's actions	Desk research: intensive analysis of the data available on the Internet from the period 2016–2021. Interviews: two interviews with the leading members of ZKlaster: the founder and the former CEO (December 2020), and the next CEO (June 2021).	Identification of ZKlaster's actions as SBSE.

Source: own elaboration.

After case selection, in the third stage, we gathered detailed data regarding the activity of ZKlaster. We conducted an intensive analysis of the data available on the Internet from the period 2016–2021, employing search keywords "zklaster," "zgorzelec klaster," and "klaster zgorzelecki." The final data set included 43 different text and video materials on ZKlaster, including press articles and interviews with ZKlaster's representatives (e.g., Chojnacki, 2019), PowerPoint presentations (e.g., Fryc et al., 2017), video conferences or webinars (e.g., III Forum Energetyki Rozproszonej, 2021), reports regarding the cluster's activities (e.g., Micek et al., 2021), and web notes (e.g., e-legnickie.pl, 2020). Additionally, we conducted two interviews with the leading members of ZKlaster: the founder and the former CEO (December 2020) and the next CEO (June 2021).

Table 3. The Interviews Analyzed for This Study

Categories of interviewees	Number of interviews
NGO – protection of climate and environment, local actions for decarbonization Academics, experts from think-tanks, consultants, journalists Politicians, representatives of public administrations (serving and former) Representatives of various energy clusters ZKlaster's leaders	8 (interviews 1–8) 11 (interviews 9–19) 7 (interviews 20–26) 12 (interviews 27–38) 2 (interviews 39–40)
Total numer	40

Source: own elaboration.

In the final stage, we imported all collected data to software for qualitative data analysis, MaxQDA, to carry out a deductive coding process. We employed concept-ordered categories and time-ordered categories to analyze the relevant developments over time (Miles & Huberman, 1994).

The category system underlying the coding scheme resulted from the choice of institutional work and the MLP as a key concept building a framework to understand SBSEs' actions. Thus, it was based on the following data structure:

- Types of SBSEs' institutional work based on a typology according to van Doren et al. (2020) distinguishing political, cultural, and technical institutional work.
- Scales of SBSEs' institutional work (Yang et al., 2022), divided into a local scale concerning activities within ZKlaster, a regional scale concerning the SBSE's work at the level of the Turoszów Sack subregion, and a national scale covering the SBSE's efforts at the national level. That allowed us to point out the importance of sustainable entrepreneurs' embeddedness in the territorial and institutional contexts of a coal region.
- The regime's impact on SBSEs operating in a niche. In line with Geels (2011), we analyzed both the positive impact that encouraged the actions of niche actors and the negative impact that inhibited those efforts. Similarly to niche actors' institutional work, we analyzed the regime's impact at different scales: local, regional, and national (Yang et al., 2022). The impacts that encouraged the actions of niche actors created opportunities in the transition process.
- The landscape's influence on SBSEs operating in the niche. In line with Geels (2011), we focused on the positive impact that supported the actions of niche actors, as according to the MLP, landscape-level events open windows of opportunity for niches to emerge and grow, and thus create opportunities for SBSEs in the transition process. We analyzed the landscape impact at different scales: local, regional, and national (Yang et al., 2022).

Results and Discussion

ZKlaster as a System-Building Sustainable Entrepreneur

The strategic document "Polish Energy Policy Until 2040" recognizes the important role of energy clusters in the decentralization and decarbonization of the Polish energy sector, which is strongly locked-in and highly coal-dependent: still, over 70% of the national demand for electricity in Poland is covered by coal-fired power plants (Wiśniewski, 2022). The concept of an energy cluster was introduced to Poland's Energy Law in 2016, however, due to severe legal constraints, most energy clusters remain in limbo, waiting for the institutional environment to change (Dańkowska & Stasik, 2021). Against this background, the Zgorzelec Cluster for the Development of Renewable Energy Sources and Energy Efficiency (ZKlaster), which is the focus of our analysis, stands out with its proactive attitude. ZKlaster was the third energy cluster created in Poland and is currently widely regarded as one of the most successful initiatives of this kind (Kurowicki et al., 2022).[1] Due to the lack of favorable legislation and financial support, ZKlaster developed a strong business profile, which enabled it to build the necessary know-how and mobilize resources to conduct its activities despite the difficult institutional condi-

[1] With regard to the recently published media reports (Rzeczkowski, 2024) about possible links between ZKlaster's leaders and Russia, we wish to state that we were not aware of any such allegations at the time of the study. While these are serious allegations, we believe that they do not affect our analysis and findings, which relate to the organizational mechanisms of the cluster and not to its funding sources.

tions. Therefore, after Schaltegger and Wagner (2011), we term the efforts of ZKlaster's change agents contributing to "solving societal and environmental problems through the realization of a successful business" (2011, p. 224) as sustainable entrepreneurship.

ZKlaster operates in the Turoszów Sack subregion, next to the border with Germany and the Czech Republic. The Turoszów Sack is a coal subregion with an open pit mine and the Turów coal-fired power plant functioning since 1962. The Turów energy complex accounts for five percent of the Polish electricity production, being an important part of the national electricity system. Although the region suffers from the negative environmental and social effects of coal mining and combustion, the concession for the Turów coal mine has recently been extended until 2044. At the same time, however, the Polish energy system, and coal regions in particular, are increasingly influenced by external factors fostering decarbonization, such as the EU energy and climate policy or the shifting international markets for fossil fuels and renewable energy sources (RES). Thus, there is a clash between two tendencies in the Turów region: to continue business as usual, supported by incumbent actors and, to a large extent, local communities; or to accelerate green transformation, supported, among others, by sustainable entrepreneurs from ZKlaster and EU policies.

Against this background, ZKlaster was formally established in March 2017 by representatives of local governments, local entrepreneurs, and an expert from a technical university. The cluster's founders defined it as "a civil-legal agreement to build a local market for electricity and thermal energy based on local RES resources, supported by the development of stable high-efficiency cogeneration units using the most efficient and cleanest technologies available" (Fryc et al., 2017, p. 3). ZKlaster was the third energy cluster created in Poland and is widely regarded as one of the most successful projects of this kind (e.g., Micek et al., 2021). As the former CEO of ZKlaster emphasizes in an interview, the cluster's beginnings date back to 2015, when several entrepreneurs and innovators initiated efforts to build the region's first photovoltaic farm. From the beginning, the cluster operated as a business venture:

We decided to choose the most effective model, which is a business based on private capital. It is the strongest entity. We approach it like entrepreneurs: we have a mission and we implement it with business tasks. And that has been the key to success. … It allows the cluster to operate with more momentum and a kind of freedom. (Interviewee 39)

ZKlaster's leaders realized that the dynamic development of an energy cluster was only possible through an active effort to make room for investments in renewable energy in the region, the development of advanced technologies, as well as reaching beyond the local and regional focus and engaging in cooperation with other actors at the national level to foster the development of distributed energy in Poland.

In this section, we present how ZKlaster exploited opportunities in the sustainable transition process by engaging in political, cultural, and technical institutional work in relation to multilevel dynamics between niche, regime, and landscape levels across different scales. That allowed it to act as a system-building sustainable entrepreneur, using the transformative potential of niche innovations in the context of coal regions.

Table 4 sums up the multiscalar institutional work of SBSEs operating in the niche, presenting both the inhibiting and enabling factors at the regime and landscape levels. Although the enabling factors created opportunities, they could only be exploited through institutional work. The high intensity of inhibiting factors implies that the pioneering energy cluster must act as a system-building, not system-following sustainable entrepreneur.

Table 4. The Multiscalar Institutional Work of ZKlaster in the Multilevel Perspective

	Niche	Regime	Landscape
Local	Political work: building a coalition around an energy cluster and hands-on learning about the required legislative changes. Technical work: a smart microgrid demonstration project. Cultural work: changing the social attitudes of local communities toward RES.	Inhibiting: – DSO's hostility toward ZKlaster; – lack of dedicated funding and proper legislation; – negative attitudes of local communities attached to coal-based economy. Enabling: – introducing an energy cluster and an auction system to the RES Act; – establishing the Competition for Pilot Energy Cluster Certificates; – grid congestion problems (which ZKlaster aimed to solve); – increasing public acceptance for RES.	Developments in clean energy technologies. International social movements fostering the green energy transition pathway.
Regional	Political work: coordinating the regional transition committee. Technical work: expert analysis of replacing the coal mine with a pumped-storage plant. Cultural work: changing social attitudes toward the green transition of coal region.	Inhibiting: – continued operation of the Turów lignite mining complex: extension of the operating license until 2044.	CJEU ruling on halting the Turów coal mine. EU's Platform for Coal Regions in Transition and Just Transition Fund.
National	Political work: networking and lobbying for legislative changes. Technical work: planned distribution of ZKlaster's green energy to the national power system. Cultural work: changing social attitudes toward dispersed energy and the role of energy clusters in the Polish energy system.	Inhibiting: – lack of the coal phase-out date; – misalignment between energy infrastructure designed for centralized energy system and RES development. Enabling: – launching the KlastER Project; – "Polish Energy Policy Until 2040" and the vision of creating 300 "autonomous energy regions" based on the energy cluster model; – general public opinion support of green transition.	EU's Clean Energy for All Europeans Package (CEP) and the revised Renewable Energy Directive (RED II) introducing new rights for energy communities. EU funds for the development of dispersed energy.

Source: own elaboration.

Below, we present in detail how SBSEs from ZKlaster exploited opportunities and shaped transition pathways by engaging in political, technical, and cultural institutional work, and in what ways this was inhibited or supported by external factors at local, regional, and national scales. Each section begins with a description of relevant developments across levels – on the regime and landscape levels – followed by a description of ZKlaster's actions.

Political Work Across Scales: Building Coalitions and Lobbying for Legislative Changes

In 2017, the Ministry of Energy issued an open call for energy clusters to grant ministerial certificates to the best and most promising initiatives. Some of our interviewees observed that certified energy clusters were to be the first to receive financial support for their projects (Interviewees 6, 11, 19). However, after the initial enthusiasm of clusters' representatives who decided to apply for the certificates, they discovered that the public financial support did not follow, and that the legal form of an energy cluster did not allow them to carry out their plans (Interviewees 20, 22). Soon, it became apparent that the vast majority of certified energy clusters functioned "only as a PowerPoint presentation" (Interviewee 8). As our document analysis revealed, to understand better the barriers and opportunities for cluster development, the Ministry of Economic Development and Technology launched the project "Development of Distributed Energy in Energy Clusters" (KlastER) (2019–2022), which served as a platform for experience exchange, knowledge generation, and visioning on the future of energy communities in Poland. The most important problems identified in the project included the lack of energy clusters' legal personality, dedicated legal solutions – for example, regarding the trade of electricity between cluster members – and public funds, as well as unregulated relations with Distribution System Operators (DSO) (Micek et al., 2021). Similarly, according to ZKlaster's representative, "in the current reality, the biggest problem is the energy legislation in Poland. Not only is it unsuitable for the development of distributed energy but it is also terribly complicated" (as cited in Chojnacki, 2019).

In this context, the EU policy enforcing goals on the proportion of renewable energy in the national energy mix and introducing energy market liberalization played an important role. The Clean Energy for All Europeans Package (CEP), agreed upon by the EU Council and the European Parliament in May 2019, allowed citizens to become active and central stakeholders in the energy markets by creating energy communities that jointly produce, store, consume, and sell energy. On this basis, the Directive (EU) 2018/2001 (RED II) specified the concept of a renewable energy community. According to several of our interviewees, these developments contributed to a shift in the Polish energy sector (Interviewees 5, 12, 16). Ultimately, it influenced the national energy strategy "Polish Energy Policy Until 2040," which emphasized the key role of energy clusters in creating 300 "autonomous energy regions" able to balance their energy production and consumption. Nevertheless, our interviewees stressed that the strategic documents did not provide clear guidance for energy cluster functioning.

Against this background, ZKlaster's ex-leader decided to establish and lead the National Chamber of Energy Clusters. It was launched in April 2020 with the aim to gather Polish energy clusters, represent their interests, facilitate know-how exchange, and "allow clusters to unite and be more visible … [as] large lobbying organizations" (Interviewee 24). The Chamber representatives took part in consultations in relevant ministries, and published opinions and recommendations on desirable policy development in the energy sector. The main postulates of the Chamber included expectations of simplifying the rules for energy clusters' operations, giving clusters the status of a full participant in the energy market, and facilitating the use of existing energy network infrastructure by clusters. Notably, as ZKlaster's ex-CEO stated in our interview, the Chamber developed its recommendations based on experiences from the ZKlaster's operations. For example, the document on current barriers to photovoltaic investments was largely prepared drawing on the lessons learned in ZKlaster:

> We were guided by the experience of our members, in particular ZKlaster that is building the largest photovoltaic farm in Poland. We want to show the directions and legal solutions that will not only promote investments but also enable a just energy transition. (as cited in energia.rp.pl, 2020)

Thus, setting up a functioning energy cluster and engaging in specific local struggles enabled SBSEs to partake in institutional work by indicating the necessary kinds of legislative changes, such as regulating the relations with DSOs or introducing special tariffs for energy distribution within an energy cluster.

Moreover, ZKlaster engaged in political work at the regional scale, drawing support from the EU. In December 2017, the European Commission established a platform for Coal Regions in Transition (CRiT) with the aim to develop regional energy transition strategies toward low-carbon economies in cooperation with local communities and experts. In July 2019, ZKlaster became a coordinator of the Regional Committee for Transition (Interviewee 25). The Committee was established to cooperate with the European Commission in preparing the region for the transition and obtaining funding from the Just Transition Fund. The latter was formed within the Just Transition Mechanism launched in January 2020 to support coal regions that could receive financial support for their energy transition plans. Consequently, ZKlaster became the region's official representative on the EU arena. In this context, as ZKlaster's CEO stresses in our interview, the cluster needed to skillfully manage its relations with European institutions, such as the European Commission and relevant Directorates-General (DG Energy, DG Regio). The cluster's efforts soon received a favorable reception from important European politicians, such as Jerzy Buzek, Poland's former Prime Minister and MEP, a co-initiator of the Just Transition Fund, who said:

> You are perfectly prepared for the inevitable changes that will take place in Europe and Poland in the coming years. I have not heard of any Polish region, or even German or Czech regions, being so comprehensively prepared at the local level for the challenges that lie ahead. The sophistication that I see in you is a fantastic argument that I will be using [in the European Parliament]. (as cited in Zamorowska, 2020)

This kind of endorsement from strong transnational allies clearly supported the political institutional work of SBSEs.

ZKlaster's CEO claims in an interview that ZKlaster had an ambitious vision of the post-coal region, where the mine and power plant would be replaced by renewable sources. Clean energy was expected to become a flywheel for the regional economy, attracting large, energy-intensive companies that would offer new jobs. According to ZKlaster's ex-CEO, "where there are no green solutions, no economic zones will be created, as no one will bet on high-emission technologies" (Interviewee 39). He also notes that a holistic transition strategy was necessary to gain the residents' support, creating a sense of security and addressing their concerns about job losses:

> People need to be made aware that the process ahead of us is inevitable, but they need to have comfort that they are not left alone, that local governments are prepared for this and are thinking about how to create jobs. (as cited in Gramwzielone.pl, 2021a)

Moreover, ZKlaster's CEO observes that the cluster's involvement in the regional transition became even more important when, in February 2021, the government of the Czech Republic filed a lawsuit against Poland to the Court of Justice of the European Union (CJEU) regarding the negative impact of the Turów mine on the state of groundwater in the area. As a result, the CJEU ruling obliged Poland to immediately halt coal mining in Turów, pending judgment. Although the Minister for Climate and Environment extended the concession for the Turów

coal mine until 2044 despite this order, the local stakeholders' recognition of the need to seek viable solutions to replace the coal industry has become higher than ever before.

Technical Work: Providing Expert Analyses and Developing Demonstration Projects

An important development that prepared the ground for Polish energy clusters to emerge was the introduction of an auction system for renewable energy investments (Iskandarova et al., 2021). It was enacted in February 2015 as a part of the RES Act, enabling the first major RES investment in Zgorzelec County, which involved the future members of ZKlaster (Interviewee 39). Several years into ZKlaster's functioning, the installed capacity of all its photovoltaic farms reached almost 100 MW.

However, as ZKlaster's CEO states in an interview, to use the real potential of cooperation in the energy cluster, its goal was not only to erect new solar power plants, but also to build an efficient local energy market. The cluster aimed to operate in an energy billing system connecting electricity producers with consumers based on real-time demand and data flows managed by AI algorithms. This way, the system would guarantee attractive prices for both sides of the transaction while simultaneously serving as a power control unit able to reduce the load for the central electricity grid. To make it possible, ZKlaster undertook research and development efforts to set up a smart grid demonstration project. As a pilot project, it operated at a low capacity of 56 kWh and, due to legal barriers, energy was not sold to users as part of the experiment. The second stage of the project development aimed at allocating surplus energy to the production of computing power – High-Performance Computing – and selling it translocally (Interviewee 40).

According to ZKlaster's ex-CEO, the primary objective of this local experiment was to prove that energy clusters could perform a critically important function in the national system by relieving the growingly congested national grids. A ZKlaster's representative admitted: "Above all, we hope that with the data we collect from this experiment, we will be able to defend the idea of energy clusters altogether" (as cited in Gramwzielone.pl, 2021b). Consequently, although the cooperation between ZKlaster and DSO Tauron Dystrybucja was initially difficult, the demonstration project enabled ZKlaster to strengthen its negotiating position. ZKlaster's representatives state in the interviews that the DSO became keen to cooperate with the cluster because with the growing number of prosumers feeding surplus energy into the national system grid, operators began to have trouble maintaining adequate capacity. ZKlaster's ex-CEO explains:

> We can see that with local generation and consumption based on the smart grid we are able to relieve the burden on the national power system. … This could be an ideal example of how local energy can affect the national power system. (as cited in Gramwzielone.pl, 2021b)

Consequently, a ZKlaster's representative stresses: "We've stopped being treated as a direct enemy by these distributors already. Well, they don't have [an option], they just have to cooperate with us" (Interviewee 40). This change of attitude shows that the energy system incumbents have started to accept that energy clusters will become an important part of the transforming system, and look for possibilities for their integration with the system.

On top of that, SBSEs engaged in technical work by producing expert analyses indicating ways in which one can creatively leverage the material coal infrastructure for the development of stable RES. In this regard, experts from ZKlaster together with partners from academic institutions developed a project for large-scale investment in a pumped-storage hydroelectricity plant on the site of the Turów open-pit mine after its phase-out (Interviewee 25). Moreover,

ZKlaster's CEO admits in the interview that the cluster's long-term goal is to take over the distribution and transmission lines built for the purpose of power output from the Turów power plant to the National Power System. This way, the energy cluster's embeddedness in the territory shaped by and for conventional energy became creatively reinterpreted as an asset and not an obstacle in ZKlaster's operations.

Cultural Work: Influencing the Existing Identities and Creating a Success-Story Image of ZKlaster

From the very beginning of its functioning, ZKlaster got involved in the collective effort of remaking the regional identity in the Turoszów Sack, where, as one of our interviewees states, "three generations were brought up on a coal culture" (Interviewee 39). Historically, the regional economy was strongly tied to the coal industry, but as the sector was gradually shrinking, much of the region did not see economic development in years (Micek et al., 2021). As ZKlaster's ex-CEO observes, early in the cluster's development, green energy was widely seen as a threat to coal-based energy production, evoking negative emotions in the local community, strongly connected to the coal industry. However, as the EU pressures toward the phase-out of mining increased, ZKlaster became a growingly important player engaged in the co-creation of the vision for the region's post-coal future. In this aspect, the cluster reached beyond its business orientation, seeking how to combine its business goals with solutions beneficial to other local stakeholders, such as municipalities and workers of the declining industries. Notably, one interviewee from ZKlaster stresses: "We were the first to notice the problem of transformation of the region, and called: wake up, local governments!" (Interviewee 24). According to Micek et al. (2021), the problem was a widespread belief among local officials that the national government and large energy companies should make all the key decisions in the domain of energy.

A remarkable milestone in the development of trust between ZKlaster and local government officials took place in May 2018, when ZKlaster was awarded the Pilot Energy Cluster Certificate by the Ministry of Energy. ZKlaster's ex-CEO mentions that since he could use a business card with the ministerial logo and the inscription "Certified Energy Cluster," the attitude of local officials changed entirely as they became much less skeptical about the idea of energy clusters.

Moreover, ZKlaster actively promoted its achievements at the national level, presenting itself as a pioneer in the development of the latest technologies and innovative solutions for RES. In the media and at numerous trade events, ZKlaster representatives proudly presented multiple projects accomplished in Poland for the first time: an off-road electric vehicle, a hybrid medium voltage line, the first company belonging to an energy cluster to obtain a license for energy distribution, a microgrid based on renewable sources and energy storage, or the largest photovoltaic farm in Poland. As ZKlaster's CEO claims in the interview, the cluster served as a model for new energy clusters by sharing its best practices, know-how, and operational strategy. ZKlaster's ex-CEO stated that the cluster's ambition was to inspire similar initiatives: "We hope that our projects will be an example for other regions, not only in Poland but also in Europe" (as cited in e-legnickie.pl, 2020). Creating the ZKlaster's image as a success story was supposed to win further allies at the local, regional, national, and international levels, and encourage other clusters to imitate this organizational model, which in turn would reinforce the cluster's bargaining position in lobbying for favorable legislation. These efforts proved successful: ZKlaster became widely regarded as a model energy cluster in Poland, as reflected in leading politicians' statements. Krzysztof Kubów, Deputy Minister for Energy, noted:

> Since the beginning, I have been observing the development of the Zgorzelec Cluster with great satisfaction. I am very appreciative of its members' achievements. I believe that the success of ZKlaster is an example for such entities in the whole country. (as cited in PowiatZgorzelecki.pl, 2019)

Similarly, the Government Plenipotentiary for Renewable Energy Sources, Ireneusz Zyska, stated that ZKlaster's ex-CEO was "the leader of an energy clusters' environment on a national scale. We would like to present the investment here [in ZKlaster's photovoltaic farm] as a model example which could be replicated in other places in Poland" (as cited in Serwis Samorządowy PAP, 2020).

Moreover, this intensive PR campaign was underpinned by education and information projects for local communities, fostering the "green regional identity" development. ZKlaster also actively engaged in local sponsorship, for example, by funding a photovoltaic installation for a local primary school, providing electric cars with free charging to a nongovernmental organization, making its computing units available to fight the COVID-19 pandemic, or funding solar streetlights in a village where ZKlaster built its photovoltaic farm. This way, ZKlaster gained more social acceptance for its further local development and the energy transition of the coal region. In this context, the dynamic growth in the number of prosumers nationally and the increasing public support for RES – to a large extent inspired by international climate movements – were also highly relevant (Hielscher et al., 2022).

Conclusions

In this article, we proposed and applied an analytical framework that allows one to understand how sustainable entrepreneurs can exploit the opportunities emerging in the sustainable transition process and how they can influence transition pathways. We claim that, to this end, one must scrutinize sustainable entrepreneurs' engagement in political, cultural, and technical institutional work in relation to multilevel dynamics between the niche, regime, and landscape levels. Moreover, it is important to investigate how they act and use the resources coming from across different scales. The same analytical framework may serve to follow the activities of other types of social entrepreneurs in the sustainable transition process. Still, we claim that sustainable entrepreneurship is particularly relevant in decarbonization because it jointly addresses the environmental concerns – that is, the effort to radically reduce greenhouse gas emissions – and the social concerns, namely just energy transition and energy justice.

The case study of ZKlaster shows how sustainable entrepreneurs in a coal region developed system-building strategies in response to the incumbents' multiscalar attempts to maintain the coal-based status quo, skillfully using the emerging windows of opportunity for sustainable business to develop. We demonstrated how SBSEs engaged in political, technical, and cultural institutional work by lobbying activities, developing new technological solutions, and promoting new vision of the region's post-coal future. Our study adds to the sustainability transition literature by enhancing the understanding of how innovations emerging in a niche can gradually influence the dominant regime structures. We showed that to better grasp this phenomenon, it does not suffice to observe internal niche processes. What is equally important for "system-building" strategies (Farla et al., 2012) is the actions of niche actors who skillfully win their place among the existing institutions by taking advantage of the possibilities that emerge as the windows of opportunity start to open.

The case study allowed us to identify three key factors that shaped the agency of sustainable entrepreneurs in ZKlaster to identify, develop, and exploit sustainable business opportunities.

First, the sustainable entrepreneurs' territorial embeddedness in a coal region proved both hindering and enabling for their efforts. Previous studies (e.g., Dańkowska & Sadura, 2020) recognize that the regime's strength is especially evident in coal regions, where the coal industry has contributed to the production of local economies and identities, including the pride in powering the national industry and the resulting difficulty in imagining an alternative, attractive vision of the regions' future after phasing out coal. Nevertheless, our results show that the context of a coal region can both hinder and enhance the sustainable entrepreneurs' agency to identify, develop, and exploit sustainable business opportunities. On the one hand, the coal regime lock-in is particularly strong in these settings but, on the other hand, there is increasing external pressure for regional decarbonization, in which sustainable entrepreneurs can play a leading role. The growing landscape pressures – mainly EU climate and energy policies – become visible first and foremost in coal regions as they threaten the local institutions that order everyday life. The decision issued by the Court of Justice of the European Union that mining at the Turów open-pit mine must cease immediately is the most notable but not the only sign of this process, which motivates local actors to explore different transition pathways. Furthermore, at the time of the growing decarbonization pressures, coal region-based niches that develop solutions for a low-carbon future receive the biggest support from EU mechanisms. The possibility to reach dedicated funds motivates local and regional actors from different sectors – including local government representatives – to further engage in cooperation with niche actors and co-create the vision of the regional energy transition. This way, niche actors who act against the coal-based socio-technical regime may use their embeddedness in the coal region as an unexpected asset, which eventually amplifies their impact. In demonstrating this dual implication of the territorial embeddedness in a coal region viewed as a dynamic geo-social space (Munoz & Cohen, 2017), our research contributes to place-based approaches to studying sustainable entrepreneurship.

Second, the SBSEs' ability to advance system-building strategies proved crucial in influencing the regulative, cognitive, and normative institutions which they perceived as barriers to the creation and diffusion of more sustainable solutions. Despite a large dose of creativity in their efforts to circumvent the considerable limitations of the current Polish energy system, the niche actors realized from the outset that, to succeed, they had to change the institutional conditions that constrained them. Importantly, proactivity across the scales – local, regional, and national – allowed the niche actors to influence the regime's transition pathway. The SBSEs recognized the need not only to engage in the local development of an energy cluster, but also to become active at the regional level and thus increase the support for the RES development, as well as to develop the national-level innovation ecosystem promoting their lobbying efforts. Nonetheless, importantly, the transformation of coal regions in a highly centralized system is closely interdependent – economically, socially, infrastructurally, and politically – with the national transition process. Hence, the institutional work performed by the SBSEs at the local or regional scale had a more or less direct bearing on changes at the national level. For example, the regional energy transition resulted in the formulation of plans to use the existing coal infrastructure to produce and transmit green energy transregionally. Also, ZKlaster's smart grid experiment was aimed at proving that local energy markets could reduce the central grid's load and support the idea of "autonomous energy areas" as described in the Polish energy strategy. This way, by showing how the developments at the niche, regime, and landscape levels manifested and interacted at local, regional, and national scales, our study contributes

to a more geographically informed and multiscalar understanding of sustainability transitions in energy sectors.

Finally, the SBSEs skillfully used "transnational linkages" (Wieczorek et al., 2015) to enhance the potential of opening windows of opportunity for sustainable business to grow. In developing their system-building strategies, the SBSEs established overarching linkages at the EU level to receive much-needed support for their institutional work performed across all three spatial levels. Based on our findings, we argue that in particularly unfavorable institutional settings, it becomes crucially important to create such transnational linkages with strong allies supporting the SBSEs' efforts. This is due to three main reasons. First, they imbue the SBSEs' activities with legitimacy at the regional and national levels. Second, the interaction of the niche and landscape actors intensifies the pressure on the regime, increasing the chances for beneficial institutional changes. Third, external allies offer opportunities for tangible support of SBSEs' activities such as expert assistance, knowledge exchange, and dedicated funding.

Our study entails several suggestions for future investigations. First, as the article explores a single case study, further research is needed to test and modify the proposed framework against a bigger number of diverse cases from across different institutional, geographical, and material settings to shed more light on the interaction between niche sustainable entrepreneurs and institutional change for sustainable transitions. As the SBSEs' location in a coal region allowed us to examine their actions in the territorial and institutional context where the regime exhibits strong resistance embedded at local, regional, and national scales, we suggest that regions shaped by industries facing phase-out resulting from climate actions offer especially relevant settings for such studies. They may further allow scholars to observe how SBSEs strive to creatively reinterpret institutional arrangements to foster sustainable innovations locally, regionally, and nationally. Such observations can contribute to the discussion on strategies of just transition and show how the opportunities created by institutional change result from the interplay of actions conducted across different scales.

Second, the focus on multiscalar institutional work opens an interesting avenue for further research on the impact of energy communities, collective energy prosumption, and other forms of local initiatives and experiments with the production and exchange of green energy. Most studies on energy communities focus on countries where this form is well established and encouraged, such as Germany or the Netherlands (e.g., Dóci & Gotchev, 2016). Future research on the strategies employed by energy community leaders acting as SBSEs in the context of national energy systems still marked by strong carbon lock-ins and little support for more decentralized solutions may broaden our understanding of bottom-up initiatives' ability to change the dominant "rules of the game."

Finally, in this study, we analyzed the sustainable entrepreneurs' system-building strategies using van Doren et al.'s (2020) categorization distinguishing three types of institutional work: political, cultural, and technical. Future studies could examine SBSEs' institutional work drawing on a different categorization. For example, after Giezen (2018), scholars could conduct a relevant analysis of SBSEs' creating, maintaining, and disrupting strategies. It would be particularly interesting to investigate how SBSEs engage not only in creation work by attempting to form new institutions, and in disruption work aimed at the erosion of existing institutions, but also in maintenance work, understood as "reproducing existing norms and belief systems" (Lawrence & Suddaby, 2006, p. 230). As Dańkowska (2022) observes, such work is needed so as "not to cross the boundaries of the legitimate, risking the rejection of the nascent innovation by the key audiences before entering more mature stages of innovation development" (p. 174).

Moreover, future research could explore in more depth the limitations of SBSEs' institutional work as well as its unintended consequences, such as shifting the sustainability problem elsewhere in the socio-technical system (Dańkowska, 2022).

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Decarbonization Efforts in Africa: Successes, Opportunities, and Challenges for Promoting the use of Renewable Energy by Social Economy

Joseph Mamman Ibbih, Samson Nyako Nicodemus

Abstract: **Background:** Africa contributes minimally to global warming, yet remains disproportionately vulnerable to the adverse impacts of climate change. African governments and policymakers have devised strategies aimed at mitigating climate change effects and promoting renewable energy adoption, decarbonization, and sustainable development pathways.
Research objectives: This article explores the intersection of decarbonization and the social economy sector in Africa, vis-a-vis renewable energy utilization. It examines the challenges and opportunities associated with integrating decarbonization efforts within social economy frameworks on the continent.
Research design and methods: The study employs narrative methodology cum content analysis to investigate the dynamics of decarbonization. It assesses the existing initiatives, policies, and challenges related to renewable energy adoption and decarbonization strategies.
Results: The findings indicate that while there is a growing recognition of the importance of decarbonization and renewable energy in Africa's social economy sector, challenges such as limited access to technology, funding, and infrastructure persist.
Conclusions: Addressing these obstacles is crucial for advancing decarbonization and climate change mitigation efforts across the continent.
Keywords: climate change, decarbonization, renewable energy, social economy, Africa
JEL Codes: Q42; Q52; Q54; O55; Z13

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Introduction

The effect of climate change due to global warming is getting serious attention of governments and policymakers across the globe. While much focus has been placed on the largest carbon emitting economies such as China and the United States, Africa is also one of the continents to be considered because of its vulnerability to the effect of climate change. The largest carbon emission from Africa is about 4% when compared to the rest of the World (AJLabs, 2023), which can be traced to wrong agricultural practices such as deforestation for fuel wood and charcoal production, as well as carbon emission from fossil fuel – hence the call to decarbonization through the use of renewable energy for heating, cooking, transportation,

and manufacturing. African countries have been implementing sustainable strategies for total dependence on renewable energy and hope to make substantial progress and impact by 2035. This is not proving easy, but efforts are being undertaken to ensure success. Governments and social economy organizations such as cooperatives, mutual associations, foundations, and social enterprises have a critical role to play in decarbonizing the continent. Although there are no significant activities relating to the decarbonization agenda by social enterprises and economy in Africa, the campaign to reduce the use of fossil fuels has been championed by the social economy. In this regard, it is worth mentioning that most developing nations have neither the capacity nor the means to adopt relevant policies that can enable them to control their annual discharges of carbon dioxide () and embark on pathways relevant for achieving the Paris Agreement objectives or sustainable development goals (SDG). First, regarding low capacity, the developing countries have conventionally exhibited rigidity against phasing out fossil fuel dependency, whereby one can state that these underdeveloped economies are yet to build ample capacities in cleaning their energy portfolios (Sharma et al., 2021). Second, due to limited options for choosing alternative low-carbon fuels, the clean energy transition mechanism in these countries often becomes delayed.

According to the United Nations Development Programme (UNDP, 2020), the intent of decarbonization is to reduce the impact of human activity on our planet's climate in order to slow down global warming. The 2015 Paris Agreement set the goal of limiting global warming to well below two degrees, preferably to 1.5 degrees Celsius, compared to preindustrial levels. In order to do this, countries, cities, regions, companies, and individuals all need to work ambitiously toward achieving carbon neutrality by 2050. The health of the planet depends on government policy, technology, innovation, and widespread public support working together to create a pro-climate culture, lower the cost of non-carbon energy, and accelerate the decarbonization efforts to meet climate goals. According to the experts at a side event held at the 8th Tokyo International Conference on African Development (TICAD, 2023), as the world moves toward greater decarbonization, it is also imperative that Africa's ongoing challenges regarding access to energy be addressed for the continent to achieve a fair and just transition to clean energy. According to UNDP, out of 2.6 billion people that still lack access to safe, clean fuels and technologies for cooking or heating their homes globally, over 75% live in sub-Saharan Africa (SSA). Moreover, to compound the already fragile situation, African countries have to contend with rising energy and food prices precipitated by the protracted recovery from the COVID-19 pandemic and the impact of the ongoing war in Ukraine (UNDP, 2020).

To confront these multifaceted threats, UNDP has urged an acceleration toward a just energy transition for the continent to counter the negative impact of climate change on livelihoods and open up new opportunities to create jobs. Stressing the significance of decarbonization and the transition from fossil fuels to renewable energy sources (RES), Africa and the global community need to focus on short-term solutions for clean energy accessibility as well as long-term solutions that will lead to sustainability. This campaign, however, is not limited to governments and policymakers; it also extends to social enterprises, which should promote the use of renewable energy. The main objective of the article is to discuss these efforts, showing their successes and challenges in promoting the use of renewable energy in Africa.

Following this introductory section, the article contains seven sections. The first two discuss the methodology, the global concept of decarbonization, Africa's decarbonization capacity, and the reasons why less developed countries (LDC) need to chart a path to decarbonization. The next two sections elaborate on renewable energy in Africa and describe the environmen-

tal, social, and techno-economic impacts of hybrid renewable energy systems. Finally, the last three sections look into social economy, decarbonization, and climate mitigation; they also present the successes, opportunities, and challenges of the efforts regarding social economy and decarbonization in Africa, and offer a brief conclusion.

Literature Review

The Global Concept of Decarbonization

Decarbonization is crucial for the global race toward net zero carbon emission as outlined in the Paris Agreement. Current action is not enough, with the global average atmospheric hitting a new height in 2022. The world continues to produce carbon much faster than nature can absorb it, which results in the greenhouse effect rapidly warming the earth. Decarbonization can be viewed as the process of reducing or eliminating carbon emissions. In this case, we refer to decarbonization when talking about the efforts to lower carbon emissions on a global scale. It can also be seen as the reduction of emissions through the use of low-carbon power sources, decreasing the output of greenhouse gases (GHG) into the atmosphere. Decarbonization typically refers to the process of reducing carbon intensity, thus lowering the amount of GHG emissions produced by the burning of fossil fuels. Generally, this involves decreasing output per unit of electricity generated. Reducing the amount of produced by transport and power generation is essential to meet the global temperature standards set by the Paris Agreement and the United Kingdom (UK) government (Nkatha, 2023).

United Nations (2023) assert that a critical additional consideration for LDC is the impact of accelerated decarbonization and renewable energy deployment, competing for land in the context of rapid population growth, rising internally displaced populations, deteriorating food security, and the potential for climate-induced conflicts. Decarbonization today is commonly associated with high-profile commitments from large corporations and is usually followed by reports on progress toward those commitments, including the corporations' pledges. However, it is a long way ahead until many of these promises are realized.

According to Kimani (2022), decarbonization involves increasing the prominence of low-carbon power generation and a corresponding reduction in the use of fossil fuels. This includes RES like wind power, solar power, and biomass. Carbon power can also be reduced through large-scale use of electric vehicles alongside cleaner technologies. Decreasing the carbon intensity in the power and transport sectors will allow for net zero emission targets to be met sooner and in line with government standards. Decarbonization also means cutting back carbon emissions. It entails transitioning into economic models that minimize or compensate for the emitted into the atmosphere alongside other GHG like nitrous oxide (N_2O) and methane (CH_4). The Paris Agreement on Climate Change breaks up with most international treaties in focusing primarily on national ambitions to be achieved through national institutions (Falkner, 2016). Emerging powers, including South Africa, have been at the center of this shift from top-down to bottom-up approaches, insisting that their national development ambitions must shape any international commitments to GHG emission mitigation (Nelson, 2016).

According to the World Bank (2018), estimates for renewable energy held a share of merely 22.02% in the final energy consumption profile of developing (i.e., low- and middle-income) countries combined, which is around eight percentage points lower compared to the level in 2000. Hence, it is quite evident that instead of reducing the use of fossil fuels, the developing countries have rather become even more reliant on them. The failure to phase out fossil fuel

dependency and make a clean energy transition has not only hampered economic and environmental conditions, but also triggered social adversities in the forms of poor human health, lack of new job creation which could have resulted from the development of the clean energy sector, and so on.

Global leaders have agreed to stabilize climate change at about 2°C above preindustrial temperatures; to reach this target, global carbon emissions should be reduced to zero before 2100. Even if the target were higher than 2°C, carbon neutrality would still be needed to stabilize the climate. As long as we emit more than we capture or offset through carbon sinks such as forests, concentrations of in the atmosphere will keep rising, and the climate will keep warming. There are also other reasons to bring emissions to zero, which include other environmental problems unrelated to climate change, such as local air pollution and ocean acidification. With the scientific consensus suggesting we need to reach zero net emissions before 2100, the key question is what policymakers should do to get there. How can we achieve net zero emissions? The latest report of the Intergovernmental Panel on Climate Change (IPCC) identifies many technically feasible pathways to reach carbon neutrality by the end of the century, based on the consensus of 830 scientists, engineers, and economists from over 80 countries, formally endorsed by the governments of 194 countries (Fay et al., 2015).

According to Fay et al. (2015), those pathways rely on four pillars:

- **Pillar 1:** Decreasing carbon intensity of global electricity production to near zero around 2050 is at the core of the decarbonization transition. This objective implies that both high-income countries and emerging economies – such as China, India, and South Africa – would have to decarbonize electricity around mid-century. Low-income countries, which represent a small share of global electricity consumption, would have a few more decades, but they too would eventually need to converge to zero-emissions electricity.
- **Pillar 2:** Switching from fossil fuel to low-carbon electricity will drastically reduce GHG emissions in energy-intensive sectors, such as transportation, building, and industry. Technologies such as electric and plug-in hybrid vehicles, electric stoves, and heat pumps, and electric furnaces are more energy efficient than fossil-fueled alternatives and will reduce carbon emissions when powered by clean electricity.
- **Pillar 3:** Boosting energy efficiency can reduce emissions, make electrification easier, and save on energy bills. This has high potential for the building, transport, and industry sectors. In agriculture and forestry, efficiency entails minimizing the loss and waste of food, increasing the supply of less emission-intensive products – including biofuels and wood materials – and changing food demand to shift consumption toward low-carbon food products and to free land for other mitigation activities.
- **Pillar 4:** Managing landscapes better will help countries increase their ability to act as net carbon sinks. Models reviewed by the IPCC show that the agriculture and forestry sector will likely need to achieve carbon neutrality by 2030 if the 2oC target is to be reached. Mitigation policies can reduce emissions from land management and land use conversion, and increase the removal of carbon from the atmosphere. Stabilizing the climate requires bringing net emissions of long-lived GHG to zero. This means that specific positive emissions can be offset by negative emissions elsewhere: from improved natural carbon sinks, through reforestation or better soil management, to combining bioenergy – that is, renewable energy derived from biomass, such as wood, crops, or crop residues – with carbon capture and storage (CCS). Countries can therefore proceed at different speeds across the four pillars, but stabilizing the climate requires significant progress in all the pillars (Fay et al., 2015).

Timing is key and significant as technologies evolve, improve, become more affordable, and open up new options. But if all actors choose to wait, those technologies will not be invented, and they certainly will neither improve nor become more affordable. In the face of development pressure, especially in rapidly urbanizing countries, waiting for technological improvements is not always an option. Developing countries, which still need to build much infrastructure, should take the opportunity to plan ahead to grow and develop with their carbon footprint in mind. Action should focus on what provides co-benefits and synergies with development, but also on what is most urgent. Some choices may be irreversible, such as unplanned low-density urban expansion or the cutting down of old-growth forests. Certain abatement actions will take time to realize their benefits; examples include building clean transportation infrastructure or developing new technologies. In these cases, measures need to be implemented early in order to reach the end goal of full decarbonization. Considering the case of a low-carbon strategy analysis, when striving to reach a particular goal in 2025, the easiest route is to take marginal actions that are cheap and easy to implement but have a limited potential. By contrast, if this goal is a step toward a more ambitious one in 2030, it requires more ambitious actions such as investments in subways, trains, and waterways, which cost more and take longer to implement. The latter approach would result in the same amount of emission reduction by 2030, but it would keep the door open to deeper decarbonization by 2035 (Fay et al., 2015).

Applied to full decarbonization, the analysis shows the need to look not only at the cheapest emission reductions, but also at more cost-effective options that will be required to reach zero emissions. To avoid lock-ins and regrets in a few decades, developing countries in Africa can use short-term sectoral targets to trigger and monitor progress along the four pillars of decarbonization. Doing so would ensure not only that the appropriate quantity of emission reductions is achieved over the short term, but also that the quality of these abatements is appropriate, which means that they put the African continent on a cost-effective pathway toward decarbonization. For instance, a goal may be to produce 30% of electricity from renewable sources by 2030, drive cars that emit fewer than 80 grams of per kilometer by 2025, or use wood materials from sustainably managed forests instead of steel and cement in a half of new buildings by 2035. A short-term goal expressed as an economy-wide emission target is also useful but cannot replace those sectoral targets, since it could be reached with marginal actions that do not contribute sufficiently to meeting the long-term goal. Sectoral pathways also provide operational guidance for sector plans and make it possible to use existing regulators and institutions to design and implement the measures.

Global inequalities are a distinctive feature of climate change. First, the pattern of GHG emissions is highly unequal across countries, as are the negative externalities on the world climate system. Second, the impacts of climate change are widely different across global regions, with warmer and poorer countries likely to suffer significant income losses, while richer countries in mid-latitude regions may even benefit from rising mean surface temperatures. Such is the extent of this differential impact that a recent study argues that "anthropogenic warming constitutes a substantial international wealth transfer from the poor to the wealthy" (Callahan & Mankin, 2022, 53). Various factors influence renewable energy development, including climate change, global warming, energy security, cost reduction, and emission reduction (Osman et al., 2022).

In a study by Brodny et al. (2021), the authors evaluated the level of renewable energy development in European Union (EU) member states and found that the energy revolution in

Europe is progressing rapidly. The study found that the EU's average gross electricity output from RES increased from 21.18% to 32.11% between 2008 and 2013 and then reached 38.16% in the period from 2013 to 2018. This rapid shift toward renewable energy is expected to lead to the sustainable development of the economy and reduced emissions, in line with the European Green Deal concept. To achieve sustainable development, Tabrizian (2019) examined the role of technological innovation and the spread of renewable energy technologies in underdeveloped nations. The study found that RES are the best and cleanest substitutes for fossil fuels and have a wide range of beneficial environmental consequences, including a significant decrease in GHG emissions, which is crucial given the concerns about climate change. Green buildings may meet the needs of their residents by using RES such as solar, wind, and geothermal energy, while reducing their energy consumption and carbon footprint to zero (Chen et al., 2023). However, technology diffusion in this sector is slow, and renewable energy technologies are only gradually gaining traction in underdeveloped nations. Similarly, Hache (2018) notes that the spread of renewable energies would complicate global energy geopolitics and issues related to energy security. Therefore, the current increase in renewable energy installations must be considered alongside energy security and technological advancement for a smooth transition to renewable energy, which proceeds toward decarbonization. The trend of renewable energy integration is expected to continue growing, with solar and wind power projected to account for 50% of global power generation by 2050 (Gielen et al., 2019). Jacobson (2017) found that 139 of the world's 195 nations have plans to transition to 80% and 100% renewable energy by 2030 and 2050, respectively. Additionally, many countries plan to use only renewable energy by 2050. A study by Zappa, Ceppi and Shepherd (2019) shows that a 100% renewable energy power system would still require a significant flexible yet firm zero-carbon capacity to balance variable wind and photovoltaic generation and cover demand when wind and solar supply is low, even when the wind and photovoltaic capacity is spatially optimized and electricity can be transmitted across a fully integrated European grid. Hydropower, concentrated solar power, geothermal energy, biomass, or seasonal storage are all potential sources of this capacity. These studies indicate that renewable energy will continue to develop, and future integration developments are anticipated.

Integrating renewable energy into the electrical power grid offers several benefits for the energy, social, economic, and environmental sectors. From the environmental perspective, the electricity sector is currently a significant producer of emissions (Bella, Calvi, & D'Amico, 2014). Therefore, electrical grids should be a crucial component of any effort to mitigate the worst effects of climate change and global warming. This is why low-carbon electricity generation that heavily relies on RES is essential to a sustainable energy future as we progress toward deep decarbonization of the power industry (Bogdanov et al., 2021). In this context, renewable energy can significantly support energy security and GHG reduction (Khoie, Ugale, & Benefield, 2019). On this note, the use of fossil fuels and energy imports – the leading causes of emissions in Africa – can also be reduced.

Environmental, Social, and Techno-Economic Impacts of Hybrid Renewable Energy Systems

Fossil fuel consumption is increasing dramatically due to excessive anthropogenic activities and industrial expansion to meet energy demands. The increase in fossil fuel consumption has risen by 96% since 1965 (Caglar et al., 2022), leading to adverse environmental impacts. Fossil fuels negatively impact air quality, the environment, health, and water resources. The

gaseous emissions released into the air due to fossil fuel consumption include GHG such as: carbon oxides – carbon monoxide and ; sulfur oxides – sulfur dioxide and sulfur trioxide; nitrogen oxides – nitrous oxide and nitrogen dioxide; and volatile organic compounds and aerosols such as particulate matter. It is reported that about 72.5% of the global equivalent emissions could be released from coal consumption (Sayed et al., 2021), causing the global warming phenomenon. Hence, most countries have faced the pressure to reduce fossil fuel consumption after the Paris Agreement and the United Nations Conference of the Parties (Fawzy et al., 2020).

According to Shouman (2017), energy security is crucial for enhancing the socioeconomic situation of those residing in rural regions. Residents in these areas frequently suffer from power shortages due to their remote locations from the national grid and poverty. Globally, RES such as solar, wind, biomass, and geothermal energy are considered the most effective solution to minimize the social and environmental problems associated with non-renewable energy sources (Osman et al., 2022). The transition to RES creates new jobs and reduces emissions. Predictions state that by the end of 2025, over 100 cities will be powered by 70% renewable electricity globally, and at least 40 cities will be powered entirely by renewable energy (Liu et al., 2020). Since RES produce naturally derived fuel, they can offer a sustainable energy source with minimal operating costs and regular energy supply. Owing to such little amounts of the waste produced, RES have no detrimental influence on the environment. Moreover, renewable energies such as solar, wind, and tidal sources need a minimal amount of water for generating power and thus can participate in saving water resources (Tanaka et al., 2022).

Nevertheless, the unstable availability of RES that depend on the weather conditions, such as wind availability and solar irradiation, is a major limitation. Energy storage systems can partially overcome this gap, but the overall cost and energy conversion efficiency is low (Elkadeem et al., 2019). Thus, hybrid renewable energy systems have been adopted as an alternative and cost-effective technology to address the above-mentioned issues. Hybrid systems integrate two or more RES with or without traditional energy sources (e.g., diesel) and storage. In general, RES and hybrid systems have gained more attention recently due to their continuously reduced costs and rising social, environmental, and techno-economic benefits. Based on the strategy of the International Renewable Energy Agency (IRENA), it is recommended to increase the utilization of RES to 85% by 2050 (Elkadeem et al., 2019; Wang & Zhang, 2022).

Following the prioritization of decarbonization outlined in the Paris Agreement, the UK government is committed to achieving net zero GHG emissions by 2050. After the Parliament's declaration on climate emergency, the Committee on Climate Change recommended that achieving this net zero was not only feasible, but also necessary and cost-effective. Rapid decarbonization is becoming more necessary as the transport sector electrifies, increasing the demand for electric power. Greater energy efficiency is therefore turning into a priority to meet the emission targets and improve the air quality and global temperature. More energy-efficient and less carbon-intense energy sources are among the most prominent ways decarbonization may be achieved. The global transport system operates primarily on carbon-based fuels such as diesel and petroleum, but a wider use of electric vehicles would improve the contribution of the transport sector to reducing carbon emissions. The commitment of African countries toward decarbonization presents opportunities for overcoming the underlying challenges and make more significant moves. The international community is fundamental in streamlining resources to help navigate the existing challenges, which can help Africa become energy-sufficient.

Africa's Decarbonization Capacity and Efforts

Phasing out fossil fuels is a key aspect of decarbonization that requires global economies to invest heavily in green technologies. The mineral resources needed to manufacture these technologies include cobalt, copper, lithium, manganese, iron, iridium, zinc, and nickel. For instance, minerals like manganese, cobalt, and lithium are used in the production of steel, rechargeable batteries, and lithium-ion batteries, respectively. This puts Africa on the frontline of decarbonization as it possesses plenty of these treasures. For instance, the Democratic Republic of Congo (DRC) holds close to half of the world's cobalt reserves. Kenya is one of the countries that have made significant efforts to achieve 100% decarbonization by 2035. The state has recognized the urgent need to address climate change, which significantly impacts its economy, environment, and livelihoods. In addition, Kenya has introduced incentives to promote electric mobility, such as reducing taxes and import duties on electric vehicles. The government has also launched a nationwide program to install charging stations, making it easier for people to embrace electric vehicles. This initiative will help to reduce GHG emissions from the transportation sector. As of 2021, approximately 86% of Kenya's electricity generation capacity comes from renewable sources. This is primarily due to the country's significant investments in geothermal, hydroelectric, and wind power. Kenya is a global leader in geothermal energy production and has the potential to become one of the world's top wind energy producers. In addition to grid-connected renewable energy, there are significant investments in off-grid renewable energy solutions, such as solar home systems and minigrids, which provide electricity access to rural communities in Kenya. However, despite the efforts in place, challenges still prevent attaining these goals. Kenya's energy demand is rapidly increasing due to population growth and economic development. Meeting this demand for renewable energy requires significant infrastructure and technology investments. This can be challenging for a developing country like Kenya, which has limited resources. Although it is estimated that about 70% of the world's supply of the vital metal comes from southern DRC, large deposits remain untapped. It is speculated that the DRC's untapped mineral deposits could be worth more than USD 24 trillion (Carter, 2023). Similarly, Zimbabwe is among the top five global lithium suppliers, while Gabon and South Africa account for 40% of the world's manganese reserves. Presently, resource extraction in Africa is marred by poverty, violence, state corruption, banditry, and environmental degradation (Nkatha, 2023). This is often the outcome because these natural treasures are controlled by foreign powers rather than African states. In the end, only these advanced economies and the continent's elites benefit from them. For example, Nigeria has large deposits of natural and solid minerals scattered all over the country, but they remain untapped, underused, or mismanaged due to endemic corruption and insecurity in the system.

According to UNDP (2023), as the world moves toward greater decarbonization, it is also imperative that Africa's ongoing challenges regarding access to energy be addressed for the continent to achieve a fair and just transition to clean energy (UNDP, 2023). The experts further assert that out of 2.6 billion people that still lack access to safe, clean fuels and technologies for cooking or heating their homes globally, over 75% live in SSA. Moreover, to compound the already fragile situation, African countries have to contend with rising energy and food prices precipitated by the protracted recovery from the COVID-19 pandemic and the impact of the ongoing war in Ukraine and Gaza (UNDP, 2023).

To confront these multifaceted threats, UNDP has urged an acceleration toward a just energy transition for the continent to counter the negative impact of climate change on liveli-

hoods and open up new opportunities to create jobs. Stressing the significance of decarbonization and the transition from fossil fuels to RES, Africa and the global community has been urged to focus on short-term solutions to clean energy accessibility as well as long-term solutions that will lead to sustainability. In line with the new UN-Energy Plan of Action Towards 2025 to catalyze large-scale action and support for the transition to clean affordable energy for all, UNDP is working with partners to support an additional 500 million people around the world to gain access to clean energy over the next four years. Through its Africa Minigrids Programme – its largest-ever energy access project – UNDP is cooperating with UN agencies in the Sahel to expand access to clean, affordable energy to drive socioeconomic development and improve the financial viability of renewable energy minigrids in 18 countries, including Tunisia, where UNDP and the government are developing a program to transform the waste treatment sector into a source of biogas (UNDP, 2023).

The World Bank's analysis shows that Africa tops other regions across the world with excellent conditions for solar power. Still, large portions of the continent's energy supplies are imported from abroad, and many of them are based on fossil fuels. Further, the transition to renewable energy requires significant investments, which can challenge developing countries in Africa – such as Nigeria, Ghana, Kenya, South Africa, Malawi, Tanzania, Botswana, Cameroon, or the Ivory Coast. Many African countries need more technical expertise, financial resources, and political will to invest in RES. To minimize carbon emissions effectively, it is important to know their sources. Energy use is responsible for the highest amount of GHG emissions. The remaining emissions are shared between land use, agriculture, industry, and waste. Despite Africa's low carbon footprint, the continent's emissions have been on the rise over the years. For example, between 2000 and 2018, emissions from land use rose by 20%. In 2018, the agricultural sector emitted 2.2 Gt -eq, which accounted for 24% of global emissions, an increase from the 18% emitted in 2000 (World Bank, 2018). To keep the emissions from rising further, Africa needs to take the initiative and begin decarbonizing as early as now. Fortunately, the continent's low carbon footprint, natural treasure endowment, and substantial renewable energy potential provide a clear pathway to execute the decarbonization agenda. The policy interventions that are necessary for Africa in achieving the decarbonization agenda include the following factors:

- African governments must invest in the national capacity to produce high-quality human resources and institutions. Countries that have the ability and capacity to navigate the changing technological and regulatory environment are well-positioned to spur greater investment and develop local content policies that match their capabilities and aspirations.
- Africa needs a regional industrial policy coordination. A single country cannot hope to industrialize without stronger regional synergies. As such, building cross-border, regional value chains can offer a pragmatic framework to boost collaboration and attract investment in downstream activities. This would involve trade and cooperation between countries based on their comparative advantage, such that some countries provide key mineral inputs, while others ensure manufacturing technologies.
- Africa must develop justice-oriented national industrial policy. The renewable energy sector offers a system-wide opportunity for industrialization. However, this needs to embrace equal opportunities and an equitable distribution of the benefits of industrialization to all stakeholders. At the heart of this is a governance framework that engages all stakeholders including governments, mining companies, shareholders, investors, and affected commu-

nities in a constructive dialogue to shape the direction and character of the industrialization pathway.

Decarbonization efforts need to come from various stakeholders – from large corporations through governments to individual citizens – if Africa expects to make an impact sufficient to limit the most catastrophic effects of climate change.

Accelerating Energy Transitions Across Africa

The global shift from a fossil fuel-based to electricity-based society is commonly viewed as an ecological improvement. However, the electricity industry is a major source of emissions, and incorporating renewable energy can still negatively impact the environment. Despite the growing research on renewable energy, we still have poor knowledge about the impact of renewable energy consumption (RENC) on the environment. Technology developments, decreasing costs of renewable energies, innovative approaches, network effects, and digitalization are opening new opportunities and making an indisputable business case for renewables. With abundant indigenous resources, Africa is well-positioned to leverage this potential. However, the potential and availability of cost-effective technologies alone are insufficient. Seizing this opportunity will require strong political will, attractive investment frameworks, and a holistic policy approach to fully reap the benefits of renewable energy. It also means that current average annual investments in the African energy system should double by 2030 (Gerd & Francesco, 2019).

Hydrocarbons, specifically petroleum, coal, and natural gas, served as the primary energy sources for the past century. However, the ongoing threat of climate change and its effects on human health and well-being has dramatically increased the need for alternative energy sources. Hydrocarbons still account for over 80% of the world's energy supply. Furthermore, the production and use of fossil fuels generates a significant portion of global GHG emissions, including (Farghali et al., 2022). Additionally, reliance on imported fossil fuels has equally contributed to risks for energy security (Chen et al., 2022).

Regarding insufficient means for decarbonization, given the vast access to RES in Africa, the existing research works often acknowledge that the financial sectors in developing nations are not developed enough to sufficiently finance environmental welfare-improving initiatives. Consequently, developing nations need to look up to their developed counterparts for external financing of environment management and climate change resilience-building projects (Zhang et al., 2022). In this regard, it has been found that public climate finances and climate-related export credits from developed to developing nations have been growing steadily with time (OECD, 2022). Besides, the SDG agenda – especially the targets concerning SDG 13 – has also endorsed the need for the developed countries which are parties to the United Nations Framework Convention on Climate Change to annually mobilize USD 100 billion worth of green climate funds in order to finance the climate change-related initiatives of developing countries. Moreover, the relatively less-developed financial sectors in developing nations are also assumed to withhold the production and consumption of renewable energy. Consequently, the underdeveloped countries have no other option than relying on external finance for lessening the fossil fuel dependency and promoting renewable energy adoption (Shahbaz et al., 2021). Furthermore, insufficient funds in these countries are also largely responsible for the lack of investments in technological development projects, especially those focusing on CCS. Therefore, it is quite obvious that the aforementioned constraints have largely contributed to the failures of developing nations in addressing their traditional and ongoing environmental

hardships. As a result, relieving these constraints is of paramount importance so that the quality of the environment in developing countries can be significantly improved in the future. In this regard, enhancing the energy productivity rate (EPR) can be hypothesized as one of the potential mechanisms through which the developing nations' energy demand can be met while containing the associated energy-related discharges of (Ramzan et al., 2022).

In terms of theoretical underpinnings, the rising EPR can be linked with lower use of fossil fuels, which, in turn, can temporarily assist in lessening the fossil fuel dependency before developing nations expand their renewable energy generation capacities (Talan et al., 2023). Besides, a report published by the International Energy Agency (IEA) argues that EPR improvement "reduces greenhouse gas emissions, both direct emissions from fossil fuel consumption and indirect emissions associated with electricity generation" (IEA, 2019). Thus, de-intensification of energy use often seems a central factor that can enable developing nations to build climate change resilience (Aldieri et al., 2021).

Beside reducing fossil fuel dependency by boosting EPR, adopting renewable energy can be deemed important for improving the environmental status, especially in developing countries. Since most of the global net energy-importing nations belong to the cohort of developing countries, one can state that those nations are traditionally fossil fuel-dependent when it comes to meeting their energy needs (Ansari & Holz, 2019). Moreover, since those countries generate the bulk of their electricity outputs using both locally extracted and externally sourced oil, coal, and natural gas, it is no surprise that the majority of those countries, especially in Africa, find themselves in the worldwide list of top -emitting countries. Thus, energy experts often recommend that the fossil fuel-intensive power sectors in developing countries should gradually undergo a renewable transition by scaling their RENC levels while simultaneously downsizing their fossil fuel use levels (Dar & Asif, 2023). On the other hand, many works endorse the environmental quality-influencing impacts exerted by the financial sectors in developing countries. However, these studies assert that the environmental repercussions linked with the development of the financial sector tend to vary, that is, the financial sector imposes equivocal impacts on environmental quality. The studies often argue that the negative consequences of financial progress in developing countries are driven by their relatively less advanced financial sectors compared with their developed counterparts. Thus, greening the financial development policies is hypothesized to enable developing countries, especially in Africa, to successfully tackle their environmental concerns. Moreover, due to the persistently surging fossil fuel dependency in the majority of developing nations, one can expect their emission figures to substantially increase in the future unless relevant emission-abating measures are taken. Accordingly, the findings from this study are expected to assist the African developing countries in designing decarbonization blueprints and enable them to keep their environmental pledges. Especially, these policies could help the African developing nations in mitigating their respective emission levels so that the targets related to SDG 13 and the Paris Agreement are fulfilled within the respective time frame.

This study offers two core contributions to the literature. First, although the energy use–environmental quality nexus is a well-researched issue, the existing works mostly scrutinize the environmental impact of rises in energy demand levels in developing countries. Hence, those studies have largely overlooked the question of how efficient management of energy demand can influence the environmental quality. Nevertheless, it is pertinent to evaluate the environmental impact of EPR improvement, because most developing countries in Africa are both fossil fuel-dependent states and net importers of fossil fuels. As a consequence, enhancing

their energy consumption level for stimulating economic growth is especially likely to degrade the environment. Hence, under such circumstances, improving the EPR can serve as a more relevant option for developing countries in Africa to overturn their environmental hardships. Accordingly, this void in the related literature is bridged by assessing the EPR–environmental quality relationship in the context of numerous developing countries.

The Clean Cooking Imperative: Challenges and Opportunities

The Paris Agreement and the 2030 Agenda for Sustainable Development (UN, 2015), both signed in 2015, thrust energy access and climate change into the center of the development policy. Taken together, they commit the world's nations to work together to eradicate poverty in all its forms, advance sustainable development, and aggressively fight against climate change. Achieving the objectives of both agreements highlights the need for a global clean energy revolution to win the fight against energy poverty and to deliver climate protection. Today, electricity reaches only about half of the people in SSA, the lowest energy access among the major regions in the world. Currently, only one country in Asia has access below 25%, compared to 13 sub-Saharan countries (World Bank, 2018). This dramatic energy access problem is exacerbated by the parallel low availability of clean cooking, where only one-third of people living in SSA have access to clean cooking. Economic growth in the region is also relatively low at an estimate of 2.8% in 2018, compared, for example, to 7.1% in South Asia (IMF, 2018).

Energy access is put under even more pressure by rapid population growth. With one billion people today, SSA's population is expected to double by 2050 (UN, 2017). Under the current and planned policy aiming to tackle energy access, the IEA (2017) outlook shows that while the share of people in the region lacking access is expected to decline till 2030 for both electricity and clean cooking, the absolute numbers of those lacking access will increase. Further, the global energy access problem is increasingly concentrated in SSA, which by 2030 will account for nearly 90% of the world's population without electricity access and 40% without clean cooking (IEA, 2018). SSA's chronic shortage of electricity carries a high economic cost, with opportunity costs amounting to up to 2% of their gross domestic product (GDP) (IRENA, 2015; IEA, 2014). Achieving energy access via clean energy in SSA is a necessary pillar of economic transformation required to deliver on the promise of the Paris Agreement and Agenda 2030 Sustainable Development Goals. Indeed, clean energy can be a "golden thread" for development, connecting all the SDG and unlocking sustainable economic growth, while improving gender equality, human health, and well-being (UN, 2017). Importantly, clean energy access enables women and children to lead more productive lives and to contribute to the economy (NCE, 2018). Access to clean energy can help to raise millions from poverty and to improve livelihoods of city residents and the rural poor. Clean energy access strategies will help countries meet long-term climate objectives as set out in their Nationally-Determined Contributions (NDC) and beyond, per the objectives of the Paris Agreement. Beyond direct economic and social benefits, clean energy access will raise human security and build resilience in states and communities to help limit the risk of large-scale migration across the African continent (Rigaud et al., 2018).

Research Method and Material

The article employs narrative methodology and content analysis to discuss the subject of climate change, decarbonization, and the efforts put forward by social economy in Africa to

achieve decarbonization. Sources of information include published journal articles and other related online materials.

Results and Discussion

Current Trends: Progress and Outlook

Generally, relatively good progress is made in achieving electricity access, yet the pace of progress is overwhelmed by population growth, keeping the absolute numbers of those without access high. Thus, sub-regions and countries achieve electricity access at dramatically different paces. East and West Africa make the most progress, planning to lower the share of those without access to electricity to less than 40% by 2030. Several other African countries like Ethiopia, Gabon, Ghana, Kenya, and South Africa are also on track to achieve universal access by 2030. For electricity, the primary challenge remains in rural areas, where grid connections are more difficult, expensive, or financially risky to install. Even in urban or peri-urban areas, where grid-based electricity is accessible, reliability is often a problem leading to expensive and polluting diesel back-up generation. In Nigeria, about 893 million people presently cook using solid biomass and other highly polluting fuels (e.g., kerosene), and even with the planned new policies, the number of people without access to clean cooking will rises slightly – to 900 million. Compared to electricity access, the clean cooking challenge is more evenly spread across growing urban and rural communities, where there is an urgent need to raise awareness and knowledge of the benefits of clean cooking alternatives, and to make these affordable and accessible. Most new power generation to 2030 will be provided via the grid (57%), albeit the share of renewable energy will provide 73% of the whole new generation, thus improving GHG emissions/kWh. In addition to enabling grid expansion, new business models are providing solutions to people previously unserved by the grid. Mobile communications and, to a lesser extent, mobile money platforms are firmly embedded in some countries and provide an important foundation for pay-as-you-go (PAYG) consumer finance, which drives rapid uptake of off-grid solar energy in several African countries (IEA, 2022).

IEA's Sustainable Development Scenario (SDS) (IEA, 2018) illustrates a pathway to achieve universal energy access compared to the current policy scenario. Each scenario provides an overview of the mix of energy sources, technologies, and investment that would be required to meet 2030 universal electricity access along with other sustainability goals. For clean cooking in the IEA–SDS, universal access is achieved by introducing better cooking options, ranging from improved biomass cookstove technologies to cookstoves using liquified petroleum gas (LPG). The long-awaited set of standards will help to ensure that technologies meet minimum performance criteria to save lives through lower emissions and save money for users through improved energy efficiency; it will also provide a framework for monitoring progress (Naden, 2018). LPG and improved biomass cookstoves are the two main routes to clean cooking access in SSA. Electricity use for cooking is widespread in South Africa, but it is largely impractical for most African countries because of the lack of reliable electricity supply and the relative high cost of electric cookstove devices (IEA, 2017).

The chronic failure to deal with the widespread lack of clean cooking burdens economies and limits productivity for the region's population. This welfare cost is borne largely by women and children through diseases and premature death. Yet, most countries in SSA lack comprehensive clean cooking strategies, and where they exist, their implementation is weak and poorly financed, so that even modest gains are hard to obtain (Hosier et al., 2017).

Raising the priority, profile, and ambition of clean cooking goals will help governments in Africa to attract development financing to support implementation. Policies and financing for clean cooking should be integrated into poverty alleviation and health strategies at the national level. The gender element is crucial, ranging from awareness-raising campaigns to directly engaging women as champions and as entrepreneurs. Engaging women in clean cooking businesses and distribution will boost results and make them more lasting (Shankar, Onyura, & Alderman, 2015).

With respect to financing, the absolute gap is much lower than for electricity, with an estimated need of USD 1.8 billion (IEA, 2018). But the required scale-up is more challenging than for electricity, partly since it lacks the benefit of institutions and infrastructure that exist in the electricity sector. Significant progress requires both greater financing and, perhaps more importantly, the building of domestic outreach and capacity.

The Perspective of Renewable Energy in Africa

Renewable energy offers a range of benefits, including a freely available source of energy generation. As the sector grows, there has also been a surge in job creation to develop and install the renewable energy solutions of tomorrow. Renewable sources also promise greater energy access in African developing nations and can reduce energy bills. Of course, one of the largest benefits is that much of renewable energy also counts as green and clean energy. This has created a growth in renewable energy, with wind and solar sources being particularly prevalent. However, these green benefits are not the sole preserve of RES (Bos & Gupta, 2019; Roe et al., 2021).

The advantages of renewable energy are numerous and affect the economy, society, environment, security, and human health. The benefits of using renewable energy in Africa include:

- enhanced reliability, security, and resilience of the nation's power grid;
- job creation throughout renewable energy industries;
- reduced carbon emissions and air pollution from energy production;
- Africa's increased energy independence;
- increased affordability, as many types of renewable energy are cost-effective and competitive with traditional energy sources;
- expanded clean energy access for non-grid-connected, remote, coastal, or island communities.

As mentioned above, many RES are not used all the time. For this reason, fossil fuels are still in use to scale up renewable sources in numerous countries. The variable production capacity means that large energy storage solutions are required to ensure that there is enough power when renewable energy generation dips. An alternative solution is to deploy several renewable technologies, creating a more flexible system of supply that can counteract dips in production for a given source. Some renewable resources, such as hydropower and biomass, do not suffer from these problems of supply, but they both have their own challenges related to environmental impact, as noted above. In addition to this, some RES, such as solar and wind farms, create complaints from most local people in Africa, who do not want to live near them.

Several countries in SSA have begun to pave the way to a new energy paradigm for electricity, one that could potentially fill the electricity access gap with cleaner and higher reliability. The resulting clean energy system would be more sustainable than traditional, grid-based power systems. The electricity sector in most countries is designed around a central, national grid, whose primary focus is providing electricity to urban areas and the secondary one is to

supply rural or other unserved areas. With the important exception of areas with major hydropower resources, the grids are typically supplied with power generated from fossil fuels – coal, oil and natural gas – with the fuel choice often driven by the country's indigenous natural resources. In the past, increasing access to electricity essentially meant expanding the grid. However, grid expansion has increasingly encountered barriers related to both the high cost to reach more distant or hard-to-connect areas that have relatively low levels of demand, and the endemic problems of reliability and coverage within many existing grid-served areas. Indeed, many grids have such fundamental problems of reliability that access alone is not a robust measure of electricity service (World Bank, 2018).

New renewable electricity pathways could herald a fundamental restructuring of the power sector throughout SSA that can greatly expand electricity access to both unserved and underserved areas in a timely manner, as well as providing a high standard of service reliability. These options create new organizational structures and opportunities for new business models to emerge and provide services at the individual, household, and community level. Important gains in solar technologies have allowed stand-alone solar home systems (SHS) and minigrid service options to develop rapidly in recent years. However, the reliance on grid infrastructure is still important in providing electricity access in Africa. A policy priority is to ensure that new capacities and connections exploit the continuum of cost-effective, systemic off-grid, minigrid, and on-grid options, and are not biased toward the existing grid or the dominant energy sources of the past – that is, fossil fuels versus newer renewable energy technology options. Another key issue for a policy is to ensure a level playing field and/or targeted, time-bound subsidies to incentivize investment in renewable energy to deliver on the promise of these new technologies and services to capture the social, health-related, and environmental benefits of clean electricity and cooking energy access in Africa.

In the last few years, rapid advances in renewable energy technologies, especially solar and wind sources, have opened major opportunities for both decentralized supply options and the greening of the central grid. While decentralized electricity services at both the household and enterprise level have long existed, these applications have traditionally relied on diesel generators. However, electricity from diesel generators entails a cost three to four times higher than the unit cost from grid (McKinsey, 2018). Thus, it is not economically viable for many, including most of the rural population and the urban poor, to rely on a fuel that may not always be available. Local diesel generation represents a major cost for businesses and has serious local environmental impacts and relatively high emissions of . Solar technologies are changing the situation for decentralized services. Recent and continuing declines in the manufacturing costs of photovoltaics (PV) and battery storage technologies, as well as information technology control packages, are enhancing the case for decentralized renewables and fundamentally expanding electricity service options beyond the traditional grid system supplemented by diesel generators (World Bank, 2018).

Clean Cooking Access: Market Developments and Technologies

The transition to clean cooking across Africa could unlock human productivity, cut human health costs, improve well-being, and save the lives of hundreds of thousands of people, particularly women and children (WHO, 2016; IEA, 2017). In SSA, 17% of the population have access to clean cooking (IEA, 2018), while in the low-income countries, this number is even lower (IEA, 2017). Most of those without clean cooking access rely on traditional biomass causing deforestation and smoke and soot pollution, which negatively impacts the local and global environ-

ment and human health. Overall, traditional biomass remains the dominant source of energy in SSA, accounting for about 60% of the energy demand today largely due to cooking (IEA, 2017). Related forest area loss is accelerating a decline in ecosystem services with loss of related benefits for people, ranging from flood buffering to water capture and filtering. Continued dependence on biomass in SSA not only adds to GHG emissions, but also raises the vulnerability of people, infrastructure, and the economy to more extreme weather events, such as flood and drought due to loss of natural ecosystem services such as flood buffering provided by forests (Lambe et al., 2015).

The availability of electricity services is often viewed as primarily a rural–urban divide, yet a World Bank study (World Bank, 2018) estimates that the share of unconnected people living under the grid in SSA can be double the number of those actually connected. The number of unconnected people under the grids varies substantially among countries. A study in Kenya notes an area with ideal conditions for grid supply and finds that electrification rates remain very low, averaging 5% for rural households and 22% for rural businesses, and that this holds across time and for both poor and relatively well-off households and businesses (Lee et al., 2019). The study implies that simply constructing a grid and providing the technical means of an electricity connection does not automatically translate to access and usage. While a portion of those failing to connect is due to the connection cost, other barriers include a lack of policy or business model to connect those living in informal housing, organizational failings within the distribution companies, sociopolitical marginalization, and poverty among those without access (Lee et al., 2019).

From the perspective of a climate change policy, renewable energy should be incentivized throughout the electricity sector. Given the large public good benefits associated with the switch from fossil fuels to renewable power generation, there is a strong policy case not only for levelling the playing field for renewables to compete with fossil fuels, but also for time-bound, technology-neutral subsidization (OECD, 2012). Such policies can provide essential early-stage support for renewable energy options, helping to create markets and experience, which will help to deliver affordable financing for investment in emerging renewable technology options, thereby leading to efficient clean cooking access in Africa.

Social Economy and Decarbonization in Africa

Social economy, as a relatively new concept, is considered the "third sector" of economy in government discourse. It plays a significant role in the socioeconomic and political spheres of any nation. In Africa, the impact of the economic recession shows in the increased unemployment and poverty rates, resulting in maximization of discrepancies between the rich and poor, producing inequalities, and creating discouraging environments for foreign investments. These social problems have called for an examination of social economy's role in liberating African economies from their current dire state (Okeke-Uzodike & Subban, 2016).

Social economy is defined as the collection of different social objectives of the various organizations that form it. According to the European Commission, social economy organizations include cooperatives, mutual societies, voluntary organizations, foundations, and social enterprises. All are based on voluntary participation and membership, and are guided by their social objectives rather than a need to make a return on capital. Many social economy organizations simply deliver services to their members or others and they aim to serve without making use of the market. Other such organizations, known as social enterprises, engage in trade activities in order to benefit their members or those they serve. In the latter case, any surpluses

or profits earned are reinvested in the enterprise, distributed to stakeholder groups, or used for the benefit of those served by the enterprise. Governance typically operates through the "one member, one vote" principle or through enterprise trustees (Restaki, 2006).

According to Eurofund (2022), social economy refers to all business activities that are not only driven by a strong social mission, but also intended to be economically viable. This includes cooperatives, mutual societies, nonprofit associations, foundations, and social enterprises, covering a wide range of activities. The aims of social economy organizations are generally to provide goods and services – including employment opportunities – to their members or the community, and pursue general-interest goals such as environmental protection. In this way, social economy organizations aim to make a profit for people other than investors or owners. To ensure that social economy enterprises can compete effectively and fairly, without regulatory discrimination and taking into account their particular needs, the European Commission launched the Social Business Initiative. Another Commission initiative launched in this field was Towards Social Investment for Growth and Cohesion, which promoted social innovation as a source of growth and jobs, supported innovative entrepreneurs, and mobilized investors and public organizations (European Commission, 2022).

OECD (2022) defines social economy as solidarity economy formed by a set of organizations such as associations, cooperatives, mutual organizations, foundations, and, more recently, social enterprises. In some cases, community-based, grassroots, and spontaneous initiatives are part of social economy in addition to nonprofit organizations, the latter group often being referred to as the solidarity economy. The activity of these entities is typically driven by societal objectives, values of solidarity, the primacy of people over capital and, in most cases, by democratic and participative governance.

According to Huybrechts (2012), social economy includes independent organizations acting independently toward particular objectives. Thus, social economy covers all economic activities conducted by enterprises, primarily cooperatives, associations, and mutual benefit societies whose ethics covey the following principles:

- Putting service to its members or to the community above profit;
- Autonomous management;
- A democratic decision-making process; and
- The primacy of people and work over capital in the distribution of revenues.

Social economy enterprises and organizations have different sizes, ranging from small and medium-sized enterprises (SME) to large companies and groups that are leaders on their markets and operate in all economic sectors.

Social economy and social innovation contribute to creating more inclusive, creative, and sustainable societies and economies. They provide innovative solutions to improve the quality of life and well-being of individuals, communities, and places, while addressing socioeconomic and environmental challenges, including those emerging with the COVID-19 pandemic crisis. Social economy organizations traditionally refer to the set of associations, cooperatives, mutual organizations, and foundations whose activity is driven by values of solidarity, the primacy of people over capital, and democratic and participative governance (Restaki, 2006).

OECD (2022) also views social economy as nonprofit or third-sector organizations that have grown in number and relevance, contributing to employment, social inclusion, democratic participation, and community building. Much remains to be done, however, to create the necessary enabling environment to support their establishment and development, and to mainstream the sector in economic and social policies. Social economy encompasses enterprises,

organizations, and other entities engaged in economic, social, and environmental activities to serve the collective and/or general interest, which are based on the principles of voluntary cooperation and mutual aid; democratic and/or participatory governance; autonomy and independence; and the primacy of people and social purpose over capital in the distribution and use of surpluses, profits, and assets. Social economy entities aspire to long-term viability and sustainability, and to the transition from informal to formal economy, as they operate in all economic sectors. In addition, since worldwide trends tend to entail increasing services, production, and privatization of government activities, social economy or nonprofit enterprises – many of which address these domains – are likely to play greater economic roles in the future. This is reflected in more explicit recognition of social economy in the national economic policies of many African countries.

Africa boasts several social economy enterprises and foundations. Some of them originate from other developed countries but participate in numerous welfare-enhancing activities. These social enterprises have participated in decarbonization activities to improve climate change resilience and mitigation activities in Africa. They are discussed below.

The Miller Center for Social Entrepreneurship is a Premier University-based social enterprise accelerator, founded in 1997. Miller Center's goal is to end global poverty and protect the planet by accompanying social entrepreneurs focusing on climate change and women's economic empowerment. The center defines one of its two selected focus areas as climate resilience focusing on efforts to improve clean energy access, safe water, and climate-smart agriculture results by the social enterprises (Rasoanarivony, 2022).

The Tony Elumelu Foundation (TEF) is owned by a Nigerian and named after its founder Tony O. Elumelu CFR. It is the leading philanthropic entity empowering a new generation of African entrepreneurs, driving poverty eradication by enhancing job creation across all 54 African countries, and increasing women's economic empowerment. The foundation launched the TEF Entrepreneurship Programme in 2015, providing over 1.5 million young Africans with access to training on its digital hub, TEFConnect, and disbursed nearly USD 100 million in direct funding to 18,000 African women and men, who have collectively created over 400,000 direct and indirect jobs. The foundation is making deliberate efforts to promote green entrepreneurship and foster an environment where green entrepreneurs can invest in renewable energy (Tony Elumelu Foundation, 2023).

Generation Unlimited (GenU) is a leading global public-private-youth partnership (PPYP), bringing together global organizations and leaders including Heads of State, CEOs, Heads of UN agencies, and civil society champions with young people to co-create and deliver innovative solutions on a global scale. This was launched by the UN Secretary-General at the 2018 UN General Assembly. Generation Unlimited is on a mission to skill the world's 1.8 billion young people and connect them to opportunities for employment, entrepreneurship, and social impact (Generation Unlimited, 2023).

The IKEA Foundation is also a philanthropy organization that focuses on tackling poverty and climate change. It currently grants over EUR 200 million per year to help improve family incomes and quality of life while protecting the planet from climate change. Since 2009, the IKEA Foundation has granted more than EUR 1.8 billion for poverty eradication and climate change.

In recent time, these foundations – The Tony Elumelu Foundation, Generation Unlimited, and IKEA Foundation – have worked together in partnership to launch a pioneering Green Entrepreneurship Programme that is aimed at empowering the African youth to tackle the

problem of climate change through investment in renewable energy. These social economy activities have the advantages of generating youth empowerment and green job creation in Africa by supporting the development of environmentally friendly businesses. Green entrepreneurship will help create jobs that contribute positively to the planet when the use of renewable energy is improved. This will also tackle climate change, biodiversity loss, and resource scarcity by fostering sustainable entrepreneurship and innovation, and will build a sustainable future in Africa (Generation Unlimited, 2023).

Successes, Opportunities, and Challenges in Promoting the Use of Renewable Energy by Social Economy

Social economy's drive to decarbonization is a welcome development in Africa. However, these efforts entail both successes and challenges.

Successes and Opportunities

Over the past 11 years, Miller Center has assisted 252 African social entrepreneurs – with an annual average of 22 entrepreneurs – in providing solutions for climate change and promotion of renewable energy (Rasoanarivony, 2022). In addition, Miller Center initiated an effort to scale up and double its impact by 2025, as measured by an increase from USD 500,000 to USD 1,000,000 in funding raised for each enterprise (Rasoanarivony, 2022).

The Tony Elumelu Foundation, Generation Unlimited, and the IKEA Foundation successfully initiated the Green Entrepreneurship Programme called BeGreen Africa, designed to provide young African entrepreneurs with the training, mentoring, and funding needed to develop innovative solutions for Africa's sustainable future (Generation Unlimited, 2023). The program has a wide coverage in Africa, spanning across South Africa, Senegal, Morocco, and five other countries. BeGreen trains at least 1,600 young people in green entrepreneurship and waste management and will provide more than USD 1 million in seed funding to 225 young entrepreneurs, which will enable them to generate revenue and create at least 8,000 jobs (Generation Unlimited, 2023).

Aside the BeGreen Africa program, several entrepreneurs have been engaged in the Tony Elumelu Foundation Entrepreneurship Programme operating in the green industry. Those beneficiaries are discussed below.

Bamboo Express empowers the youth and women locally in Africa. TEF has supported the company's owner, Lombola Lombola. Bamboo Express is solving the problem of deforestation, youth unemployment, and lack of income alternatives for rural women as they focus on a youth apprenticeship program and purchase 90% of raw materials from those women. The company tackles deforestation in an effort to reduce the problem of climate change (Tony Elumelu Foundation, 2023).

D'Rose Recycling Company is an eco-friendly business which upcycles solid waste like old tires, bottles, and plastics into recycled furniture suitable for homes, offices, playgrounds, and studios. TEF has assisted its owner, Bimpe Oni. The company seeks to address the challenge posed by the tons of plastics and tires which end up in the ocean each year, causing water pollution and driving sea life into extinction (Tony Elumelu Foundation, 2023).

BanaPads is yet another company assisted by TEF. Richard Bbaale, a social entrepreneur from Uganda, founded BanaPads in 2010. The entity uses banana pseudostem waste, usually left to rot after harvesting, to make sanitary pads. It is an award-winning social enterprise registered in Uganda and Tanzania with the aim of manufacturing affordable and eco-friendly

(100% biodegradable) sanitary pads to keep village girls in school and create jobs for local women. The pads are also collected to be used as manure, which means that the waste in local landfills will be reduced since the banana pseudostem is a recyclable product (Tony Elumelu Foundation, 2023).

Ecohub is a local start-up that innovatively uses plastic waste to produce affordable, architect-designed flat-pack ecobricks and ecohouses. Its founder is Letsogile Kennedy, an award-winning social entrepreneur and architect. Ecohub also obtained assistance from TEF. The company's plan is to manufacture green building materials from waste, providing affordable and sustainable housing that can last for 20 to 25 years (Tony Elumelu Foundation, 2023).

The Challenges of Africa's Decarbonization Agenda and How to Overcome Them

Social economies that promote the climate and decarbonization agenda as well as climate entrepreneurs face several challenges such as limited access to finance, technology, and infrastructure as well as regulatory barriers. These are discussed below.

- Limited access to finance: Social enterprises and foundations face challenges of inadequate financing to advance the agenda.
- Limited access to technology: This serves as a key challenge for young entrepreneurs in Africa in pursuing the decarbonization and climate change agenda. Inadequate access to new technologies prevents climate entrepreneurs from maintaining competitiveness and innovation.
- Lack of infrastructure: Africa lacks access to quality infrastructure such as transportation, electricity, and Internet connectivity. This can make it difficult for green businesses to operate efficiently and cost-effectively.
- Lack of skills and experience: Social entrepreneurs may lack the necessary skills and experience to succeed in green businesses. This can make it difficult to develop and implement effective business strategies, manage finances, and navigate the regulatory landscape (Tony Elumelu Foundation, 2023).

Overcoming these challenges requires access to finance, technology, and business development support, as well as policies that promote the growth of green businesses. This is essential for the growth of climate entrepreneurship and climate-oriented social economy. Although Africa possesses the natural treasures needed to decarbonize successfully, several obstacles hinder that from happening:

- Africa lacks adequate infrastructure to achieve decarbonization: Adequate grid infrastructure is needed to facilitate the integration of RES into the current energy mix. Unfortunately, African states are underequipped with such infrastructure. In addition, the current capacity can only support small-scale renewable source deployment.
- The initial cost of transitioning into green economy is too high: Africa does not have the necessary infrastructure to allow the integration of renewable energy projects yet. Building new systems from scratch is very expensive due to equipment purchases, installation expenses, and grid connection costs. Considering that Africa is also home to more than 70% of the world's less developed nations, the continent is not financially capable of meeting the upfront costs, thus delaying decarbonization projects longer than necessary.
- In an effort to meet immediate energy demands, Africa has become overdependent on fossil fuels: In the majority of African nations, the demand for energy is often higher than the supply due to inadequate or outdated energy infrastructure and electricity storage systems. Consequently, countries opt to put decarbonization projects on hold so they can

use the available resources to meet immediate energy demands. However, too high fossil fuel dependence leaves vast RES deposits in Africa untapped and fails to address energy poverty.

- Political obstacles and regulatory restrictions hinder decarbonization: Numerous political issues stall Africa's decarbonization efforts. Those include political instability, which discourages long-term investors. Countries experiencing political instability also tend to have regulatory challenges, such as inconsistent policies due to frequent changes or reversals by the government. Political and regulatory obstacles are often accompanied by corruption, which is a rampant issue in many African states and limits the successful execution of decarbonization projects.
- Directing all efforts toward adaptation as opposed to mitigation slows down decarbonization projects: Africa's vulnerability to climate change has increased over the years, as exemplified by the extreme weather events that have plagued the continent in recent years. The few projects that have been implemented focus on adapting to climate change impacts like food insecurity, floods, and drought, which have recently become rampant, leaving these nations with no other means to support their decarbonization initiatives.

The list below provides examples of decarbonization challenges faced by organizations:

- Large upfront investments for changes can deter decision-makers, who may prefer prioritizing funding in other areas that have a track record of benefits or profit, like sales or new technologies.
- Pushback and legislative protection of fossil fuel industries can make it difficult to legally eliminate fossil fuel usage in certain areas.
- The costs of new technologies and research can make the necessary changes inaccessible for companies lacking resources.
- Lack of climate education and buy-in at all levels can produce much bureaucracy for individuals who need capital and support to enact changes.
- Cooperation on a global scale is difficult when managing the various needs, values, and accessibility to resources of different countries and jurisdictions.
- Balancing policies like carbon taxes with the impact on citizens is necessary since families and individuals may be inadvertently affected by factors like high costs.

Conclusion

The article reveals that the challenges of limited access to finance and technology, as well as lack of infrastructure, skills, and experience, are serious limitations to Africa's decarbonization pursuit. The urgency to design, assess, and implement decarbonization pathways in Africa has been increasing. Although several initiatives by the social economy and social entrepreneurs are already operating to foster the growth of decarbonization and climate-oriented solutions, social economies and entrepreneurs still face several challenges. Tackling those challenges will go a long way in decarbonizing Africa and improving the implementation of climate change mitigation strategies.

The study was limited by a literature gap and lack of empirical data for empirical analysis. Time was also an important constraint.

Future research directions could focus on several areas and aspects, such as the place of technology and infrastructure in pursuing decarbonization and climate change, and the future energy demand so as to reduce African overdependence on fossil fuels.

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Investigating the Phenomenon of Social Entrepreneurship

Marwane El Halaissi and Oualid Benalla

Abstract: **Background:** Social entrepreneurship (SE) has been gaining ground in economy and politics since the 1980s, arousing scientific interest. But despite numerous studies, the field still lacks a standardized theory, inviting interpretations by other disciplines.
Research objectives: We show that SE draws on two theories of economics – entrepreneurship and market failure – and clarify their suitability for explaining the field.
Research design and methods: Our bibliometric analysis involved statistical methods to ascertain qualitative and quantitative shifts. We aimed to delineate the publication landscape and identify the emerging trends.
Results: The article calls for a standardized theory and better integration of perspectives in SE research, underlining social value creation, long-term effects, and contextual influences.
Conclusions: SE is a developing field without standardized frameworks, focusing on social rather than economic value. It underscores entrepreneurial qualities in addressing societal needs and advocates nuanced policies that support entrepreneurial processes and societal impact.
Keywords: social entrepreneurship, entrepreneurship theory, market failure theory, socioeconomic problems
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Introduction

Social entrepreneurship (SE) has been gaining ground in economy and politics since the 1980s, following the efforts of powerful foundations such as Ashoka or the Grameen Bank, which has aroused the scientific community's interest. Since the 1990s, several studies on SE have emerged, giving rise to various definitions, conceptions, and theoretical understandings ranging from economics to anthropology (El Halaissi & Boumkhaled, 2018). Despite this, SE has failed to develop a standardized theory (El Halaissi, 2023), which leaves the field open to interpretations by other disciplines and makes it appear as a "cluster or umbrella construct" (Steyaert & Hjort, 2008; Mair, 2010). Thus, SE remains an emerging field that combines concepts from different disciplines.

The scientific literature shows various tendencies: certain groups of researchers describe the character traits of SE organizations, while others focus on case studies, some of which concern the impact of SE at the local and territorial level and its role in solving socioeconomic problems. Yet another group draws on the entrepreneurship theory, trying to shed light on how this phenomenon works. The hypothesis we defend is that SE as a concept lies at the crossroads of two

theories of economics: entrepreneurship and market failure. The question we wish to answer is: to what extent are these two theories suitable for explaining social entrepreneurship?

Literature Review

The conceptualization of SE remains in its infancy; the field is perceived as a formula of entrepreneurship which proposes a lever to boost socioeconomic activity. Several definitions of SE present four key elements, namely: the social entrepreneur's character traits; the range of operations; the resources and processes used; and the social entrepreneur's mission (El Halaissi, 2023). Thus, SE forms a subfield of entrepreneurship in the early stages of development, alongside other subfields such as business concepts (Steyaert & Hjorth, 2008). As a scientific field, SE has attracted the scientific community's interest and gained several definitions. Still, it remains "ill-defined" and "self-contained" (a cluster); the conveyed ideas are few and disorganized without a significant theory (Steyaert & Hjorth, 2008).

Social entrepreneurship contains three basic elements: identifying a stable equilibrium that excludes, or marginalizes, a social group that lacks the means to transform the equilibria; identifying an opportunity and the development of a proposed new social value; and developing a new equilibrium that ensures a better future for the group and society. Thus, SE is based on the discovery and exploitation of business opportunities through the identification of social economic needs unmet by the market and the state; its mission is the creation of social value (Omrane & Fayolle, 2010). Social entrepreneurship appears as a formula of entrepreneurship itself (Dees, 1998). Defourny and Nyssens (2010) list three main intertwined notions: social enterprise, social entrepreneurship, and social entrepreneur. To some extent, SE research has replicated the theoretical and empirical evolution of entrepreneurship. Researchers focus on the entrepreneur's personality, in particular on behaviors or processes, and on the social opportunity to emphasize the entrepreneurial nature and differentiate it from other phenomena. One research stream focuses on the social entrepreneur's personality; following this approach, social entrepreneurs possess special traits (Drayton, 2002), special leadership skills (Thompson et al., 2000), passion to realize their vision, and strong ethics as defined by Drayton (2002). Several researchers focus on entrepreneurial processes – that is, on the way entrepreneurs act – to differentiate between social and entrepreneurial initiatives (Dees, 1998). Currently, there is no single definition of SE and no conceptual framework to unify the different approaches. Even after two decades of research, the concept remains at an embryonic theoretical stage (El Halaissi, 2023). Several researchers have tried to address the different SE conceptions by mapping the range of SE definitions (Choi & Majumdar, 2014). Social entrepreneurship is a complex phenomenon defined by objective, subjective, and processual approaches. It combines managerial efficiency with addressing social needs and reinvesting profits for the community (El Halaissi, 2023). The literature also includes narrow and broad approaches, with some arguing that SE demonstrates the pre-paradigmatic stage. Despite such complexity, scientific journals, monographs, and academic units have already institutionalized SE (Pacut, 2020).

The literature dealing with SE remains poorly defined; Spear (2001) argues that it has borrowed terminology from the field of entrepreneurship. Definitions of SE refer to processes and behaviors, definitions of social entrepreneurs rely on the initiative's founder, and definitions of social enterprises utilize the tangible outcomes of SE (El Halaissi & Boumkhaled, 2018).

Research Method and Material

We conducted a bibliometric analysis, involving the application of statistical methods to ascertain both qualitative and quantitative shifts in a research domain. This process aimed to delineate the publication landscape regarding the subject matter and identify emerging trends within the discipline, as outlined by De Bakker et al. (2005). This study used the Scopus online database, which houses scientific documents across all disciplines. The availability of comprehensive research output data through Scopus facilitates bibliometric analysis. This is attributed to Scopus's provision of extensive data pertaining to research output, dissemination, collaboration, and impact, as elucidated by De Bakker et al. (2005). We conducted our research based on the following criteria: TITLE-ABS-KEY ("social entrepreneurship") AND (LIMIT-TO (SUBJAREA, "BUSI") OR LIMIT-TO (SUBJAREA, "SOCI") OR LIMIT-TO (SUBJAREA, "ECON") AND (LIMIT-TO (SRCTYPE, "j")). Our primary results showed that between 1989 and 2023, 2,125 articles about SE appeared within the Business, Management, and Accounting field; 1,674 within Social Sciences; and 1,103 in Economics, Econometrics, and Finance. The examination of the Scopus database focused on SE research conducted within the period spanning April to July 2023. This investigation encompassed a comprehensive analysis of all documents on this topic retrieved from Scopus. The resulting sample comprised 3,012 journal articles indexed to Scopus. The bibliometric indicators used in this research were as follows:

- language of SE research publication,
- areas of knowledge within which authors have published SE research,
- change in the number of SE research documents published,
- countries where authors have published SE research,
- journals in which authors have published SE research,
- authors who have published SE research.

Results and Discussion

Results of Bibliometric Indicators

Language of SE Research Publication

The language publishing landscape in the SE domain predominantly revolves around English. Given the global dissemination and accessibility facilitated by English as the lingua franca of academia, a significant majority of scholarly articles and research outputs on SE appear in English (4,091 documents). The second most common language is Spanish (93). This trend reflects the international reach and influence of English-language journals and underscores the interconnectedness of the scholarly community engaged in SE study across geographic regions. Despite the sporadic instances of articles published in other languages, the prominence of English-language publications serves to foster collaboration, knowledge exchange, and cross-cultural dialogue among researchers, practitioners, and stakeholders in the SE field on a global scale.

Table 1. Language of Publications

Language	No. of publications	Language	No. of publications
English	4,091	Italian	2
Spanish	93	German	2
Russian	32	Chinese	2
French	23	Bosnian	2
Portuguese	17	Turkish	1
Croatian	10	Serbian	1
Slovenian	6	Lithuanian	1
Czech	4	Basque	1
Ukrainian	3	Arabic	1

Source: Scopus analysis.

Knowledge Areas of SE Research Publication

According to Vasquez and Davila (2008, p. 107), authors have studied entrepreneurship from the perspective of economics, psychology, sociology, and anthropology. Similarly, SE has emerged not only within management sciences (Bagnoli & Megali, 2011; Meyskens et al., 2010) and entrepreneurship (Chell, 2007; Corner & Ho, 2010) but also across various disciplines (Duane Ireland & Webb, 2007; Short et al., 2009) such as sociology (Hockerts & Wüstenhagen, 2010), ethics (Cornelius et al., 2008), finance (Austin, 2006), political science (Dey & Steyaert, 2010; Hemerijck, 2002), as well as psychology and education (Chand & Misra, 2009). This emerging academic field characterizes social entrepreneurial activity as a source of social value creation (Cherrier et al., 2018; Young, 2006), incorporating the concept of entrepreneurship within the framework of addressing social problems (Bahari et al., 2016; Dart, 2004; Dees, 1998). Figure 1 shows the percentage share of documents published in different knowledge areas. The Scopus database contains 3,129 documents in business.

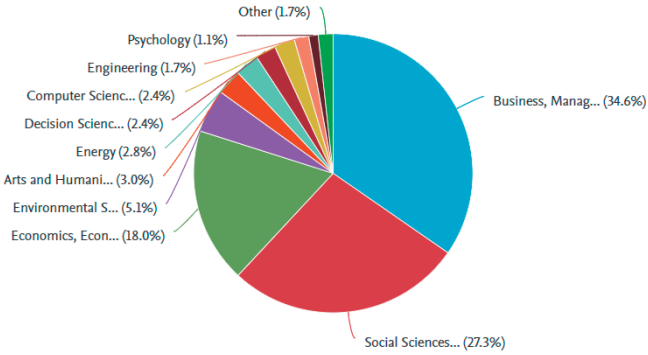

Figure 1. Research Area

Source: Scopus analysis.

Year of Publication

According to the Scopus database, the term "social entrepreneurship" first appeared in a journal in 1989. However, the quantity of documents published per year before 2006 remained notably low. The dataset underscores a discernible escalation in scholarly engagement with this field over time, with a consistent annual increase in the number of publications. In 2006, Muhammad Yunus and the Grameen Bank – recognized for their pioneering work on microcredit – received the Nobel Peace Prize, which greatly propelled the subject forward. From the year 2008, the academic interest in SE increased. By 2012, the number of articles pertaining to SE reached nearly 100; a similar trend emerges between 2014 and 2016. In 2023, the aggregate publications amounted to 400 documents. This sustained scholarly interest underscores the continued relevance of SE within society and highlights the ongoing potential for researchers to address numerous gaps in understanding.

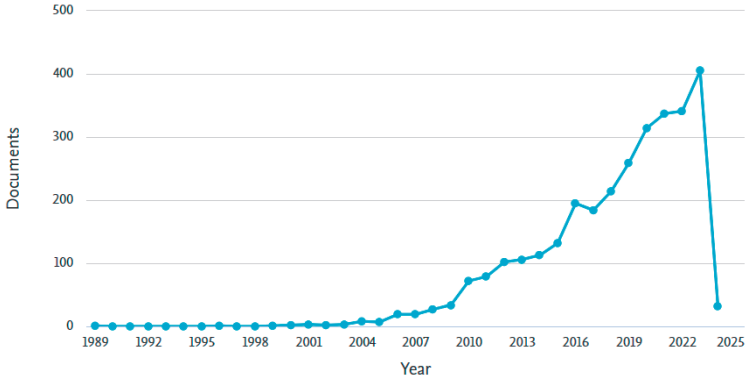

Figure 2. Documents per Year

Source: Scopus analysis.

Countries of SE Research Publication

The analysis of countries' contributions to the SE discourse reveals a prominent role of several nations. Foremost among these is the United States, with a notable publication output of 700 documents. Following closely behind, the United Kingdom emerges as a significant contributor, with 339 publications. India and Spain also feature prominently in the landscape of SE research with 214 and 204 documents, respectively. These figures underscore the global interest in and engagement with the topic, reflecting diverse perspectives and approaches from different regions around the world. Table 2 presents the countries that have published most documents on SE.

Table 2. Countries Where SE Research Has Been Published

Countries	No. of publications	Countries	No. of publications
United States	700	Canada	137
United Kingdom	339	Germany	137
India	214	Italy	119

Countries	No. of publications	Countries	No. of publications
Spain	204	France	114
Australia	141	South Africa	103

Source: Scopus analysis.

Journals of SE Research Publication

Acquiring knowledge about the academic journals disseminating SE research holds particular significance within the realm of scholarly inquiry, facilitating informed decisions regarding journal selection for literature review endeavors. Additionally, comprehending the thematic orientation of each journal with regard to SE is essential. Table 3 delineates the top-ranking journals in terms of their SE publication output.

Table 3. Journals That Have Published SE Research

Journals	No. of publications
Journal of Social Entrepreneurship	197
Sustainability Switzerland	110
Emerald Emerging Markets Case Studies	83
Journal of Business Ethics	65
Social Enterprise Journal	56
Entrepreneurship and Regional Development	48
Voluntas	41
Journal of Business Venturing	36
International Journal of Entrepreneurship And Small Business	36
International Journal of Entrepreneurial Behavior And Research	35

Source: Scopus analysis.

Authors Who Have Published SE Research

The analysis of scholars within the SE realm reveals a cohort of distinguished academics whose prolific contributions significantly influence scholarly discourse. Notable among these authors is Sophie Bacq, whose seminal works have garnered widespread acclaim for their innovative insights and rigorous methodologies. Additionally, the research endeavors of Vanessa Ratten have played a pivotal role in elucidating key concepts and theoretical frameworks within the SE field. Alongside, Yanto Chandra stands as a formidable figure, renowned for their multidisciplinary approach and nuanced understanding of the complexities inherent in SE practice.

Table 4. Authors Who Have Published SE Research

Author	No. of publications	Author	No. of publications
Bacq, S.	17	Roundy, P.T	10
Ratten, V.	16	Urban, B.	10
Chandra, Y.	11	Mair, J.	9

Author	No. of publications	Author	No. of publications
Kruse, P.	11	Ramirez-Montoya, M.S.	9
Kickul, J.	10	Renko, M.	9

Source: Scopus analysis.

Thematic Findings

Theoretical work on SE resembles the work on entrepreneurship in that it shares a common starting point: entrepreneurial practice. However, entrepreneurship has reached an emerging consensus on the field's definition, whereas SE boasts a proliferation of definitions (Dees, 1998; Mair & Marti, 2006; Dees & Anderson, 2006). Although SE research has long developed a comprehensive description of the phenomenon, at present no unanimous definition exists (Aliaga-Isla & Huybrechts, 2018). This is because SE has unclear boundaries with other disciplines, and interdisciplinarity has strengthened entrepreneurship as a research field. Social entrepreneurship also draws influence from several disciplines such as anthropology, economics, sociology, or political science (Dacin et al., 2011). Thus, SE research may be replicating the evolution of entrepreneurship research (Bruyat & Julien, 2001) – which stems from the inability of SE as a research field to develop a solid theory that permits generalization. The authors underline a lack of theories, generalizable models, and definitions of SE; in this sense, Thompson et al. (2000) observes the increasing use of SE as a notion although its meaning is not yet understood.

Social entrepreneurship research has to some extent replicated the theoretical and empirical evolution of entrepreneurship. Building on the work of Israel Kirzner and Joseph Schumpeter, Shockley and Frank (2011) argue that entrepreneurial thinking in SE has roots in the creativity and originality of entrepreneurial discovery. Several SE theories seem to converge with Kirzner's and Schumpeter's work – such as Young (1983), who equates nonprofit entrepreneurship with opportunistic insight, or Weerawardena and Mort (2006), who include "proactivity" as one of the three dimensions of SE multidimensional model. As in conventional entrepreneurship, entrepreneurial thinking in SE demonstrates the nonrational nature of the processes related to new institutions or entrepreneurial discovery. In other words, it stems from new institutions or entrepreneurial discoveries, not from the social entrepreneur's rationality. Much of SE's theoretical construction focuses on the social impacts of SE mainly at the microsocial level, thus following the theoretical evolution of the classical perception of entrepreneurship.

One group of researchers has focused on the entrepreneur's personality – in particular on behaviors or processes – or on the social opportunity to stress the entrepreneurial nature and differentiate it from other phenomena. Some academics distinguish a trend toward SE individualization, which limits the analysis to the social entrepreneur as an individual. Within this trend we find Drayton, who questions the nature of SE, while focusing on the qualities and motivations of social entrepreneurs based on their testimonies. To decipher the phenomenon of SE, authors propose to analyze the individuals behind SE organizations by looking closely at characteristics such as previous experience or motivations. The processes described by Drayton and Isaak resemble Schumpeter's "destructive creation." According to Drayton, social entrepreneurs differ from conventional entrepreneurs in the former's unique ability to deal with social problems (Drayton, 2002). Based on entrepreneurial theories, Dees (1998) suggests that social entrepreneurs are a unique species of the entrepreneurial family.

The field of SE research remains focused on identifying the distinctive traits of entrepreneurs. Many academics interested in this aspect describe the social entrepreneur using con-

cepts from the entrepreneurship theory; the majority of research tends to individualize the social entrepreneurial actor. Mair and Marti (2006) remain skeptical of this approach since, as Gartner (1985) states, "who is the entrepreneur?" is not the right question to ask. Mair and Marti argue that looking at a set of activities arising from SE as a process seems a more fruitful approach. Other authors (Bacq & Janssen, 2011), sharing Mair and Marti's idea, have taken up the theoretical model of Gartner, who described the process of business creation in 1988 using the following elements: the characteristics of the individual(s) creating the business, the process of creating the new business, the characteristics of this organization, and the new entity's environment.

According to Gartner's (1985) theoretical model, one can summarize entrepreneurial actions in six behaviors: identifying a business opportunity, accumulating resources, marketing a product or service, producing a product, creating an organization, or responding to government and society. The identification of social opportunities is the central process of SE, and the marketing of products or services targeted at people in poverty are all important steps in entrepreneurial action for SE in the sense of Nicholls (2010). To clarify the points of concordance between SE and conventional entrepreneurship, we can use microcredit as the flagship activity of SE, which focuses on a strategic choice: the fight against poverty through income-generating economic activities. Entrepreneurship theory conceives the phenomenon of SE as a new form of entrepreneurship, orchestrated by an individual or by organizations with special character traits, who/which create socioeconomic value through processes borrowed from the market and framed by values, ideals, and common welfare. This entrepreneurial form develops in an organizational framework adapted to the local context, in structures called "social enterprises," whose norms are collegial and collective in nature. Hence, the contribution of the classical entrepreneurship theory involves integrating well-established concepts from the entrepreneurship theory into the SE realm. It emphasizes the entrepreneurial nature of social entrepreneurs, highlighting traits, behaviors, and innovation in addressing societal challenges.

Market theory emerged more than 120 years ago following the publication of Leon Walras's *Elements of Pure Economics*, which laid the foundation for modern economic thinking through general equilibrium reasoning – a mathematical model that describes the allocation of resources or goods within the production and consumption units of the economy. The paradigm developed following the introduction of the Arrow–Debreu model in 1954 and the publication of Gérard Debreu's *Theory of Value* in 1959, which demonstrated that a market could ensure the efficient allocation of goods and services under certain conditions. These mathematical models of general equilibrium suggest that individual markets and interrelated markets can achieve the Pareto efficient equilibrium – a market state in which the redistribution of productive goods or resources can improve the position of one individual without influencing another (Arrow & Debreu, 1954). The Pareto optimum is considered the benchmark for assessing the efficiency of markets, and is often consistent with pure and perfect competition, in which prices are equal to total average cost and, as a result, profits or rents – profits over and above costs, which include the risk-return on capital – are nonexistent (Scherer & Ross, 1990). In practice, pure and perfect competition serves as an ideal that is rarely or never achieved, which renders the Pareto optimum unattainable as well.

Research in economic theory generally classifies the Pareto optimum and the theory of pure and perfect competition as the literature on market failure (Dean & McMullen, 2007). According to Bator (1958), market failure equals the relative malfunctioning of an ideal system of prices set by market institutions to make desired activities sustainable or to stop unwanted

activities. The literature suggests that market failure refers to the complete failure of a market to emerge, as well as the failure of an existing market to reach the Pareto optimum. Market failure is a theory that aims to explain the social purpose of organizations that emerge in a social market crisis, namely a situation where the market cannot meet social needs as in the case of public goods (Weisbrod 1975, 1977), or contract failure (Nelson and Krashinsky1973), which means the inability of the individuals who need these goods and services to pay for them.

A problem for the entrepreneur is an opportunity for the social entrepreneur. Different authors propose that market failure creates various opportunities for both the entrepreneur and the social entrepreneur (Austin et al., 2006). The central drive of SE is the social problem, so the organizational form of the social enterprise should correspond to the appropriate modality for mobilizing the resources needed to solve the problem. Classical entrepreneurship theory conceives of market failures as an entrepreneurial opportunity, and several entrepreneurship theorists have proposed that competitive imperfection in markets implies opportunities for entrepreneurial action and economic profit. Following Harvey Leibenstein's X-efficiency theory of market gaps and imperfections, it departs from the ideal state of pure and perfect competition correlated with expected entrepreneurial activity and the magnitude of these outputs. Kirzner introduced the concept of entrepreneurial vigilance to understand the modality of identifying economic opportunities in one's environment. Opportunity refers to a socio-economic imperfection or imbalance that exists in the market and is overlooked by actors but can be identified by "vigilant entrepreneurs." Thus understood entrepreneurs need significant knowledge of their society to identify these imbalances. Under such conditions, the motivation to satisfy the collective welfare finds ample justification, as noticed by Spear (2001).

Social entrepreneurship is presented as action by individuals or private organizations addressing different opportunities in the market – that is, social needs (Korosec & Berman, 2006). Various authors argue that SE is a response to market failures, namely the inability of the market and the state to provide for the social needs of citizens (Shepherd et al., 2010; Omrane & Fayolle, 2010; Mair, 2010). Social entrepreneurship primarily deals with meeting social needs that neither the public nor the private sector has addressed (Alvord et al., 2004). It relies on the discovery and exploitation of business opportunities through the identification of social and economic needs unmet by the market and the state, and its mission is to create social value (Omrane & Fayolle, 2010). Thus, SE appears as a tool to help governments solve social problems; it offers an analytical framework to propose answers to sustainable development challenges (Omrane, 2013). Bacq and Janssen (2011) describe SE as a panoply of steps from identification through evaluation to exploitation, thus converging with the classical conception of entrepreneurship by Kirzner and Schumpeter, and with the theory of market failure. By exploiting opportunities in the market – social problems not addressed by the active system – SE responds to the social needs of citizens and creates social value (Bacq & Janssen, 2011). Some researchers argue that SE is a process of identifying, evaluating, and exploiting opportunities for creating social value through market activities and the use of a variety of resources (Zahra et al., 2008; Janssen et al., 2013).

Mair and Marti (2006) offer another reading of SE as a multiphase process centered on the combination of resources, innovations, and pursuit of opportunities to solve social problems. They distinguish between a variety of definitions and organize them into three stages. First, SE forms a process of creating value through combinations of resources in new ways. Second, it is a set of resource combinations aimed primarily at exploring and exploiting opportunities to create social value through stimulating social change or meeting social needs. Third, it con-

cerns the provision of goods and services but can also refer to the creation of new organizations. According to Martin and Osberg (2007), SE consists of three components. The first one is the identification of a stable and unjust equilibrium that excludes, marginalizes, or negatively affects the lives of certain social groups that lack the means to ensure equilibrium. The second component is the identification of an opportunity and the development of a new social value to challenge the equilibrium situation. Finally, one establishes a new stable equilibrium that reduces the suffering of the target populations through imitation and the creation of an ecosystem around an equilibrium situation to ensure a better future and society.

Mair (2007) equates SE with meeting the local people's basic needs that conventional organizations have been unable to meet. This process includes the provision of goods or services, the creation of institutions, or the reform of inadequate organizations, the main objective being to change or modify the economic or social structures that have led to the system's failure to meet basic needs. The financial viability of social enterprises is an important SE pillar but not a sufficient condition; sometimes the target population's capacity to pay becomes an obstacle to the viability of the SE project. The aim of SE is to create social change by modifying political and economic realities at the local level. It is the local context that shapes the opportunities for SE and determines the tactics and strategies to employ that characterize the entrepreneurial approach. Indeed, the entrepreneurial approach to SE is reflected in the ability to obtain and attract resources, and to recombine them to create new value – new ways of doing things (Mair, 2010). Leadbeater equates SE with entrepreneurial behavior for social purposes – mobilizing market activities to meet the needs of disadvantaged social groups. Bacq and Janssen (2011) argue that SE centers on the search for innovative solutions to social problems not addressed by the existing system.

Thus, descriptions present SE as a movement that addresses market failures by responding to social needs – such as jobs, education, or care – through innovative and socially oriented organizations. Its role is to create new ways of production that take into account the social needs of citizens. Avise defines SE organizations as social enterprises whose purpose is to help individuals disadvantaged by the market, and which ensure the inclusion of populations excluded from the system through the provision of employment and skills training (O'Connor & Meinhard, 2014). In the same vein, Sulphey and Alkahtani (2017) argue that SE tackles problems that traditional organizations (market, state) cannot solve. Thus, SE presents itself as an indispensable solution to the increasing social problems and challenges of human communities in the face of recurrent market crises. It appears as a flagship solution (Parkinson & Howorth, 2008), which addresses the needs of the underserved persons in society and assumes a "palliative role" (Nicholls & Cho, 2006). Thus, the contribution of the market failure theory is the framing of SE as a response to market failures. This builds on the idea that social entrepreneurs identify opportunities created by the shortcomings of the market and governmental systems, providing solutions to unmet social needs.

Knowledge Gaps and Research Agenda

The SE field still has certain knowledge gaps to fill, even with significant advancements. Future research could address the lack of a standardized theory and the difficulty of integrating different perspectives. More research is urgently needed to understand the dynamics of social value creation, the long-term effects of SE initiatives, and the influence of context on

entrepreneurial behavior. Closing these gaps could lead to a more thorough understanding of SE, directing real-world applications and influencing policy choices.

Integration of Perspectives

While the text acknowledges the complementarity of the two perspectives, there is a potential knowledge gap in terms of how these perspectives can be effectively integrated. Future research could explore frameworks that bridge the gap between the process-oriented view of the classical entrepreneurship theory and the outcome-focused approach of the market failure theory.

Holistic Impact Assessment

The text primarily focuses on the entrepreneurial and economic aspects of SE. Future research could delve deeper into holistic impact assessment methodologies that consider broader societal implications, environmental sustainability, and long-term community development.

Cross-Cultural Perspectives

The discussed theories appear to have a Western-centric orientation. An avenue for future research is to explore how these theories and their implications might vary in different cultural contexts, ensuring a more inclusive understanding of SE worldwide.

Longitudinal Studies

There is a limited exploration of SE evolution over time. Longitudinal studies tracking the development, success, and challenges of social enterprises could contribute valuable insights into the sustainability and scalability of SE initiatives.

Conclusions

Various researchers understand SE as a set of activities that offer innovative responses to market failures. A thorough investigation into the SE field has produced insightful discoveries that highlight the diverse character of the discipline. By analyzing theoretical stances, methodological strategies, and bibliometric information, this study offers a nuanced understanding of the current state of research and suggests avenues for deeper investigation. The descriptive results highlight how SE is a dynamic and developing field of study, while the literature review reveals a conceptual landscape characterized by a lack of standard frameworks, fragmented theories, and differing definitions. Despite the entire research conducted since the 1990s, SE remains in its early stages, which forces academics to struggle with developing a coherent and thorough theoretical framework. In the eyes of SE actors, social problems are "opportunities" to seize that will allow the creation of value with a social content, not value in the economic sense. Therefore, it seems that social entrepreneurs can carry out their mission and respond to unmet needs only if they are motivated and have the necessary entrepreneurial qualities to carry out these social projects targeting the local population. Thus, SE research focuses on the creation of non-economic value for individuals and society, but without continuously including the current states of nature, as well as the sources of life and support for the community.

Convergences and Divergences

Both theories enhance one another and contribute to a more comprehensive understanding of the phenomenon by convergently highlighting the entrepreneurial nature of SE. The second theory emphasizes the SE's broader societal effects and its goal, particularly in response to market failures, while the first theory focuses on the processes and actors within SE. These intersections highlight SE's complexity and diversity, capturing its entrepreneurial spirit and its larger social significance.

Implications for the Practice of Entrepreneurship and for Policy Development

The presented perspectives have implications for practitioners and policymakers alike. Practitioners are encouraged to adopt an entrepreneurial mindset, embracing risk-taking and innovation to address societal challenges. Policymakers are urged to develop nuanced policies that recognize SE's diverse nature, fostering an environment supportive of both entrepreneurial processes and societal impact.

Limitations of the Bibliometric Analysis

The article's limitations include a potential oversimplification of SE's complex nature. The study tends to categorize SE as a response to market failures, possibly overlooking other motives or influences. Additionally, there might be limitations in the applicability of the proposed comprehensive definition across diverse cultural and regional contexts.

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Measuring Social Economy in Public Statistics: Introduction to the Polish Experience

Agnieszka Pacut

Abstract: This article presents the objectives, scope, and evolution of the research on social economy conducted by the Research Centre for Social Economy at the Statistical Office in Krakow (Statistics Poland). It highlights the experience and achievements of public statistics in Poland in surveying social economy entities, including social enterprises.
Keywords: social economy, social enterprise, public statistics, Poland, quantitative data
JEL codes: C1, C46

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Social economy is a component of socioeconomic practice that has garnered the interest of academia and public sector worldwide for many years due to its considerable promise in addressing the integrated economic, social, and environmental approaches of sustainable development (Compère et al., 2021). It highlights the social dimensions of development (Hujo & Braumann, 2016) and offers tools that can contribute to transformations toward equity and sustainability (Chaves & Monzón, 2012; UNRISD, 2015).

Various efforts take place at the international level to increase the visibility and effectiveness of social economy. One of these is the implementation of the "Opportunities and Challenges of Statistics on Social and Solidarity Economy (SSE)" project by the United Nations Research Institute for Social Development (Compère et al., 2021). This project presents the state of the art of SSE statistics (Bouchard & Salathé-Beaulieu, 2021), maps international experiences in social economy research (Compère et al., 2021), and makes improvement recommendations for policy makers (Chaves-Avila, 2021). Previous studies present the data collection methods, approaches used, advantages, and disadvantages of surveys conducted by various data providers on social economy – including national statistical offices, government departments and agencies, social and solidarity economy representative organizations (umbrella), universities and other research centers, development agencies, and other non-state entities promoting the SSE (Bouchard & Salathé-Beaulieu, 2021). At the same time, they highlight the importance of public statistics and the challenges it faces in providing the data necessary for programming public policies dedicated to the development of social economy. In particular, this shows the

importance of research, knowledge, and data for social economy development, public policy creation, and concept legitimacy.

The above serves as the background for presenting the experience and achievements of Statistics Poland in measuring social economy, as one of the Central and Eastern European countries that has been systematically developing research in this area since the 1990s.

Statistics Poland (Polish: Główny Urząd Statystyczny, GUS) began surveying nonprofit organizations – foundations, associations, and other social organizations – in Poland in 1998. Subsequent editions of the survey, conducted in 1999, 2002, and 2006, did not receive wide publicity, but they were the starting point for the office's involvement in the Equal Community Initiative program 2004–2006. As a result of the program, Social Surveys Statistics Poland developed a detailed description of the survey methodology concerning associations, foundations, business and professional associations, and faith-based charities. In 2009, the Research Centre for Social Economy (Polish: Ośrodek Badania Gospodarki Społecznej) was established as a separate unit of the Statistical Office in Krakow (GUS, 2019). The purpose of this unit is to: 1) provide reliable information characterizing social economy entities, 2) identify their economic and social potential and the scale and conditions of their activities, and 3) provide comparable data in subsequent time series (Szlubowska & Sekuła, 2024).

The legal basis for the survey of associations, foundations, business and professional associations, and faith-based charities is the Act of June 29, 1995 on public statistics and the Ordinance of the Council of Ministers on the Statistical Surveys Program for Public Statistics, issued annually and determining the subject and object scope of the surveys, as well as the types, forms, and deadlines for making the resulting statistical information available.

The purpose of this survey is to provide information characterizing selected types of nonprofit organizations, determine their economic and social potential, and indicate the scale and conditions of the conducted activity. The information elaborated is used to prepare the account of the nonprofit institutions sector distinguished within national accounts, and to monitor indicators in the field of, among others, social capital, social economy, and implementation of the law on public benefit activities and volunteering (GUS, 2019) and the Act of August 5, 2022 on the social economy (Małecka-Łyszczek et al., 2023).

In the study of nonprofit organizations, the Statistics Poland relies on the international statistical definition of nonprofit organizations as recommended by the United Nations (UN, 2003). According to this definition, the nonprofit sector includes entities which are formalized, sustainable, institutionally separate from public administration, not profit-oriented, self-governing, and characterized by voluntary participation in the organization's activities.

As part of the survey of associations, foundations, business and professional associations, and faith-based charities, the reporting obligation covers the following subsequent types of entities: 1) nonprofit organizations – foundations, associations, and similar social organizations; 2) faith-based charities – organizational units of the Catholic Church and other churches and religious associations whose activities were social; and 3) business and professional associations. Over time, Statistics Poland has also included other entities in the survey, such as: 1) socio-occupational reintegration units, namely social integration centers, social integration clubs, occupational therapy workshops, and vocational activity establishments, referred to in the literature as Work Integration Social Enterprise – WISE (Pizarro Escribano & Miranda González, 2022; Rey-Martí et al., 2021); and 2) cooperative organizations, namely employee cooperatives, social cooperatives, and cooperatives of disabled persons and blind persons. In addition, the

survey includes unpaid work outside the household (voluntary work). Thus, the study covers the entire group of entities classified by the legislator as the social economy sector in Poland.

The subject matter includes such issues as the scope, areas, and forms of activity, membership, activity recipients, members, social work (volunteers), paid work, financial aspects of activity, management, form and level of cooperation with the public sector, commercial and other nonprofit organizations, types of exemptions and privileges applied by organizations with public benefit status, and others. The scope of data collected varies according to the type of entity. For a detailed discussion of research tools and indicators, see *Methodological report. Non-profit organizations: Associations, foundations, business and professional associations and faith-based charities* (GUS, 2019).

Surveys of the above-mentioned group of entities employ statistical forms filled in by the organizations covered by the reporting obligation. In addition, the survey compiles data obtained from administrative and non-administrative sources – that is, the Social Insurance Institution (Polish: Zakład Ubezpieczeń Społecznych, ZUS), the Ministry of Finance, the State Fund for the Rehabilitation of Persons with Disabilities (Polish: Państwowy Fundusz Rehabilitacji Osób Niepełnosprawnych, PFRON), and Country Offices. The survey uses several forms of reports, depending on the entity type and the subject matter scope. The selection of units for reporting follows two methods: full and representative (GUS, 2019).

The survey data are presented as reports available on the website, statistical tables (GUS, 2024), and a local database (GUS, 2024a). Moreover, the Ministry of Labor and Social Policy also publishes the data on social economy from Statistics Poland's surveys (DES, 2021).

Social economy research is an important element among the tasks of the Statistical Office in Krakow. The implementation of public policies aimed at strengthening social economy entities generates information needs, which the office tries to satisfy by extending the subject and object scope of research. The challenges for social economy research identified by Statistics Poland include increasing the quality of the research work carried out, debriefing respondents, and disseminating research results to stakeholders.

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Evaluating Evidence-Based Ecosystems-Based Adaptation for Food Security Assembly (EBAFOSA) and Nasarawa State University (NSUK) Initiatives: Decarbonization, Clean Cooking Energy Promotion, and Cassava Food Chain Entrepreneurship in Nigeria

Richard Munang

Abstract: **Background:** This article examines the enterprise-focused efforts of the Ecosystems-Based Adaptation for Food Security Assembly (EBAFOSA) and Nasarawa State University (NSUK) in decarbonizing the domestic energy sector, particularly in Nigeria, while drawing lessons applicable at the continental level. **Aims:** The study aimed to assess the impact of EBAFOSA and NSUK initiatives on decarbonization, focusing on the adoption of clean cooking energy and entrepreneurship within the cassava food chain, with a particular emphasis on household engagement and economic outcomes. **Method(s):** The research engaged up to 60 households in Nasarawa, Nigeria and evaluated the efficacy of interventions such as the displacement of charcoal with briquettes in cassava processing. Data collection involved assessing energy cost reductions, shifts in energy sources, and economic implications for local actors. **Results:** Findings indicate significant reductions in household energy costs (by 2–3 times) and a notable transition from charcoal to briquettes among garri processors, with approximately 36 processors (representing a conversion rate of about 65%) adopting this cleaner energy source. This shift led to a 46% reduction in fuel costs for these actors. **Conclusions:** The multifaceted issues faced by Africa's decarbonization efforts serve as an opportunity to ignite innovation and foster significant change. Collaborations like NSUK and EBAFOSA and their innovative approaches to sustainable energy show the promise of scalable solutions.

Keywords: clean cooking energy, decarbonisation, entrepreneurship, EBAFOSA, NSUK, Nigeria
JEL Codes: E21; F64; L25; O13; Q18; Q42

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Background and Objectives

Reports from the IPCC and UNEP clearly show that the world is on track to exceed the safe 1.5°C warming limit set by the Paris Climate Agreement. The IPCC's 6th Assessment Report, aptly called "a code-red for humanity," was clear that the globe is on track to breach the

1.5°C warming threshold in 20 years. The 2023 UNEP emissions gap report states that global emissions trends continue toward unsafe warming levels of 2.5°C–2.9°C (UNEP, 2023). We see that with the globe already about 1.1°C warmer than in the late 1800s, emissions continue to rise. To keep global warming to the 1.5°C warming target, we need to reduce emissions by 45% by 2030 and reach net zero by 2050 (United Nations, n.d.). The current levels of commitment fall far short of that goal. It is estimated that to date, governments' commitments fall far short the requirements. Commitments from up to 195 countries are set to increase global emissions by 9% by 2030, compared to 2010 levels. Cumulatively, climate change threatens to wipe off 4–18% of global GDP (Marchant, 2021).

However, the need for decarbonization is not the only driving stimulus. Embracing circularity and low emissions pathways also portends significant economic opportunities across the globe. For example, in Europe, circularity can reduce pollution by 72% by 2040, remove 70% of CO_2 emissions by 2050, and save up to $1 trillion by 2050 while preserving material that would otherwise be lost (Schaible, 2021). In Africa, the estimates show that a competitive, low-carbon manufacturing sector could help the region generate an additional $200 million – $2 billion in yearly revenue by 2030 while creating up to 3.8 million jobs over the next 30 years (McKinsey, 2021).

However, Africa is unique for being the lowest emitter. With up to 17% of the global population, the continent accounts for the least emissions at 4%, which makes it a net positive. On the profile of these continental emissions, the African Development Bank (2020) records that up to 57% of emissions are land-based, emanating from agriculture, land-use change and forestry, and one of the leading sources is high dependence on wood-based energy. Specifically, Hinneh (2019) notes that firewood and charcoal provide over 80% of domestic cooking energy in sub-Saharan Africa. In terms of numbers, World Bank (2020) records that up to 900 million people across Africa use unclean cooking energy. This has come at a significant cost to human and environmental health. Sedano, Silva, Machoco, and others (2016) report that fuel wood causes up to 67% of forest degradation, making it a major source of Africa's land-based emissions. On the human health front, indoor pollution from charcoal and firewood use causes 490,000 to 700,000 premature deaths annually in Africa, according to Nature (2023).

To address these risks, countries have put forth plans to transition communities to liquid petroleum gas (LPG) as a cleaner cooking solution. According to Pope and Puzzolo (University of Liverpool, 2021), some countries have set targets to increase LPG use by 35–58% by 2030. However, inflationary pressures compounded by the lingering effects of COVID-19 and the Russia-Ukraine conflict caused a price surge of up to 48% in some countries, according to Guguyu (2022), making this option out of reach of more people. The World Bank (Kammila et al., 2014) observed that only about 5% of Africa's population used LPG. However, during periods of high inflation and rising costs, more people returned to using charcoal. In some countries, this fall in LPG demand also hurt business, causing some vendors to scale down by up to 90% to adjust to a slow market according to Africa News (2022).

According to Goswami (2018), we may observe a similar situation in Nigeria. The country is the largest producer of charcoal in Sub-Saharan Africa (Lansu, Bos, & Ivens, 2020), an activity

linked to deforestation and forest degradation. Nigeria has one of the highest deforestation rates globally at 5% annually and has lost 50% of its forests in the past two decades. About 80% of Nigerians live in rural or semi-urban areas and depend solely on fuel wood for their energy needs. In total, 90% of the wood demand from forests goes to fuel wood. On the health front, household air pollution causes approximately 93,000–95,000 premature deaths annually, and women who do most of the cooking and their children are the most vulnerable (CCACOALITION, n.d.; ICEEDNIGERIA, 2024). Furthermore, like the rest of Africa, global inflation caused cooking gas prices to rise by up to 83.7% between 2021 and 2022 (Ibrahim, 2022; Imam 2022). This development forced many households to switch to unclean alternatives, especially charcoal and kerosene (Vanguardngr, 2022).

Across Nigeria and Africa, these inflationary pressures revealed the propensity of market preferences to shift to cheaper, unclean cooking energy options, which harms the long-term consistency of transitioning populations into clean cooking. It also lays the basis for a need for cheaper, cleaner cooking options accessible to the majority. The Nasarawa State University, Keffi (NSUK), in collaboration with the Ecosystems-based Adaptation for Food Security Assembly (EBAFOSA) has been working to enhance the uptake of affordable clean cooking solutions and generate data to inform lessons for continental impact. The collaboration between the NSUK and EBAFOSA began with the local governance structure of the Emir of Nasarawa. Recognizing the need for partnership between academia and the UN's lead environmental agency, they aimed to create environmental enterprise opportunities in the emirate and ensure sustainable market practices in Nasarawa and beyond.

This article aims to discuss efforts showcased by EBAFOSA and NSUK on reducing carbon emission and promoting the use of clean cooking energy (briquettes) as well as the promotion of garri production; one of the cassava value chains in Nigeria. The is the first of its kind in Nigeria on narrating practical efforts with evidence-based data in promoting decarbonisation, clean cooking briquettes, and cassava value chain entrepreneurship in Nigeria. This study responds to the need for practical solutions to advance uptake of clean cooking solutions which are critical to enhance Africa's decarbonisation efforts considering that the continent's main emissions sources are land based. Following this introductory part, the paper has five sections. Next section will present the literature review on few studies that have outlined decarbonisation efforts in Africa, focusing on addressing land-based emissions from unclean/biomass energy; next, the article will discuss the methodology, then results, discussion, and it will end with conclusions.

Literature Review

According to estimates, globally, up to 2.4 billion people use solid fuels like wood and charcoal for energy (Belopolsky, 2023). These fuels release harmful pollutants and greenhouse gases. Consequently, the global economy loses over $2.4 trillion annually because of damage to the climate and local economies, while up to 3.2 million people lose their lives prematurely each year primarily from indoor pollution arising from unclean cooking. Moreover, unsustainable harvesting and incomplete biomass combustion contribute an estimated 1.9–2.3% of global emissions.

Sub-Saharan Africa accounts for about 15% of global population, but accounts for over 34% of the world's usage of traditional cooking fuels and technologies (Durix et al., 2024). Across Africa, up to 2.3 billion people still lack access to clean cooking, while over 850 million of them

depend on wood and charcoal for cooking, and this has come at a high cost to human and environmental health (Diallo, 2022; IPCC WGII, 2023). Environmentally, fuel wood causes up to 67% of forest degradation and is the largest source of Africa's land-based emissions (Sedano et al., 2016; AfDB 2020). Cumulatively, estimates are that biomass fuel is responsible for the deforestation of 2 million hectares annually, twice the size of the Gambia. In human health, every year, 490,000 to 700,000 adult lives are lost prematurely in Africa due to indoor pollution occasioned by the use of charcoal & firewood (Gilpin, 2022; Collins 2019; IEA, n.d.) The impact on children is even worse, with 1.6 million to 3 million African children dying each year from smoke inhalation caused by indoor and outdoor cooking (Gilpin, 2020). Among adults, women suffer disproportionately from this situation because they take on the more significant burden of housework (Whiting, 2021). According to estimates, women spend 3–5 times more time than men on domestic activities (AfDB, 2016). Over time, a vicious cycle is emerging: deforestation is increasing the time burden in many areas, forcing women to travel farther to find fuel. These health impacts also include psychological effects (Whiting, 2021). Cooking primarily with charcoal and wood makes women about 50% more likely to suffer from depression compared to those using gas (Shupler, 2022).

Cumulatively, estimates show that the cost of inaction on clean cooking costs Africa up to $330 billion every year regarding impacts on climate and health (Durix et. al., 2024).

In response, Africa's efforts to enhance access to clean cooking are well documented. The updated climate action commitments, known as Nationally Determined Contributions (NDCs), show that up to 98 low and middle-income countries (LMICs) have set goals related to household energy or clean cooking, with over 50% of these countries being African (Clean Cooking a, n.d.). Accordingly, 47 of the continents 54 countries, which is 87% of the continent's NDCs, have prioritised clean cooking targets (Nationally Determined Contributions and Clean Cooking c, n.d.). At the same time, Africa is home to several initiatives aimed at transitioning the region into clean cooking. As an example, the UNDP Climate Promise initiative which also includes clean cooking support, is active in 45 of the 54 countries in Africa – which constitutes 83% of countries (UNCP, n.d.; Diallo, 2022).

The urgency to transition Africa to clean cooking is a core driver of notable initiatives such as the African Union High – Level Panel on Emerging Technologies (APET). This initiative challenges African countries to turn agricultural waste to clean cooking fuel. Waste recovery into clean cooking briquettes, where agricultural residues are compressed into solid fuel pellets, is one of the most efficient and effective methods to achieve this goal. These fuel briquettes also advance circular economy principles as they unlock inclusive enterprise opportunities that can be tapped.

Already several countries across the continent are demonstrating the viability for enterprise around waste recovery to clean cooking fuel briquettes. For example, in Rwanda, the government has set a target to decrease the dependency on charcoal use from 79% down to 42% of the population by 2024. Furthermore, the government in Rwanda actively promotes uptake of fuel briquettes as an alternative to wood and charcoal for cooking purposes through positive narratives and unlocking market opportunities for local enterprises. Consequently, key stakeholders are following que. For example, a local cooperative – the *Coopérative pour la conservation de l'environnement* (COOCEN) produces and supplies briquettes to prisons and schools in Kigali. This prevents the burning of up to 1,800 tonnes of firewood annually and cutting of no less than 9,000 trees every year. This reduces deforestation by up to nine hectares of forest plantation and mitigates approximately 297 tonnes of carbon dioxide emissions annually.

In Kenya, the tea sector which utilises about 1 million cubic meters of firewood annually, is taking steps to adopt new business models towards substituting fuel wood with fuel briquettes. Specifically, Kings Biofuels, a briquette-making company, is in partnership with the Kenya Tea Development Authority (KTDA), a major tea sector regulator in the country, to produce over 200 tonnes of briquettes per month for use in tea drying. The country also implemented policy and legislative measures to increase the use of affordable clean cooking fuels by offering fiscal incentives. Specifically, the Kenya Finance Act of 2021 exempted clean cooking fuels, such as biogas and fuel briquettes, from value-added tax. This aims to provide a sustainable alternative to charcoal, which up to 70% of Kenyans use for cooking, and to generate billions in alternative incomes (Ndegwa et al., 2020). Kenya's charcoal supply chain currently trades up to $1.6 billion (Wanjiru & Nyambane, 2016). The incentives of the finance Act 2021 make it cheaper to produce cleaner fuels and transition the billions in charcoal into cleaner fuels.

Briquettes are also effective at enhancing gender access to economic opportunities (Njenga & Mendum, 2018). For example, in Ghana, women fish smokers shifting from charcoal and firewood to fuel briquettes register up to 10% more in energy cost savings (Gebrezgabher, Amewu, & Njenga, 2018). When considering the cost of labour for splitting firewood in addition to buying price, the total saving by switching to briquettes increases to 26%. Meanwhile, in Uganda, the accessibility of briquettes as an enterprise area empowers marginalized women to retail fuel briquettes to their local community (Clean Cooking b, n.d.). Up to 160 women retailers have been established, each earning at least $152 per month, a decent wage from retailing fuel briquettes.

Across the continent, briquettes application has shown several benefits, including (Ramsay & Njenga, 2021): providing opportunities for small enterprises, lowering domestic energy costs to enhance household savings, lowering the risk of indoor pollution, helping to re-purpose waste, ecological benefits by protecting forests among key benefits. However, to succeed at scale, briquette making must become a viable enterprise, and a number of business models to this end are applicable (Charcoal Project, 2021). Some notable examples include "Fusing Agroforestry and Small-scale Manufacturing to Boost Livelihoods and Create Sustainable Fuel" in Kenya, which oversees up to 200,000 hectares of dryland landscape managed with agroforestry, while tree residues serve to produce charcoal briquettes that generate 20–40% in profit margins for local communities while reducing fuel costs by 30–70%. Another model "Scaling Charcoal Briquette Enterprises," still in Kenya, is recovering charcoal waste in the capital Nairobi, and transforming it into fuel briquettes to further substitute charcoal use. The foundational premise of this enterprise is that 10–12% of charcoal consumed in the city is discarded as dust and fines, which can accumulate to up to 150 tonnes per day. This enterprise has employed up to 70 persons and sold up to 200 tonnes per month in local markets. The model "Marketing and Manufacturing Charcoal Briquettes in an Urban Setting" in Uganda has seen an enterprise produce up to 60 tons per month of briquettes, which it sells alongside improved cookstoves designed for firing fuel briquettes. This intervention has employed up to 30 people directly, and another 100 indirectly along its entire supply chain in the Kampala metropolitan area. These examples provide evidence of the enterprise potential of waste recovery to fuel briquettes as a viable strategy to decarbonise the continents land-based emissions sources, and primarily those arising from the prevalence of unclean cooking.

To build on these successes, several key lessons and policy recommendations emerge:

– Charcoal briquettes are a viable alternative to traditional wood charcoal, improving livelihoods and supporting environmental sustainability.

- Briquette producers need to find sustainable alternatives to charcoal dust from the charcoal value chain, as rising competition has increased prices and affected availability.
- Successful production and trade of charcoal briquettes can be cost-effective with affordable, sustainable raw materials, efficient operations, high-quality products, and targeted customer segments.
- Effective enforcement of charcoal regulations would ensure that briquettes are treated equally in terms of taxes, labor costs, and government regulations.
- Financial investments can help small and medium enterprises (SMEs) in the briquette industry grow into larger operations, making price competition more balanced with firewood and charcoal.
- Technological advancements should be carefully managed to avoid driving small-scale, informal briquette enterprises, particularly in urban informal settlements, out of business.
- Among others, additional policy recommendations from literature include:
- The need to legislate policies prosecuting individuals and companies indiscriminately clogging trees for wood fuel and charcoal production binding ministries of forestry, Agriculture and environment with such task.
- Prioritising finance and investments for research towards providing various sustainable raw materials for briquettes production with high calorific value; providing forest guards with adequate resources and welfare to safeguard green cover, wildlife and other natural resources.
- Incentivising affordable credit for SMEs producing briquettes for equipment to support mass production of briquettes to cater for national clean cooking energy needs.
- Creating awareness at the grassroots on the urgent need to combat climate change and its impacts and to protect our green cover and how clean cooking fuel briquettes is strategic to this end.

The literature attests to the practicality of uptake of clean cooking solutions from an enterprising dimension setting the stage for empirical investigation of work by EBAFOSA toward strengthening the call for enhanced enterprise uptake of these solutions. To this end, the NSUK work through the entrepreneurship centre focuses on tapping this niche for Nigeria and creating lessons to inform continental-wide policy and investment shifts.

Research Method and Material

This study utilised a mixed-method research strategy combining narrative methodology and desk studies. The narrative methodology was suitable because the study aimed to discuss EBAFOSA's and NSUK's efforts to reduce carbon emissions, promote clean cooking energy, and support cassava value chain entrepreneurship in Nigeria. I applied narrative methodology because the study focused on narrating the efforts, presenting generated data for informed policy in course of EBAFOSA-NSUK collaborative implementation. Moreover, I employed desk studies because literature review of published works on decarbonising domestic served as strategy to lay the case of the importance of decarbonising domestic energy in an enterprise dimension, and to corroborate and validate findings of the work by EBAFOSA-NSUK.

Specifically, leveraging the policy framework of EBAFOSA and engaging youth people to retool especially working with young entrepreneurs across Nigeria to support them in retooling their skills and engage in devising environmental solutions to meet key on-demand areas in communities. Waste recovery to clean cooking solutions of fuel briquettes has been among

the most critical demand areas. Accordingly, through these interventions, market trials generated data that showed the market viability of this approach. By using the governance structure of the Emirates of Nasarawa, communities were encouraged to adopt fuel briquettes, which had lower production costs and thus offered cheaper market prices than charcoal. The impacts demonstrated the technical and market feasibility of this solution.

Results and Discussion

Up to 60 households in Nasarawa were engaged, demonstrating the market and technical feasibility of these solutions through various impacts. Households reduced their energy costs by 2–3 times. While 1 kg of fuelwood goes for about N600–650 ($1), equivalent to about 2 litres of kerosene, which sells for N800 ($1.3), the price of a kilo of briquettes was between N250–300 ($0.4) but produced the same amount of energy.

I leveraged data on these empirical successes by households to engage markets beyond households and target commercial applications. Accordingly, one of the major cassava processors turning cassava into a local edible called garri, operating in Azuba, was also engaged in displacing charcoal with briquettes in processing the cassava into garri. Once again, multiple impacts were registered, and up to 36 garri processors, representing a conversion rate of about 65%, shifted from charcoal to garri. Specifically, adopting and using briquettes reduced Azuba actors' fuel costs by 46%. Up to 3000 kgs of charcoal was displaced. Fuel costs were reduced and profitability increased. The processors increased their profitability from 3000–5000 naira per bag to between 5800–8000, and this resulted from a 50% reduction in fuel costs. The quality of garri improved because of non-smokiness, resulting in a 52% increase in clients among the processors. Moreover, reduced smoking enhanced the aesthetic appeal of briquettes as an alternative to charcoal, resulting in more young people engaging in garri processing, earning up to 1,500 Naira per day.

To enhance the reach of these solutions, the results of these trials served to inform the development of a climate action entrepreneurship curriculum under the NSUK School of Entrepreneurship. A new course "climate action and entrepreneurship" was introduced in years 3 and 4. This aimed to train more young people to expand the reach of clean cooking solutions in communities and self-employment/enterprise opportunities for youth across Nigeria. The first class attracted 20 students with different disciplinary backgrounds who are now being trained to develop and decentralize clean cooking solutions from an enterprising lens.

Cumulatively, the total savings generated by one primary charcoal user who switched to briquettes was estimated at ₦14,500 per week. If we extrapolate for the estimated 140 million charcoal users in Nigeria (Remteng et al. 2021), this means $4.2 billion worth of household savings recouped weekly to be engaged in other areas of the Nigerian economy.

Lessons and Policy Implications

Most importantly, these developments have highlighted the following strategic enablers for expanding affordable and accessible clean cooking solutions in Nigeria and across Africa.

a) Skills retooling – to increase market access to clean cooking solutions, there is a need for adequately trained human capacity to develop and decentralize these solutions competitively. There is no vacuum in the market, and the majority use charcoal and firewood. This means that clean cooking solutions will need to be more competitive to displace the current unclean

biomass solutions. Consequently, there is a need to train adequately – especially young people – to be well placed in devising more affordable solutions that are higher quality in terms of burning better and non-smoky, compared to conventional charcoal and firewood. The NSUK Entrepreneurship Centre is leading the way in helping youth retool their skills. It enables them to use low-cost waste-to-fuel briquette solutions to generate income and promote cleaner cooking options in their communities.

b) Enabling policy basis – the pursuit of clean cooking solutions needs to be based on the fulfilment of country development priorities to enhance acceptability, especially at the policy level. Accordingly, in Nigeria, the climate action commitments, popularly called Nationally Determined Contributions (NDCs), provide a much-needed basis. Nigeria's Nationally Determined Contributions (NDCs), including updated commitments (Climate Watch, n.d.), prioritize tackling unclean cooking. The targets include a 13% increase in households using improved cookstoves by 2030, equating to an additional 7.3 million households. This provides high-level policy endorsement of clean cooking solutions as a priority for Nigeria and legitimizes NSUK efforts.

c) Investment plans – there is a need to translate policy commitments into investment plans that clearly elaborate the social, market, policy, financial, and political enablers toward expanding enterprises in the clean cooking value chain. This is critical to attract more players to invest in actions that drive the uptake of clean cooking in the economy. Such investment plans need grounding in empirical data based on successes already underway in the country. NSUK will enhance this aspect by integrating trained youth into a network of data generators. Their work will help inform the development of investment plans.

d) Innovative finance – one of the most critical limitations to enterprise engagement, especially by youth and the informal sector, which are the vastest constituency of ground actors, is capital affordability across Africa. Up to 80% of the population is engaged in the informal sector, while youth constitute over 60% of the population. In Nigeria, the informal sector accounts for up to 50% of GDP and up to 90% of employment, while youth constitute about 70% of the population (Monye & Oyintare, 2020; Chimezie, 2023). Tapping these constituencies to invest in clean cooking solutions is critical to bridge the accessibility gap. But the big question is on access to capital. Cumulatively, Africa's informal sector-driven enterprises face an over $330 billion financing gap (African Business, 2019). At the same time, the cost of credit in Africa is among the highest globally. Seven of the top 10 highest lending rate countries in the globe are in Africa (The Global Economy, 2023). Nigeria has the 31st most expensive cost of credit globally and the 13th most expensive in Africa (The Global Economy, 2023). We see these high market rates reflect in government borrowing, where countries on the continent pay 5–10% interest rates when they borrow in international financial markets, compared to near zero to negative rates for Europe and America (Mutize, 2020). The leading cause of this costly credit is the perceived high risk of the continent's economies in general. This means that establishing structures to reduce risks for enterprises—particularly in new areas like waste-to-clean-cooking solutions, and especially those run by youth and the informal sector—is crucial for ensuring the availability of affordable capital for these businesses. This is where blended finance de-risking tools come in. Simply put, such tools convene a menu of actions that cumulatively lower enterprises' default risk. These actions include targeted training for enterprises to undertake circularity in plastics. It includes insurance cover for products made from circularity in plastics to cover for market risks on the loss of demand and income. It includes cash guarantees to cover financers against default risk in cases where enterprises default on their repayments.

Such de-risking tools are critical and should be prioritized to create an enabling financial environment for enterprises.

e) Data for policy recalibration – there is a need to ensure recalibration of policy incentives focuses on addressing gaps and opportunities aligned to expanding empirical successes. Accordingly, NSUK collaborates with other policy actors to organize periodic "data for policy" forums, where data on the impacts and successes of youth-driven enterprises driving uptake of clean cooking solutions are shared to inform recalibration of diverse policies toward addressing opportunities and gaps needed to expand these pockets of successes into the mainstream. Moreover, NSUK provides a framework that leverages data from successful enterprises to identify key gaps and opportunities, helping to expand these successes across the country. This is a critical success factor to drive the uptake of clean cooking in Africa.

Conclusions

The multifaceted issues faced by Africa's decarbonization efforts, specifically in the clean cooking sector, serve as an opportunity to ignite innovation and foster significant change. The experience of the work in Nigeria underscores the resilience of the African spirit, demonstrating how clean cooking solutions such as fuel briquettes can transform communities environmentally, economically, and socially. This journey had its obstacles, from economic fluctuations to the high costs of traditional fuel sources and their significant health risks.

However, collaborations like NSUK and EBAFOSA and their innovative approaches to sustainable energy show the promise of scalable solutions. Endeavours in education, policy enhancement, market viability assessment, investment planning, and innovative finance are an encouraging paradigm shift for Nigeria and the entire African continent.

While the road to full decarbonization in Africa may be long and fraught with challenges, it is a journey worth embarking on. It constitutes an opportunity to champion clean, affordable energy solutions and work collectively for a sustainable future. The triumphs and learnings of initiatives like fuel briquettes represent an inspiration to tackle the environmental crises of our time, embodying the African proverb: "If you want to go far, go with others." Together, we can harness our shared wisdom and achieve sustainable success in Africa's decarbonization journey.

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