Concept Paper

Role of Social Enterprises in Addressing Energy Poverty: Making the Case for Refined Understanding through Theory of Co-Production of Knowledge and Theory of Social Capital

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Abstract: Social enterprises have become increasingly central in the field of energy poverty. As a result of market and government failures, an increased emphasis on social enterprises to address energy poverty has emerged. Still, there is limited theoretical understanding guiding the role of social enterprises in addressing the challenge of energy poverty. We apply theories of co-production and social capital to analyze the role of social enterprises in disseminating and implementing cleaner energy alternatives to resource poor communities. By combining implications of these theories, we argue that social enterprises act as honest brokers between communities and technologists, cultivate new social relationships, and change social structures to move poor communities to adopt and use cleaner energy systems. Understanding the role of social enterprises in addressing energy poverty through a theoretical realm will provide a guiding framework to undertake systematic empirical investigation.

Keywords: social capital; co-production of knowledge; energy poverty; honest broker; social networks

1. Introduction

Around three billion poor people, or almost 41% of the world's population, continue to rely on the use of solid fuels such as wood, charcoal, agricultural residues, and animal dung [1]. These solid fuels are mostly used for cooking and heating in open fires or in traditional stoves. The burning of solid fuels in these traditional stoves releases significant carbonaceous aerosol emissions and particulate matters, causing acute and chronic respiratory infection. They are a prime source of household air pollution (HAP) [2]. Also, about 1.6 billion people across the world do not have access to electricity [3]. People predominantly use kerosene in open fires and wick lamps for household lighting. Burning kerosene in open fires releases carbon monoxide and black carbon, which also contribute to HAP, and are hazardous to human health and the environment. While the use of traditional technologies and the lower rung of fuels have pernicious health and environmental implications, it remains the primary source of cooking, lighting, and heating in many areas of the world. Lack of adequate, high quality, and affordable forms of energy or energy systems contribute to the state of energy poverty [4–7]. Energy poverty is defined as the absence of access and choice to adequate, affordable, reliable, high-quality, safe, and environmentally benign energy services to support economic and human development [6,8–10]. Research has shown that lack of affordable, cleaner, and modern energy services contribute to overall well-being [4,6,7]. Energy poverty thus acts as a barrier to overall social and economic human

development. Insufficiency of cleaner and affordable fuel and energy systems is core to energy poverty challenge. The potential solution lies in enabling energy poor communities to use: (1) clean fuels and (2) clean energy technologies [11].

Widespread and sustainable use of clean energy technologies such as cleaner cookstoves (CCS), induction stoves, solar cooking solutions, and solar lighting systems have significant environmental, climate, and health benefits. Clean energy technologies demonstrate potential to address challenges of energy poverty. However, the uptake and sustained use of these technologies are not widespread, and the abandonment rate for these technologies is high [12–14]. This challenge perpetuates energy poverty. Various interventions by governments and nongovernmental organizations (NGOs) have failed so far in addressing this challenge. Governments have made sizable investments in interventions which have proven ineffective because of poor technology, misunderstanding of community needs, structure of energy subsidies, coordination failures, and poor distribution networks [15–18]. Contrastingly, the charity driven NGOs have strong understanding of community needs, but have failed in their interventions because of effort fragmentation and insufficient attention to financial sustainability [15].

The poor track record of government and charitable efforts have given rise to an increased focus on complementary commercial and market-driven models for sustained dissemination and implementation of these clean energy systems [15,19]. Given the low financial returns reaped in the low income household energy services field, social enterprises rather than conventional business enterprises are more likely to enter this sector [15,16,19–23]. Global efforts on these clean energy systems by UN's SE4 All (Sustainable Energy for All), Global Alliance for Clean Cookstoves (GACC), Solar Cookers International (SCI), and Solar Energy Industries Association (SEIA) emphasize social entrepreneurship as a viable approach for addressing energy poverty. For instance, GACC largely depends on the success of social enterprises to reach its vision of disseminating 100 million CCS in the world by 2020. Similarly, Lighting Africa is a World Bank initiative to create an enabling environment for social enterprises working in pro-poor solar energy services. We define social enterprises integrate business and benevolence so as to create social and environmental impact [24]. They have a hybrid nature, and they leverage social relationships to co-create a social good [20,25–27].

Despite the recent emphasis on social enterprises to address energy poverty, we leverage theories of co-production and social capital to expound the purchase of social enterprises in addressing energy poverty for two reasons. First, there is not adequate systematic theoretical literature to understand the role of these enterprises in the context of energy poverty [28]. Research has mostly taken an actor-centered approach [20,28]. As such, there have been many case studies of successful social entrepreneurs. However, there is limited theoretical literature guiding their development in their specific areas of work [19]. Second, the operational nature of social enterprises causes them to internalize market-based approaches to advance a social mission [29]. They co-create social good by leveraging social relationships and connecting disparate stakeholders [29].

The theories of co-production and social capital are commensurate conceptual underpinnings to discuss social enterprises and a social good (that is addressing energy poverty, in this manuscript). Thus, this conceptual paper makes an attempt to bridge this gap by applying the theories of co-production of knowledge and of social capital to explore the role of social enterprises in addressing the challenge of energy poverty. Theories of co-production and social capital have been specifically chosen to discuss the role of social enterprises in energy poverty. This is for two reasons: (1) social enterprises internalize market-based principles for creating a social good. This merits social relationships with stakeholders to leverage business acumen and deliver benevolence. A theory of social capital looks a relatively commensurate choice to explain social relationships of social enterprises. (2) Addressing energy poverty needs development of clean energy technologies that fulfill the social, behavioral, and cultural needs of poor communities. A theory of co-production highlights the importance of social and technological determinism in development of a system. Thus, viewing the role of social enterprises via these two theories could provide better implementation strategies for scholars and practitioners to address energy poverty by deploying social enterprises. It must be noted that this manuscript does not

trivialize the role and possible contributions of other theoretical frameworks in this substantive area. The purpose is to expand the discussion on the role of social enterprises and energy poverty using these two theoretical frameworks.

The paper is organized as follows: Section 2 briefly discusses the background of the theory of co-production of knowledge from the science, technology, and society (STS) framework. STS scholarship describes co-production as a dynamic interaction between technology and society [20]. Instead, co-production advocates for greater ‘community-scientist’ interaction and for including perspectives of communities in technological design and development. Section 3 uses insights of co-production of knowledge from Section 2. Section 3 discusses how theory of co-production of knowledge can explain the role of social enterprises addressing challenges of energy poverty. Section 4 critiques the theory of co-production and emphasizes combining the theory of social capital to better understand the role of social enterprises in the context of energy poverty. Section 5 starts with a brief background on the theory of social capital. Section 6 discusses how social enterprises capitalize on social relationships; Section 6 uses insights of social capital from Section 5, and argues how the theory of social capital can be leveraged to understand the role of social enterprises to bring about the intended change in the energy poor communities. Section 7 critiques social capital theory and its framework for social enterprises intervening in the energy poverty sector. Section 8 synthesizes these two theories and presents three key overall implications, while Section 9 concludes.

2. Theory of Co-Production of Knowledge

Through the vantage point of STS scholarship, the theory of co-production portrays the ways in which technology and society can co-exist and influence each other. Co-production dissolves the boundary of technological determinism and social constructivism. It moves to a systematic understanding of how technology and society co-produce and impact each other and are interwoven in a feedback loop [30]. According to Jasanoff [30], co-production of knowledge represents how nature (science and technology) and society are inseparable wherein technology and society each underwrite the other’s existence. Realities of human experience and choices they make are essentially a combined outcome of scientific, technological, and social genomes.

Co-production highlights the role of both social and technological determinism, giving primacy to neither. This argument merits a closer critical inquiry. There have been two fields of scholarship advocating either social constructivism or technological determinism. Although this notion is losing its cachet, scientific knowledge has long been deemed to be constituted by social practices. This group assumed the ontological primacy of ‘social’ over science and technology [30,31]. There have been strong advocates in this group who argue that social realities determine the workings of science and technology. This group adopted a linear approach, which provided a causal primacy of ‘social’ over ‘science’. This was a defining characteristic of the theory of Social Construction of Technology (SCOT). However, other researchers contend that science and technology are isolated outcomes of the top-down and self-regulating hierarchy of technical experts. Social realities were clearly exogenous for this group. This group adopted a linear approach by giving causal primacy to ‘science and technology’ over ‘social practices’. They had the heightened sensitivity to the ways science and technology achieve practical universality and then eventually drive sociological settings [32]. This group doubted the competency of people to indulge in a critical evaluation of technology merely based on their experience with the technology. This group was primarily concerned with emergence of new scientific knowledge within the research laboratory [32]. The dismissal of the perspectives of communities highlights the hierarchical power dynamics within the scientific research process.

Co-productionists discard both these notions for two reasons. First, the linear approach of causal primacies of science over society or vice versa inhibits symmetrical probing of science and society. It also restricts wider stakeholder engagement [30]. Giving primacy to either science or society perpetuates unequal power relations. Normative perspectives on co-production of knowledge show that research should not create unequal power dynamics. Rather, the pursuit should be to bridge this chasm.

Second, if science and technology are to be used to inform decision making, then they must conform to the ideals of democracy and consider social phenomena as endogenous to scientific knowledge production. Incorporation of co-production dissolves the science-practice boundary, facilitates wider stakeholder engagement, and advocates for greater democratic space to be utilized by organizations and governments [30,33].

In sum, co-production bridges the dichotomy between science and technology on one side and society on the other by acknowledging the importance of linkages among both human and non-human different actors. Creation of knowledge is not monolithic in nature and requires simultaneous interaction between science and society. The idea of mutual engagement between science, technology, and society as argued by theory of co-production emphasizes the role of social institutions as key stakeholders to collaborate and create practical solutions.

3. Role of Social Enterprises in Addressing Energy Poverty: Understanding through Co-Production of Knowledge

Co-production provides a framework for understanding the role of social enterprises in addressing energy poverty. There have been multiple examples of misalignment in the development of clean energy technologies in the lab and the corresponding expectation of communities in the field. This disconnect has largely been attributed to a 'relevance gap' in energy poverty research done in the laboratories. It also underscores a lack of community input and experiential expertise. Co-production of knowledge aims to empower communities to participate as equals with technological experts. Social enterprises hold a strong purchase in bridging this community-technology chasm. Co-production of knowledge highlights the following key points.

3.1. An Intermediary Coordinating between Scientists and Communities

Technology and society are dynamic and shape each other. Social factors cannot be ignored in designing clean energy technologies to solve problems in poor communities [34]. Social enterprises facilitate mutual engagement of technology and communities, which can improve the research process [29]. They help in a smooth transition of technology from 'lab to field'. Through innovative processes of aligning community needs with clean energy technologies, social enterprises connect communities and technologists to better communicate their needs, preferences, and constraints. Unlike NGOs or for-profit private players which are deeply embedded in their respective sectors, social enterprises emerge and sustain at the cross-over of different sectors [35]. Social enterprises work simultaneously with the government sector, private sector, and the civil societies. The cross-sector nature of social enterprises allows them to act as a go-between for scientists and communities.

3.2. Market-Based Innovation

Kerlin [36] and Ridley-Duff and Bull [37] characterize social enterprises with two factors: first, application of innovation for solving social issues, and second, emphasis on commercial activity to advance the social mission. Clean energy technology development has been a function of financial investment. Labs are challenged to produce their technologies efficiently, thereby looking for opportunities to improve their efficiency. Poor communities (beneficiaries) are excluded from this development process because they lack the capacity to invest financially. Development of such technologies is bound to be misaligned with communities' priorities, because their knowledge, information, skills, and experiences are not taken into account. To produce outcomes that matter to communities, it is important that relevant stakeholders are involved in the design, implementation, and adoption of an innovation. The role of social enterprises must be understood in relation to two simultaneous trends: first, social enterprises develop pro-poor financial mechanisms, lower their service expenditures (costs), and improve their supply chain strategies to manage the challenges created by technology and dissemination challenges. Second, social enterprises mobilize communities through innovations in social marketing. Innovations ushered to promote interaction of these two ends

(technology and society) positively impact dissemination and adoption of technology. Thus, social enterprises have linkages with technology developers on one side while being embedded in the communities on the other side. Thus, these institutions act as a key facilitator and hold a substantial cachet in the co-production process. Figure 1 (below) consolidates the role of social enterprises in addressing challenges of energy poverty through the vantage point of co-production of knowledge.

Figure 1. Understanding the role of social enterprises in energy poverty through co-production of knowledge.

4. Critique

Co-production advocates creation of knowledge through a participatory process and emphasizes the role of socially embedded institutions (social enterprises) to act as an ‘honest broker’. This school of thought paves the way for a broader understanding of how social enterprises actually bring change to the social structure while being embedded in the social structure itself. Specifically, it explores the ways in which social enterprises elevate communities on the energy ladder and motivate them to use better technology. While the theory of co-production of knowledge explains one role of social enterprises as honest brokers, it does not address how these social enterprises interact within the existing social structure. If social enterprises are to broker relationships, social enterprises must engage in building ties or networks with technologists and communities. Co-production falls short in providing with a conceptual understanding on construction and usage of social ties. The theory of social capital provides an additional lens to view strategy adopted by social enterprises to disseminate clean energy technology among community members and address the challenge of energy poverty.

5. Theory of Social Capital

While the idea of social capital traces its roots to sociological literature, it was Loury [38] and Bourdieu [39,40], who were the first to use the term social capital in their corresponding research. Loury [38] used social capital to discuss the social position of individuals, explaining that an individual’s social origin determines the amount of resources that must be invested to facilitate acquisition of human capital characteristics [38]. Loury [38] studied social capital in conjunction with the social origin of individuals. The consequences of social position lead to the development of social capital. However, there has not been further systematic elaboration on social capital in his literature [41]. Bourdieu [39,41] is credited with further advancing the concept of social capital. Social capital is defined as “the aggregate of the actual and potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition” [41]. Social networks are not social capital itself, but rather social capital is an outcome of social networks. Accumulation of social capital requires deliberate economic and cultural investment, which depend on social networks. Social capital reproduces a social class where the elites have better access to information due to their wider social networks. According to Bourdieu, the reserve of social capital possessed by an agent is determined by the totality of the networks which one can effectively mobilize. Coleman [42] expanded the literature of social capital through his view of social capital on the basis

of its function. According to Coleman [42] social capital is “a variety of entities with two common elements: they all consist of some aspect of social structures and they facilitate certain action of actors-whether persons or corporate sectors-within the structure.” Social capital provides benefits, but can also require commitments. Coleman regards social capital as a function of the accumulation of norms of reciprocity. The more social capital is used, the more it grows [43,44].

Although Loury, Bourdieu, and Coleman have made significant contributions to the concept of social capital, it is Putnam who is credited with drawing attention on this literature and with presenting the most contemporary definition of this concept. Putnam defined social capital as “those features of social organization such as trust, norms, and networks that can improve the efficiency of society by facilitating coordinated actions” [45]. Putnam’s definition of social capital presents three components: moral obligations and norms, trust, and social networks. The central thesis of Putnam’s argument is based on the importance of social capital to shape economic system and political integration of a society. If a region has a strong and well-functioning economic system complimented with successful political discourse, it is because of the region’s successful accumulation of social capital [46].

Analyzing a range of concepts and definitions on social capital, Adler and Kwon [43] identify two content dimensions of social capital: structural and relational. The structural approach focuses on connections and ties among social agents. It explains the pattern of connections, density of networks, and the hierarchy and intensity of connections. The dominant metaphor in the structural approach of social capital is “it is who you know (rather than what you know)”, which decides the flow of information. The structural approach views social capital as a glue that holds people together. The relational approach takes a critical tone on the structural approach of network connections in the social system. This approach argues that it is not the number of connections which matter but the quality of relationships. The relational approach emphasizes the importance of norms, trust, reciprocity, and values as the key attributes of social capital that need to be considered to assess the accumulation of social capital.

6. Role of Social Enterprises in Addressing Energy Poverty: Understanding through Theory of Social Capital

In the wake of the theory of social capital, it is clear that social enterprises leverage and simultaneously mobilize social relationships in communities, where they intervene. The presence of trust and a strong community network allow social enterprises to sustainably disseminate and implement clean energy technologies [37]. Defourny [47,48] argues that social capital is key to understand the role of social enterprises in their area of intervention. It has two distinct advantages. First, this concept provides insights into material resources (human resources and capital expenditure), which social enterprises utilize to bring about intended value creation. Second, it assists in understanding a number of non-material economic and political factors, which may be significant in bringing about the social and environmental change. Both these advantages are evident in the role of social enterprises in addressing energy poverty challenges. Social enterprises are primarily driven by social value creation and this mission distinguishes them from commercial entrepreneurs. Economic value creation is a necessary but not sufficient condition for social enterprises.

Social enterprises create a quasi-market for their targeted consumers to reach their goal. Economic value creation (revenue from selling these clean energy technologies) is just the means to achieve their social objective. Mobilization of resources requires developing ties and trust with different sectors (public, private and non-profits) and also with energy poor communities (targeted customers for social enterprises). Development of ties and networks are a function of social capital often used by social enterprises to advance their mission [49,50].

There are instances where communities initially take up clean energy technologies [51,52]. However, sustained use is low [14,53–55]. Abandonment of clean energy technologies is a central challenge perpetuating energy poverty [56–60]. Slaski and Thurber [61] identify three challenges for persistent energy poverty: (1) low motivation, (2) low affordability, and (3) low level of user

engagement. Social enterprises leverage their social capital developed by virtue of their presence in communities to address these three challenges [15].

Motivation is connected with the degree of awareness of clean energy technologies and their perceived value. Improved willingness to pay (WTP) is a function of affordability of poor communities, and motivation to spend on clean energy technologies [62–65]. Slaski and Thurber [15,61] argue that instances are available when communities have adequate affordability but low motivation. Thus, enhanced motivation can increase willingness to pay contingent to communities having sufficient disposable income for clean energy technologies. User engagement is related to the scale of lifestyle change ushered in by the use of cleaner technologies. A relatively high gap in lifestyle changes may deter energy poor communities from adopting a cleaner technology, unless adequately motivated. Shrimali [15] posits that entrepreneurs who will be most successful in disseminating clean energy technologies are those who are most innovative in creating strong ties and trust with energy poor customers. The motivation of people who are energy poor to adopt cleaner cooking technologies is a function of the trust (and quality of ties) these communities have with social entrepreneurs working in their communities. Social marketing and advertising campaigns can enhance the perceived value of clean energy technology. The cost of clean energy technologies is a function of innovative pro-poor finance and low-cost supply chain strategies. In turn, these strategies depend on networks of social enterprises with the public and private sectors [66–68]. In summary, factors driving abandonment of clean energy technologies can be addressed by leveraging of social capital by social enterprises as illustrated in Figure 2. While social enterprises create and utilize their social capital to disseminate clean energy technologies, the same trust and social network helps in garnering revenues, and generating financial and human capital required for sustenance of these social enterprises. In addition, social enterprises themselves act as a connector (or broker as discussed earlier) among diverse and disconnected groups thus facilitating exchange of required resources to benefit their targeted energy poor customers.

Figure 2. Understanding the role of social enterprises through social capital in addressing energy poverty.

7. Critique

Understanding the role of social enterprises to address energy poverty highlights the importance of social networks, ties, trusts, and relationships. Social enterprises use their networks with energy

poor communities to motivate, engage, and acquaint them with clean energy technologies. They also use their relationships with technologists, governments, private players, and civil societies to cultivate pro-poor financing and supply chain strategy to reduce the cost of technologies. These networks are used to generate revenues, which sustain social enterprises. Slaski and Thurber [15,61] highlight the need for social entrepreneurs to be innovative in creating ties and trust with energy poor communities. Still, successful enterprises require more than just building trust among potential users. Only focusing on building these in-group ties, following the bonding model of social capital, will leave little room for outside voices and engagement. To be effective and sustainable, social enterprises must instead develop linking social capital between the communities and need and businesses and the government who can address their needs.

Further, one aspect of the role of social enterprises in impacting energy poverty that is not fully fleshed out by the social capital theory is just how networks and ties with government and private sector companies can impact the cost of technology. While the development of ties and networks is often used by social enterprises to advance their mission [28,69], social capital does not spell out how social enterprises can leverage these ties to change the price of the technology they aim to spread. Social enterprises are taking on a challenge that both the government and private sectors have tried and failed to tackle, and now need to leverage resources from these sectors to advance their missions. Research ought to tackle best practices in turning relationships into financial support to help more social enterprises take on the challenge of energy poverty.

8. Discussion

Poor countries grappling with energy impoverishment have relatively less evolved institutions. Coordination among disparate stakeholders is low. Thus, a significant role of social enterprises is to act as a “connector” of diverse stakeholders. Social enterprises work for social value creation. Addressing energy poverty in low income communities realizes low profit margin. Thus, it is natural that social enterprises (and not business enterprises) would be relatively more interested to venture into this challenging situation. Also, equitable distribution of clean energy systems in poor countries needs organizations that can be honest brokers, bridge disparate institutions, create new social relationships, and are embedded in local social systems. Thus, it is imperative for a social enterprise to be a connector or an interface among diverse stakeholders. The theories of co-production and social capital are drawn from diverse academic disciplines. It can be argued that these two theories fall short in providing with a universal conceptual understanding on the role of social enterprises in addressing energy poverty. Nevertheless, syntheses of these theoretical frameworks provide the following key insights.

8.1. Honest Broker

Communities and technology must interact dynamically to create an evolution of knowledge and meaningful change. Social enterprises act as ‘honest brokers’ between the ‘lab’ and the ‘field’. Social enterprises help in co-production of knowledge by expanding democratic space to equally accommodate both communities and technologists. A mix of market-based acumen and benevolent characteristics allow social enterprises to understand the challenges to changing the status quo as it relates to energy poverty. Handling of multiple sector issues has been a challenge for the private sector, public sector, and civil societies. These sectors tend to focus more on technology development, rather than on building alignment with community needs. Civil societies also tend to lack market acumen. Although possessing strong understanding of community needs, civil societies fall short of understanding the economics of clean energy technologies. While the private sector focuses mostly on developing the technology, and civil society focuses mostly on community needs, the space for a go-between across sectors is ripe for social enterprises to step in. To be effective, social enterprises must use market acumen to ensure sustainability, while also ensuring that community needs are at the center of their work.

8.2. Creation and Use of Relationships

Social enterprises create a quasi-market for their targeted communities. Della Porta and Diani [70] argue that it is their ability to address complex problems by combining diverse stakeholders (ranging from communities to private and public institutions) and developing alternative arrangements, which create social values. Accomplishments of social enterprises by creating these social values depend on numerous non-state and non-market resources. For instance, they need to develop networks with the political and business communities, foster a degree of trust with targeted communities, and build partnerships with various economic and social institutions [49]. Success of a social enterprise to sustainably disseminate clean energy technologies are shaped by trust and network with the targeted communities, and hence by extension quality of their social capital. In other words, the utility of social capital is paramount for social enterprises to create new relationships, develop and sustain trust in communities, and co-create a social good. Social enterprises are able to create and sustain relationships with the business and economic community, technologists, and the communities which will potentially use the technology.

8.3. Embeddedness

Social enterprises must become embedded in the social structure to change the social order and recreate the new status quo. The concept of embeddedness and interaction between the agent (social enterprise) and structure (communities/laboratories) appears to be central to understanding social enterprises. For instance, they can work with scientists, technologists, and communities to dissolve technology-society boundaries. They create a new social norm wherein communities participate in technology development. Similarly, social enterprises (as a social agent) interact with communities (and social structure). They usher in awareness campaigns, social marketing models, innovative financing models, and better service delivery to motivate communities to move from traditional cooking technologies to improved cooking technologies. This creates a new social order and the social phenomena of change (elevation of communities on the energy ladder) continue. In doing so, these social enterprises cultivate innovative revenue mechanisms which keep them sustainable in the communities without having to perpetually depend on government or the private sector.

9. Conclusions

The theories of co-production and social capital possess unique strengths and weaknesses in understanding the role that social enterprises can play in addressing energy poverty. First, the theory of the co-production of knowledge dissolves the boundary between science and practice. It aims to engage stakeholder engagement in a broader sense, and advocates for more democratic space for communities and organizations. This theory posits the social enterprise as an honest broker, working to bridge the gap between the lab and the field. Enterprises that favor either community or technology at the expense of the other set themselves up for failure by ignoring this important principle from the co-production theory. The theory of social capital advances the idea that social enterprises and the communities in which they intervene experience a reciprocal relationship at both the micro and macro levels. The larger social structures impact social enterprises, which in turn impact the larger policy landscape. The local environment and the social enterprise also experience this back-and-forth relationship, with the local community creating opportunities and threats for the social enterprise. Social enterprises also leverage their social capital by providing insights into both material and non-material resources and factors. While social capital is considered in terms of building relationships to leverage non-material connections, the theory also highlights the impact of network-building to impact the cost of technology.

Social enterprises addressing challenge of energy poverty ought to incorporate three main implications from these theories: acting as honest brokers between communities and technologists, cultivating new social relationships, and changing social structures to move poor communities to adopt

and use cleaner energy systems. In addition to creating suggestions for social enterprises working in the energy poverty sector, this paper serves as a framework for continued systematic, empirical studies of what works across the social enterprise sphere.

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