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Original research article

# Crowdfunding renewable energy investments: Investor perceptions and decision-making factors in an emerging market

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## ABSTRACT

Crowdfunding has emerged as a viable tool in the alternative finance industry to complement financing for projects where government and bank investments have been unable to cover including in renewable energy. Nevertheless, the crowdfunding literature on developing countries, especially in Africa, remains scanty and little is known about its potential to substantially contribute to financing renewable energy provision from a lending (crowdlending) or investment perspective rather than as donation or philanthropy. In this paper, we close the loop around the mechanics and dynamics of crowdfunding by investigating crowd perceptions in a developing country context using Ghana in West Africa as a case study. We employ an integrative literature review anchored on collective action, social proof, persuasion, network and signalling theory, and complemented with critical focus groups interviews of household retail investors in Ghana to distil the key issues and concerns relating to crowdfunding for renewables. We then propose a conceptual framework based on the findings. Our findings demonstrate that an unfair playing field exists on financial returns between renewable energy and investment alternatives available to the crowd. Hence, the crowdfunding landscape will require deliberate design to improve attractiveness around non-financial attributes such as developer/fundraiser reputation and project viability to further strengthen project economics. Additionally, perceptions around security and ease of use of crowdfunding platforms are highlighted with the former being situated in the challenges of the broader banking or financial system. Overall, the paper underscores the need for social proof and quality signalling to attract household investors. Further research around motivations for collective action in such developing markets is recommended.

## 1. Introduction

Energy transitions that limit the use of fossils and promote low carbon electrification are critical in addressing climate change by reducing green house gas (GHG) emissions. It is within this context that The Intergovernmental Panel on Climate Change (IPCC) report underscores the urgency of “effective and equitable mitigation actions” in delivering sustainable development [1]. Undoubtedly, renewable energy technologies (hereafter renewables or REs) have a substantial role to play in a global low carbon future [2–4]. This is important especially in developing countries, such as in Africa where close to 600 million people lack access to modern energy services, and new energy supplies would need to consider climate implications even as universal access is sought [5]. Financing for universal access by 2030 requires about US\$25 billion annually but significant shortfalls exist, making the question of where

and how to mobilise additional sources of finance both a research and developmental concern [5,6].

Over the last decade, crowdfunding has emerged as a viable tool in the alternative finance industry to complement financing of projects or startups where government and bank investments have been unable to cover, including in renewable energy [7–10]. Crowdfunding for renewable energy continues to receive much interest in the literature and valuable lessons have already been communicated mostly in developed countries contexts such as in Europe [11,12].

The crowdfunding literature on developing countries, especially in Africa, is scanty and little is known about its potential to contribute substantially to the financing of renewable energy from a lending (crowdlending) or investment perspective rather than a donation/philanthropic basis. Crowdfunding of RE projects can take place in four forms: (1) crowdlending: lending money to RE project developers or

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individuals that wish to install RE systems for own consumption (2) equity: buying ownership in RE project development companies, RE technology companies, or communal electricity providers using RE technology (3) reward: pre-purchasing RE technology hardware and software for own use; and (4) donation/philanthropy: donating to RE for energy provision to public infrastructure or vulnerable social groups [13–16].

However, in Africa, it has been found that non-investment based alternative finance (predominantly donation-based crowdfunding) dominates the market with most of the funding originating from outside the continent [17]. This is particularly perplexing given that data also shows a growing aspirational middle and upper class on the continent with considerable disposable income that could be tapped to narrow the current financing gap [6]. This is also complemented by the growing popularity of digital and mobile financial solutions, and an established cultural heritage of mutual communal support [18–20]. The extant literature has laid a solid foundation by establishing the nature and types of crowdfunding and outcomes from the platform and project developer perspectives [21]. Also, there is growing literature on crowdfunding from an investment perspective in western and developed country contexts (for example, [22–25]).

Nevertheless, attempts to close the loop around the mechanics and dynamics of crowdfunding by investigating the perceptions of the crowd, especially in a developing country context such as in Africa, remains nascent. To this end, this study aims at providing in-depth understanding on household investor perspectives regarding crowdlending for renewable energy. Specifically, we examine the following research questions: (1) what factors/attributes impact the decision to invest using crowdfunding and why? and (2) what is the role of crowdfunding platforms in the decision-making process? To answer these questions, we conducted three focus group interviews with household investors in Ghana. In our analysis, we classify the results around (i) the type or choice of renewable energy technology, (ii) attributes affecting decision making, and (iii) crowdfunding platform considerations. We draw on the findings to generate a conceptual framework for crowdfunding for renewable energy in such developing markets.

The remainder of this paper is structured as follows: Section 2 provides a detailed review of the issues and theories that influence renewable energy crowdfunding in the literature. Section 3 describes the focus group design and execution which is followed by the results in Section 4. Section 5 discusses the findings and proposes a conceptual model for RE investment decision via crowdlending. The paper concludes with Section 6 which highlights the implications of this study as well as directions for further research.

## 2. Literature review

### 2.1. Crowdfunding: Context and theories

Crowdfunding is increasingly becoming a viable alternative in the global renewable energy financing landscape. Crowdfunding is often described as raising funds by soliciting for relatively small contributions from a large pool of individuals using online social networks without the use of standard intermediaries [25–27]. There are four types of crowdfunding, grouped under investment and non-investment models [28,29]. The investment model includes equity crowdfunding and peer-to-peer lending/debt crowdfunding. The non-investment model on the other hand includes donation crowdfunding and reward crowdfunding.

Over the past few years, crowdfunding for renewable energy projects has offered many developers the opportunity to develop projects with some independence compared to what pertained decades ago where large financial institutions and banks could never be bypassed. For example, the Citizenenergy.eu website documents about 73 projects funded across 20 countries with over €41 million invested which has generated over 200 gigawatt-hours of green energy as of June 2023. It is important to note, however, that crowdfunding is not intended to

replace any of the traditional funding models in the energy financing space but complement financing efforts. Specifically, scholars and practitioners such as [15,30,31] assert that crowdfunding potential largely rests on complementing the efforts of other professional investors. In some cases, this can be a mixture of crowdfunding campaign funds and bank loans [32].

Crowdfunding for renewable energy projects bring several advantages: one of the most important is the opportunity to mitigate climate change through the investment in RE technologies like solar energy and wind, contributing to the attainment of the Sustainable Development Goals (SDGs) [33] especially Goal 7 and 13 on “affordable and clean energy” and “climate action” respectively. Additionally, crowdfunding RE projects can improve risk-sharing among many small investors [15]. Again, [14] opine that crowdfunding has the potential to generate societal support for renewable energy and is crucial in garnering political support in helping to overcome the “NIMBY” (Not-In-My-Back-Yard) opposition some RE projects face [34].

However, the literature cites many risks that accompany crowd-funded projects in general, and which may become more complicated with renewable energy specific risks. These include, among others, fraud, information asymmetries and dynamics in bargaining power. One of the often-cited concern is the risk of fraud [35,36]. Many critics cite fraud as one of the main concerns because of the lack or absence of a face-to-face interaction, leaving what is presented on the crowdfunding website or platform as the sole information available. This risk is often magnified by the geographical separation between funders and creators/project developers, making it more difficult to oversee or vet what is presented.

Another closely related risk cited by [15,27,36] are information asymmetries. They posit that project developers or creators often know more about the project and its quality than potential investors creating an information gap. Going back to the earlier point about dependence on primary information displayed on crowdfunding websites and coupled with the short time frame allotted, funders often have incomplete and imperfect information about the project. Work done by [37] also acknowledge the information asymmetries inherent in crowdfunding and suggest signalling from project developers or creators and third-party endorsements as a measure to mitigate this.

Another downside is the little bargaining power crowdfunding investors have compared to professional investors like banks or venture capitalists [38]. [31] posit that unrealistic investor expectations and the opportunity cost of lost expert advice are also a bane of crowdfunding. This argument is re-echoed by [39], who explain that individuals or funders often lack the knowledge or training to assess financial risks effectively.

Despite the risks highlighted above, crowdfunding provides financial and non-financial benefits for fundraisers, funders, and the community. First and foremost, it provides access to capital to start-ups and small and medium-sized enterprises who have difficulty obtaining funding through traditional banking systems, especially for niche and innovative projects [16,40]. According to [40], fundraisers can leverage crowdfunding to demonstrate demand for a product or service. Closely related to this is the additional benefit of providing marketing for projects in the early stages of development. For funders, crowdfunding provides an opportunity to gain financial returns from new types of investments either through lending or equity. Additionally, funders can assume the position of philanthropists by giving to projects they care about (for doing good) without a financial return. Furthermore, through reward-based crowdfunding, funders can receive specific rewards associated with the project they have contributed to funding [29]. Lastly, crowdfunding can have community benefits enabling the public to decide and exert influence on projects which deserve financial support from a social or local perspective. Often, the community can derive some consumption value by taking part in the project, develop a sense of empowerment and ownership and individuals can enhance their own reputation as part of the social group or community [41,42].

2.1.1. Theories employed in crowdfunding research

Several theories have also been developed that shed light on the relationship between the crowd, fundraiser, and crowdfunding platform and how that impacts crowdfunding success – that is the decision of funders/backers to contribute to the campaign (or invest in this case). A review of the extant literature highlights five key theories: (1) collective action theory; (2) social proof theory; (3) network theory/social capital theory; (4) signalling theory; and (5) persuasion theory — see Table 1. For example, [43] report on collective action when they analysed how civic amateurs raised US\$1.5 million (NZ\$2.27) within three weeks to save a communal beach from becoming private. Here, the crowd was unified by shared concerns and moved by the campaign messaging around environment preservation, egalitarianism and ensuring accessibility to a space they feel connected to. Also, [44] demonstrate the influence of social proof in an ecommerce setting when a visual cue of 1 million existing user accounts increased user registrations in an

**Table 1**  
Key theories relating to crowdfunding success.

Key theories	Description	Associated works
Collective Action Theory	Provides a framework to explain why and how individuals come together to pursue common goals and interests. This can include the conditions and motivations that lead people to achieve outcomes which can be more difficult to pursue or achieve solely.	[43,58–61]
Social Proof Theory	This theory explains how individuals look to others for guidance especially in uncertain situations as they are unsure as to how to behave. This could manifest as observing other's behaviour, reading reviews or testimonials, and referring to data that show preferences or actions.	[43,44,62–64]
Network Theory/Social Capital theory	Provides a framework for studying and examining social relationships and the patterns of connections among individuals, groups, or organizations and how that influences the success of funding campaigns.	[45,65–68]
Signalling Theory	This theory explains how fundraisers/entrepreneurs can use signals or cues to communicate their credibility to the crowd/backers. This is often a way to overcome information asymmetry and signal project quality.	[46,69–72]
Persuasion theory (e.g. Elaboration Likelihood Model (ELM) and Narrative persuasion theory)	This theory focuses on understanding how people or the crowd can be influenced to change their attitudes, beliefs or behaviours. For example, the ELM suggests that there are two routes to persuasion: the central route and peripheral route. The central route involves engagement in a critical thought process of the merits of the information provided such as costs and benefits of the product/project. The peripheral route involves persuasion based on superficial cues or the remaining elements of the message such as language/ tone or background music.	[23,73–75]

experiment.

The literature on crowdfunding campaigns shows that when fundraisers launch a campaign, their friends and family are often the initial target audience and primary supporters, and these serve as networks to spread the word about the campaign through sharing campaigns links, updates, or promotional materials. The strength of these networks tends to influence the success of the campaign. For example, [45] finds that pre-existing relations between the crowd and fundraiser often leads to making higher contributions in reward crowdfunding. Hence these relationships become social capital. Next, [46] demonstrate the difference that signalling plays in crowdfunding success on Kiva—a crowdfunding platform. Specifically, they found that refugee entrepreneurs who partnered with microfinance institutions with features such as lower default rates, high profitability, transnational operations, and digital focus had better crowdfunding outcomes.

Lastly, growing literature highlight the importance of persuasion theory and particularly the Elaboration Likelihood Model (ELM) on campaign success. For example, [23] found that while persuasion generally influences crowdfunding success, the fundraiser's motivation and ability dictate whether this success is driven by issue-relevant information or peripheral cues such as a positive narrative tone.

2.1.2. Understanding crowdfunding backer behaviour

Related to the understanding of campaign success is funder/backer behaviour. Here, crowdfunding studies have used often investigated the phenomenon using the Theory of Planned Behaviour (TPB) [47–49], Trust theory [50–52] and the Technology Acceptance Model (TAM) [53–55]. Regarding the theory of planned behaviour, [47] through an extended model, demonstrates its applicability in explaining the intention to contribute financially and share information in reward crowdfunding. Similarly, [49] found that the model enhanced understanding of how attitude, perceived behavioural control and entrepreneurial education influenced entrepreneurial intentions and raising capital through crowdfunding. Also, the role of trust in financial transactions is well highlighted in the literature. Specifically, in investment-based crowdfunding, [52] find that performance-based trust factors such as project information quality, fundraisers' reputation and ability/expertise have significant impacts on potential funders' trust. Lastly, as crowdfunding heavily relies on technology, TAM theory is gaining increasing attention. For example, [53,54] report that ease of use and perceived usefulness influence crowdfunding adoption.

On investment-based crowdfunding, the finance literature especially on the investor motivation becomes pertinent considering that there is often an opportunity cost with investments. It is well established in the literature that majority of investors would be concerned about monetary returns vis-à-vis the perceived risk [38,56]. Other factors include reputation of firm, the affordability of share price [22], as well as the social benefits, including environmental considerations [57]. At any one time, these theories and factors could influence campaign success to different degrees based on context. Hence, knowledge of these dynamics is crucial.

2.2. Renewable energy project risks

Renewable energy projects like other infrastructure projects are fraught with many risks which can impact development, construction, operation, and overall financial viability as shown in Table 2. Bringing together crowdfunding and renewable energy project risks presents a unique cocktail of risks and how potential funders perceive and evaluate these are useful for understanding the opportunities and challenges for crowdfunding for renewable energy in emerging and developing country contexts. Importantly, funders/backers have been observed to leverage signalling, trust, social proof as demonstrated in Table 1 as heuristics or risk mitigation mechanisms.

**Table 2**  
Renewable energy project risks.

Risks	Description	Risk Mitigation Mechanism
Resource risk	Renewable energy projects depend on the availability and reliability of natural resources such as sunlight or wind. In an investment situation, variability could result in lower revenue and impact on profitability.	Adequate resource assessment and estimation is required to reduce this risk.
Technology risk as well as operational and maintenance risks	Renewable energy technologies vary by effectiveness and reliability, and these come with associated technological risks. These risks could manifest as technical failures or equipment performance issues which can lead to revenue loss and impact project economics.	Due diligence in technology selection, robust engineering, and regular maintenance can minimise risks and optimise performance.
Regulatory and policy risk	Changes in government policies, regulations, and support mechanisms can significantly impact the economics and viability of renewable energy projects. Alterations in feed-in tariffs, tax incentives, grid connection policies, or subsidy programs can create uncertainty and affect project revenue streams.	Staying informed about regulatory changes and having a flexible project plan that can adapt to evolving policies are important risk mitigation strategies.
Financial, market and offtake risks	Renewable energy projects often require significant upfront capital investments. Costs may be associated with project financing, managing construction costs, and securing long-term power purchase agreements or off-take contracts. There are potential issues of fluctuations in energy prices, interest rates, and currency exchange rates. Market risks around price volatility, competition and availability of grid access can also not be discounted.	Securing long-term, stable off-take agreements and managing market risks through hedging or diversification strategies can mitigate these risks.
Permitting and environmental risk including stakeholder and community risk	The permitting process for renewable energy projects can be lengthy and complex, which can result in delays and sometimes rejection increasing project timelines and cost. Also, projects could face opposition from local communities and stakeholders over noise or visual impacts among others.	Familiarity with the relevant environmental regulations, permitting processes, and approval requirements will be useful. This could include collaborating with experts and consultants. Also, community engagement and addressing local concerns can minimise risk.

Authors' construct based on [76–81].

### 2.3. Recent developments in crowdfunding in Africa

Crowdfunding in Africa is still in its infancy with some countries dominating the market in Sub-Saharan Africa. The East African market is dominated by Kenya and Uganda, and in West Africa by Nigeria, and Cote d'Ivoire while the Southern African market is led by South Africa, and finally Rwanda in Central Africa [17,19,82,83]. Furthermore, [17] find that financing volumes in Africa are the smallest compared to other regions while the majority (>80 %) of that volume was raised from outside the continent.

The lack of regulation continues to be a primary issue in most markets. Efforts since 2018 have been geared towards improving the regulatory environment. The African Crowdfunding Association, an industry association established by several crowdfunding platforms continues to collaborate with national regulatory authorities to develop a crowdfunding framework.<sup>1</sup> Based on data on the association's website, only three countries (Nigeria, Tunisia, and Morocco) are recorded as having adopted a regulatory framework as of January 2024. Countries such as Ghana, South Africa, Kenya and Angola have either draft regulations, guidance or a policy note in place. For example, the Bank of Ghana in February 2021 published a policy note covering donations and rewards crowdfunding [84] — see Table 3.

It is expected that the focus on improving regulatory clarity will continue in the coming years to ensure customer protection and enhance professionalism. That said, lessons around crowdfunding regulation in developed economies show that policies should aim for harmonisation across Africa as well as balanced and supportive regulations [85,86].

## 3. Methods

### 3.1. Using focus groups for research

Focus groups are commonly used across a wide range of research disciplines including in behavioural and social sciences and very suited to understanding problems or processes [87]. Within the growing energy and energy transition literature, focus groups have been deployed across numerous studies to generate meaningful findings and insights [88–92].

Focus groups involve small groups of people, purposefully selected to discuss and explore a particular topic [93]. According to [94], focus groups afford the researcher an opportunity to uncover people's per-

**Table 3**  
Proposed licensing policy for crowdfunding models in Ghana.

Type	Requirement	Licence approval	Regulatory body
Donation/Reward	Ability to collect, hold and disburse funds.	Enhanced Payment Service Providers (EPSPs) and Dedicated Electronic Money Issuers (DEMIs) in partnership with a bank and Specialised Deposit-Taking Institutions (SDIs)	Bank of Ghana
Equity	Ability to collect and invest funds.	Banks, SDIs, Enhanced PSPs and DEMIs in partnership with a Securities and Exchange Commission (SEC) approved entity.	Bank of Ghana, SEC
Debt	Ability to collect and invest funds.	Banks, SDIs and Enhanced PSP and DEMI in partnership with SEC approved entity.	SEC

Source: [84].

<sup>1</sup> See <https://africancrowd.org/>



ceptions, attitudes, experiences, and values; this is facilitated by the sense of cohesiveness members often feel as part of the group [95,96]. As such, they have been useful in energy research which in many cases is “socio-technical” in nature. Focus groups have been used solely or in conjunction with other methods either qualitative (interviews or observations) and quantitative (surveys). How they are used, however, depends on the context and research objectives.

For this study, the relative novelty of the investigation especially with regards to renewable energy within the African context made focus groups the most preferred to elicit the context-specific factors. Additionally, the quest for diversity of perspectives, real time feedback and interaction as well as cost-effectiveness and efficiency made it most suited to addressing the research objectives. Last but not the least, consideration was given to the importance of focus group findings in guiding the prioritisation and design of future quantitative research [97,98].

### 3.2. Focus group design

Primary considerations with designing focus groups border on the number of participants per group and how many focus groups to have to reach saturation. Based on the extant literature on number of focus groups enough to identify the most prevalent themes within a data set [99,100], we conducted three focus groups involving 20 people in Accra, Ghana in January 2017 (see Annex 1). The digital and fintech landscape in Ghana has been of immense interest following the rapid uptake of mobile money and a growing middle class. [101] reports that Ghana was among three countries with tremendous growth in registered accounts in Sub-Saharan Africa; this includes innovations (use of QR code) to enable instant payments from mobile money to bank accounts including international cards. Additionally, [102] reports that the country is one of the most vibrant Fintech hubs in Africa owing to the over 38 million mobile money (‘MoMo’) accounts. There is also political will to digitalise various sectors of the economy with progress seen in the digital address system and automation of government business processes [103]. Importantly, the country is seen as one with a growing middle class with attributes that suggest that people in this group are more likely to embrace technological innovations [104]. More recently, Ghana’s central bank —the Bank of Ghana — has published a crowdfunding policy brief that highlights a licensing policy for donation and reward crowdfunding [84].

The focus of crowdfunding as an investment brought several considerations into the sampling and recruitment processes. Purposive sampling was used to recruit participants making sure that they satisfied the income requirements — that is, participants should make at least US \$10 a day, a starting point for the global middle class [105] as this research sought to elicit views regarding crowdfunding as an investment. All participants had prior investments either in government treasury bills, bonds, mutual funds, and real estate. In the recruitment, participants were either met face to face or a preliminary telephone call was used to assess interest and screen participants on income and other known descriptors such as the level of education.

This was done in all cases, followed by an email containing all the relevant materials concerning the study. A few days before the focus groups, participants were sent a reminder email and telephoned to reconfirm attendance. Usually, ten (10) people were invited per session. There was an average 30 % drop out rate before the day of the event. Following an open-ended interview protocol, the group discussion was led by the facilitator (lead researcher) and an assistant who took notes. Interview questions (see Annex 2) were developed by the researchers and subjected to ethical review by the University of Dundee Ethics Committee. Informed consent was highlighted in all communications preceding the focus groups and later explained at the beginning of each of the focus group and consent forms distributed for signature. All focus groups were tape-recorded with the permission of participants and anonymised during coding and analysis.

### 3.3. Data analysis

The transcripts from the focus groups were subjected to qualitative content analysis. Content analysis involving coding (to identify themes and categories) from interviews and focus group transcripts is considered the most structured approach in qualitative data analysis [98]. It is regarded as a systematic bottom-up approach which can ensure comprehensive analysis of the phenomenon under investigation either by induction or deduction approaches [106,107]. In the study, the deductive approach was used because the existing literature fed into the design of categories and themes. The analysis followed the three main phases which are preparation, organising and reporting as described in [107].

The transcription was done verbatim using the NVIVO software package to ensure closeness to the data and catalyse the data analysis process. This was followed by reading and rereading for intimate familiarity with the data. The organising phase or data reduction phase was achieved through coding of data. A set of broad predefined codes such financial benefits, project characteristics and crowdfunding characteristics guided the coding process. This resulted in twenty- four (24) first order codes and eight (8) second order codes/themes (see Table 4). The study did not seek to do a saliency analysis of themes however the frequency of mentioning within and across groups was prioritised. All themes except government policy, payback time, market demand and education were mentioned across all three focus groups with strong agreement demonstrated through non-verbal cues such as nodding. Consideration was given to [108] criteria for trustworthiness by the leveraging peer debriefing using academic supervisors and peers throughout the research process. This was supported by prolonged engagement with data, adequate description of the context for other researchers to judge transferability and justification for theoretical and methodological choices as detailed in [109].

## 4. Results

The first part of the findings is focused on participant perceptions of the renewable energy and key investment attributes that feature in their decision-making. The second part deals with crowdfunding platform issues that influence investor decision-making.

**Table 4**  
Code tree.

First order codes	Second order themes
<ul style="list-style-type: none"> <li>• Cost of technology</li> <li>• Availability of renewable energy resource</li> <li>• Environmental effects of the technology</li> <li>• Ability to reduce waste or be stored.</li> <li>• Public trust for the technology</li> </ul>	Type of renewable energy
<ul style="list-style-type: none"> <li>• How much it would cost to partake or participate.</li> <li>• Returns or interest rate in comparison to alternative investments.</li> <li>• Long term cost implication</li> <li>• Cost/revenue model</li> </ul>	Rate of return and price of investment
<ul style="list-style-type: none"> <li>• Trust in governance and people managing it.</li> <li>• History and legal status of developer/fundraiser</li> <li>• Experience of developer</li> <li>• Credibility of the organisation</li> </ul>	RE developer/fundraiser reputation
<ul style="list-style-type: none"> <li>• Proof of concept</li> <li>• Measures for long term sustainability</li> </ul>	Project viability
<ul style="list-style-type: none"> <li>• Policy commitment by government</li> <li>• The level of education/publicity</li> <li>• Need for such a campaign/project.</li> </ul>	Government policy Payback, Market demand and Education
<ul style="list-style-type: none"> <li>• When I can get my money out</li> <li>• Risky online payments</li> <li>• Distrust for people who manage systems</li> <li>• Security of the platform</li> <li>• Inadequacy of banking laws</li> </ul>	Security
<ul style="list-style-type: none"> <li>• Ease of use of platforms</li> </ul>	User friendliness

#### 4.1. Renewable energy technology and investment attributes

##### 4.1.1. Type of renewable energy technology

Participants in each focus group were asked to mention some renewable energy technologies and explain which ones they are likely to invest in. Technologies mentioned include solar, wind, biomass, hydro and geothermal. Majority of participants across all focus groups were most conversant with solar with some already owning the technology in the form of small home installations and lamps. One participant however noted that he would invest in solar as this is a popular and well-regarded technology by many in Ghana, despite his own personal apprehension to it. He stated *"I don't love solar. I don't think it works well. I won't do [install] it in my house. But I am living in a country where people's psyche is that solar is so good so when I invest in it, I will get money back but I will not install solar in my own house. So, get it clear... so it's the business... Ghanaians think solar...solar... solar"*. Wind energy was the next contender, however there were more sceptics than with solar.

One participant gave this reason to explain why wind does not make it in her top three renewable technologies. She said: *"I don't see any wind that blows in Ghana... to be frank! The weather is still in my house"*. Non-verbal cues such as nodding were also observed from other participants based on their experience about how windy their neighbourhoods appear to them. One participant however stated from a survey report they read, that there was scope to explore wind energy especially in coastal areas. This was the only participant who seemed to have mentioned some data or report to back up their opinion or assertion. The others based their opinions on observation and experiences. The findings regarding technology choices support the hypothesis that participants base their decision-making on their *a priori* beliefs and experiences about renewable technology type which may shape their attitude to the specific risks associated with that technology [110].

From the above, the following is formulated:

**Proposition 1.** Solar energy projects are more likely to be funded by middle class Africans than other renewable energy projects in line with their *a priori* beliefs.

##### 4.1.2. Rate of return and price of investment

The rate of return which is a measure of the financial performance of an investment was the most mentioned attribute in all focus groups. From an investor's point of view, the main goal of investing is to maximise the return taking into account the associated risks. The literature strongly emphasises that investors pay attention to fund attributes related to performance such as profitability and return on investment [111,112]. However, the Socially Responsible Investment (SRI) literature has shown that while SRI investors consider past performance, they base their investment decision on different types of non-financial investment attributes or screens [73,113,114,115]. No altruism and social obligation to the environment was mentioned suggesting that most participants would mainly participate for the profit although the impact of non-financial motives like the environment was not explored further.

All participants across focus groups had previous experience of investing in government treasury bills and were accustomed to returns of between 18 and 25 % which they considered riskfree. One participant had this to say about what they considered an attractive and worthwhile investment: *"Normally what Ghanaians will say is that anything at par or above T-bill rates is good for them. Any investment I do must be above T-bill rates. Because with T-Bills there are no real risks because I give the money to government, I am assured in 3 months or 6 months I will get this amount but yours there are risks to it so it must be more"* Another participant clearly stated that he considered himself "highly risk averse" and added that a return above treasury bill rate was not necessarily attractive to him considering the rate of inflation in the country. He was of the view that inflation can erase all the gains of an investment. He states *"...so the simplest thing I do, is open a dollar account and put my money in a dollar savings account"*. The perception of the dollar as a safe haven in

maintaining the purchasing power of ones savings and its influence in fuelling the pricing of goods and services in dollars is challenge recognised by the Government of Ghana with prohibition notices communicated in 2007, 2012 and more recently in 2022.<sup>2</sup> Furthermore, he adds that the perception of dollar as a more stable currency is making consumers consider dollar investments with dollar returns.

From the above, the following is formulated:

**Proposition 2.** The more attractive the returns from renewable energy crowdfunding project versus risk-free instruments such as treasury bills are, the more likely middle-class Africans will invest in such projects.

Closely related to the return was the price of the investment. Further probing to ascertain what participants meant by that term, majority of participants agreed with the question of *"How much will it cost me overall to be part of that"*, *"How much I am getting and how much will it cost me to start"*. Essentially, participants knew that depending on the model, there would be a minimum price to partake and the lower that is set the better as it prevents exclusion based on non-affordability issues. Generally, participants agreed that benchmarking that against minimum amounts for mutual funds and government treasury bills was preferred. This was GHS500 at the time, which is approximately US\$40-US\$50 depending on exchange rate.

From the above, the following is formulated:

**Proposition 3.** The likelihood of middle-class Africans investing in renewable crowdfunding projects increases when the investment price is comparable to the minimum amounts required for government treasury bills or mutual funds.

##### 4.1.3. RE developer or fundraiser reputation

The RE developer or fundraiser reputation was the most important non-financial attribute discussed by participants across the focus groups. Statements like "are they credible?" and "do they have the capacity?" were mentioned. Participants emphasized the importance of these factors in enhancing the trust and credibility of crowdfunding projects. This was explained further by statements like *"Those behind the project. If they are credible. If they are not some DKM people"*. The term "DKM people" as used here was in reference to a financial scandal involving DKM Diamond microfinance company which gained immense popularity from 2013 to 2015 for promising high interest rates on investment over a short period. However, in 2015, it was revealed that DKM was operating an illegal investment scheme outside the regulations of the Bank of Ghana (Central bank), resulting in the scheme's collapse and with many customers losing their savings and investment. Regulatory authorities were also heavily criticized for the lack of effective oversight and regulation of the microfinance industry. It should be noted that while DKM was not a crowdfunding entity or fundraising organisation, scandals in one segment of the financial sector has ripple effects in other areas. The fear of fraud in crowdfunding is well highlighted in the extant literature including by [39,116]. Participants were quick to add that an avenue for face-to-face interaction could allay fears around trust and credibility. One participant said, *"Personally, I would love some face to face"*. Another, supporting the earlier participant said *"Of course, face to face"*. Again, another said *"this feedback please listen to it... it is key"*. In essence, participants explained that a physical location associated with the project where funders/backers could go for inquires would improve credibility.

From the above, the following is formulated:

**Proposition 4.** The perceived credibility of the fundraiser or renewable energy developer significantly increases the likelihood of investment from middle-class Africans in renewable crowdfunding projects.

<sup>2</sup> See <https://www.bog.gov.gh/wp-content/uploads/2022/04/BOG-Notice-BG-GOV-SEC-2022-04-Prohibition-of-Pricing-Advertising-Receipt-and-or-Making-Pmts-for-Gds-and-Services-in-Foreign-Currency-in-Ghana-1.pdf>

#### 4.1.4. Project viability

Project viability placed highly after developer reputation in what participants would consider. This was rephrased by some participants as the *feasibility* of the project. Discussions centred around the potential of the project to achieve its objectives and deliver the expected outcomes. Participants explained that they would want to see what plans had been put in place to ensure that the project is sustainable and has a high probability of success. For example, participants stated “*If I say viability... is it going to provide what we claim it is going to do?*” “*What are the some of the things they have put in place to make sure the project materialises and lives overtime. The feasibility of running the project. You should know whether it will survive in the long term or how sustainable it will be in the long term.*” This means that potential funders would like to view information which signal credibility and sustainability of the project. This information should generally address the issues that affect investor returns. Studies such as [117] have underscored the importance of informational quality on signalling project trust in crowdfunding projects. If done well, this should address the well-documented issues of information asymmetries that characterise crowdfunding projects.

From the above, the following is formulated:

**Proposition 5.** Middle-class Africans are more likely to invest in a renewable energy crowdfunding project when they perceive it as viable, based on the information presented.

#### 4.1.5. Government policy

The need for a tailored government policy was mentioned in two of the focus group sessions. One of the participants explained that support and policy from government would influence their decision “*All that they have said boils down to the policy commitment by government. We are talking about renewable energy here. The technology expertise we don't have [it] in -country and we are not spearheading it. Are they supporting households?*” Generally, a large section of renewable energy and transition literature emphasises the necessity of supportive government policies to foster the adoption of renewable energy across various jurisdictions (see [118,119]). In giving further context, [120] emphasise the importance of government involvement in the success of crowdfunded projects as their presence mitigates against information asymmetry, enhance trust between fundraisers (project developers) and funders. Again, government involvement could result in a more profound synergy between them and society which according to [121] could enhance the understanding of challenges and opportunities in local level energy transitions.

From the above, the following is formulated:

**Proposition 6.** Government policies that support renewable crowdfunding projects increases the likelihood of investment from middle-class Africans in these ventures.

#### 4.1.6. Payback time, market demand and education

Payback period, market demand and information/education provided featured least. For payback period, a participant explained that he would want to know when he could get his money back in case, he needed it for other things. The participant who included market demand as part of his list explained it in these terms: “*Is there a need for it? Like we started with 'dumsor [electricity crises in Ghana from 2013-2016]', that means we have a challenge in the system. So, it means it is something I can consider and invest in.*” On the issue of education and information provided, one participant suggested that having access to detailed information about its structure, setup, and operations is likely to attract their investment. This is captured in a fragment of their explanation .... “*We should know the whole system in and out*”. In one of the focus group sessions, one participant stated that they had no interest in such a project at all. In explaining why, they state that “*Not interested at all because the national system does not work... I will not get my money back ... I will not make such an investment!*”.

## 4.2. Crowdfunding platform issues

### 4.2.1. Security

Majority of participants asserted that the key issue in online financial transaction is the issue of trust, credibility, and security. This was shown in statements such as: “*...That is the issue here... the trust. If I am bringing my money out ... are they going to put it to good use*”. Another participant said “*...Security, security that's the main thing, for me also security because I am very conservative*”. Another added...*and the reliability of the source... if I am going to use a card I will have to be cautious*” One participant expressed that he had little issues using crowdfunding or online platform for social giving but definitely not for investment saying: “*I will have a lot of hesitation for investment. For social, if it is appealing, I will just throw some money into it.* In general, participants were of the view that platforms must build and maintain trust. This could mean putting processes in place to avoid fraudulent campaigns, fake profiles or misappropriation of funds.

Another participant related the platform security issue within the context of banking laws and regulations. He mentions, “*I am concerned about the platform and security; what boosts confidence is good laws in the banking system. If the banking system has assured me that if my account is hacked, there is evidence that it was hacked then the bank will refund my money to me, then I don't care. I can do business on the internet. I mean people elsewhere put money in the bank because up to a certain amount you are secured.*” The issue of consumer protection is well highlighted here. Many jurisdictions like the United States, United Kingdom, China, Germany where crowdfunding has flourished, have stringent and effective securities regulations, anti-money laundering measures, consumer protection laws, and increasingly, data privacy regulations. Hence, although specific platform concerns were discussed, this was related to the entire banking system and how much confidence people had in it. Considering mitigation strategies, one participant said “*.. I think one of the things that has helped me with the few places I have been is the testimonials on crowdfunding platforms, this has generally encouraged me to give although I am still cautious.*” Generally, majority of participants agreed that reviews and testimonials from people who had some experience dealing with such investments could improve trust.

From the above, the following is formulated:

**Proposition 7.** The likelihood of middle-class Africans investing in renewable crowdfunding projects increases with their perception of the crowdfunding platform's security.

### 4.2.2. User-friendliness/ease of use

Apart from the issues of security, a few participants hinted about the platform's ease of use. The technology adoption literature is replete with studies (e.g., [122,123]) that emphasise the importance of *ease of use* in different industries spanning consumer electronics, ecommerce, digital banking, and payment systems and even ride hailing services. One participant stated “*My challenge has always been the ease of use of such platforms. You want to donate now but if it is complicated, you tend to just give up.* Streamlining features and processes to enhance user experience should therefore be prioritised. Studies such as [53,124] have highlighted the importance of perceived ease of use regarding crowdfunding adoption in Ghana.

Furthermore, one participant added that trusted payments systems like PayPal also do not work in Ghana. He mentions having challenges signing up although a friend asked him to. Participants intimated that reputable payment systems could do a lot to enhance credibility of innovations in developing markets. This highlights the need to increase the attention paid to partnerships that enhance or resolve multiple issues around ease of use as well as trust. On another hand, participants showed a massive endorsement for mobile money as an avenue for investment. It appears to have earned consumer points on security, ease of use and its integration into the current banking framework. Again, leveraging trusted networks is critical for supporting innovations in



many areas.

From the above, the following is formulated:

**Proposition 8.** The more user-friendly a crowdfunding platform is perceived to be, the greater the likelihood of middle-class Africans investing on it.

**5. Discussion**

This paper sought to shed light on the questions of (1) which renewable energy attributes matter for making an investment decision via crowdfunding and why?, and (2) what is the role of crowdfunding platforms in the decision-making process? This is achieved through focus group discussions with household investors to present qualitative evidence which extends the knowledge from the few quantitative studies for example, [124] that have been done in similar contexts as well as fill the gap regarding the dearth of evidence from the “crowd” in the crowdfunding literature as mentioned in [21]. Fig. 1 illustrates our conceptualisation of the key decision-making attributes, categorised around (1) RE project fundraisers, (2) Crowdfunding campaign, (3) Policymakers, and (4) Crowdfunding platform operators. The findings overall, highlight the complexity of factors that confront citizen investors as they venture into the inherently risky domains of “renewable energy” and “crowdfunding”.

Firstly, respondents were quite knowledgeable about renewable energy with solar PV proving to be a clear favourite in terms of technology choice. As an investment, participants showed acceptability for investment returns between 18 and 25 % per annum based on existing alternatives. Evidence from several European crowdfunding platforms show returns of 3 % to 10 % based on the technology, maturity and financial incentives like subsidies and feed-in- tariffs [125] This suggests that without certain financial and policy support systems, an unfair playing field exists compared to alternative investments which could offer over 20 % rate of return per annum. Already, regulation is very formative in several areas adding to the perceived risk by potential investors. Drawing from Rogers diffusion of innovation theory [126], investment crowdfunding which is associated with greater risk will encounter a slower uptake than its less risky counterpart, donation/ philanthropic crowdfunding – as the utility associated with philanthropy is the “ feel good or warm glow effect” backers achieve [127].

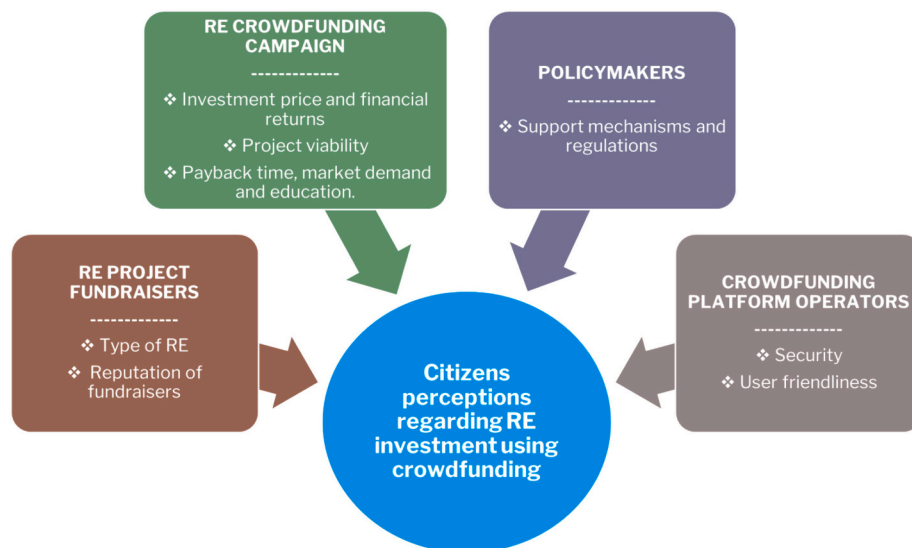
The findings, based on the state of the industry, have underscored two important non-financial attributes that inherently affect project economics. The developer reputation and project viability attributes

were the most discussed and reflect past findings around the need to establish trust and credibility as well as proof of concept. These confirm earlier studies that emphasise the theories of trust, signalling and social proof as previously discussed in Section 2. Closely related, the issue of deliberate, consistent, and favourable government policy/political environment is a necessary enabler as already documented in the literature [128,129]. In instances where crowdfunding for renewable energy is encouraged, alignment between RE policy and financial regulation becomes critical to develop the necessary environment that fosters investment.

The study identified factors such as security and ease of use as key concerns relating to the willingness to invest although more related to the crowdfunding platform characteristics. Ease of use is an attribute that is often relevant for adoption of technology. For example, previous studies such as [53,124] that apply the TAM model have established that ease-of-use influences use intention. Security concerns were significantly shaped by the prevailing issues within the banking system, which impacted consumer confidence in its capacity to safeguard those engaging with new innovations. Here also, some signalling through partnering with trustworthy financial organisations was recommended. For example, the availability of payment gateways such as PayPal on crowdfunding platforms could enhance crowd/backer confidence. This finding highlights the significance of credible and relevant partnerships in advancing projects that accelerate the pace of the transition.

**6. Conclusions, policy implications and future research**

In conclusion, the investment crowdfunding landscape especially for renewable energy faces strong headwinds which require deliberate and consistent policy as well as collaboration to address and improve. The study indicates that while numerous factors influence investment decision-making, the key concerns center on enhancing the support and improving the policy environment to allow renewable energy to compete with traditional investment options such as Treasury Bills in terms of returns. Closely related is the need to signal or better communicate the credibility and trustworthiness of the project developer or fundraiser. Efforts at de-risking renewable energy crowdfunding through small-scale pilots that address the key issues may be useful. Of course, there is scope to consider if the level of effort required is an efficient use of addressing the financing issue as well as improve climate action at the local or community level.



**Fig. 1.** Conceptual framework for RE crowdfunding. Source: Authors' construct.

6.1. Contributions

This study extends the crowdfunding literature in emerging markets by offering insights into the relevant factors that shape citizen investor decisions to invest in renewable energy via crowdfunding. Although some of the factors identified here may have been highlighted in earlier studies, the unique aspect of studying the African context is evident primarily in the rate of return expectations as compared to other studies in western or developed country contexts. Our study reveals the range of investment returns the crowd may expect and offers developers or fundraisers insights into assessing financial viability based on this expectation. Additionally, the findings provide a starting point to explore how policy and investment subsidies could improve project economics.

Again, our study highlights the importance of developer or fundraiser credibility or reputation and how signalling and quality information could improve the likelihood of investment considering the weaknesses or seeming distrust of the banking system. Furthermore, we derive propositions based on our findings to inform possible future research. This could allow researchers to empirically examine by formulating hypotheses for quantitative studies or defining new areas of inquiry for further qualitative exploration.

Lastly, in terms of theoretical contribution, this research reveals that when it comes to crowdfunding for renewable energy, a single theoretical framework is inadequate for a comprehensive perspective. Instead, the results indicate that a more effective explanation of the phenomenon emerges from integrating various elements drawn from multiple theories and perspectives.

6.2. Limitations and future research

The limited availability of a “crowd” from which to sample from meant a purposive sample was the most practical option to undertake the study. Hence, it is possible that some additional attributes could have been captured. Further, the data was collected data in 2017 and factors identified as influencing crowdfunding investment decisions at

the time of the study may have changed somewhat due to shifts in market conditions, regulatory environments, or technological advancements. Also, the period of data collection reflects people’s perception ex-ante (around crowdfunding entry into Ghana) and hence findings are valid for very early market conditions. As these conditions change, it is expected that perceptions may change based on experiential learning.

In term of future research, there is scope to investigate conditions under which household investors may desire slightly lower returns considering that the desired rates may be difficult to offer in the prevailing climate. Research into what proofs and signals may increase the intention to invest using crowdfunding can be explored. Additionally, data collection in the capital area may underestimate considerations of potential users in more rural areas where electricity access may be more acute. Hence, this presents an opportunity to examine the generalizability of the framework in other contexts such as in rural areas. Finally, research into how credible payment partnerships can bridge the gap between the existing security in the banking system and crowdfunding platforms can be explored.

**CRedit authorship contribution statement**

**Bridget Okyerebea Menyeh:** Writing – review & editing, Writing – original draft, Validation, Methodology, Formal analysis, Data curation, Conceptualization. **Theophilus Acheampong:** Writing – original draft, Formal analysis, Conceptualization.

**Declaration of competing interest**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

**Data availability**

Data will be made available on request.

**Appendix A. Annex 1. Key characteristics of participants**

Focus Group 1	Gender	Age Group	Educational Level	Monthly income (GHS)
A	Male	45–54	Master’s degree	<10,000
B	Male	25–34	University degree	4000–6000
C	Female	25–34	Master’s degree	4000–6000
D	Female	25–34	University degree	4000–6000
E	Female	35–44	Master’s degree	<10,000
F	Female	25–34	University degree	4000–6000
G	Male	25–34	University degree	6000–8000
Focus Group 2	Gender	Age	Educational Level	Income
H	Female	25–34	University Degree	4000–6000
I	Male	35–44	University Degree	4000–6000
J	Female	25–34	Master’s Degree	4000–6000
K	Male	25–34	Master’s Degree	4000–6000
L	Male	35–44	Above Master’s Degree	<10,000
M	Male	25–34	Master’s Degree	<10,000
Focus Group 3	Gender	Age	Educational Level	Income
N	Male	35–44	Masters	4000–6000
O	Female	25–34	Masters	4000–6000
P	Male	45–54	University degree	<10,000
Q	Male	35–34	Masters	4000–6000
R	Male	25–34	University degree	4000–6000
S	Male	25–34	Masters	4000–6000
T	Female	25–34	Masters	4000–6000

Note: USD1 was equal to GHS4.35 in 2017. See <https://data.worldbank.org/indicator/PA.NUS.FCRF?end=2022&locations=GH&start=2005>

## Appendix B. Annex 2. Questions in the moderation guide

Phase	Questions
Introductory questions (Investigating potential rationale for collective action)	<ul style="list-style-type: none"> <li>• What do you think about erratic power supply?</li> <li>• In what ways has it affected you?</li> <li>• What initiatives have you or others taken to reduce the impact?</li> <li>• How do you think citizens, or you can help with the power situation?</li> </ul>
Main Questions	<ul style="list-style-type: none"> <li>• What types of renewable energy do you know about?</li> <li>• I want you to imagine if you had a budget of GHS100 - what energy types would you invest your money in? What characteristics do you like about these technologies?</li> <li>• If you were offered an opportunity to invest small amounts of your saving in a renewable energy power plant whose power will be put into the grid, what would you typically consider before you investment.</li> <li>• How do you invest your savings now?</li> </ul> <p>What are some of the initiatives or projects you or others had to bring money together for? How was this money collected?</p> <p>Have you heard of crowdfunding?. Does that sound like something you might use and be engaged in? If participants have, what do you know about it?</p> <p>Do you know anyone who has used this method? What was their experience? Have you considered using it?</p> <p>How would you find it if investments were collected online through a payment platform on the internet? Why?</p>

Each main questions included a set of follow up questions and probes to ensure the topic reached saturation.

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