What Drives Senegalese SMEs to Adopt Renewable Energy Technologies? Applying an Extended UTAUT2 Model to a Developing Economy

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Abstract: Renewable energy technology (RET) can help small and medium enterprises (SMEs) in developing economies to both meet the need for a stable energy supply and contribute to the fight against climate change. In Senegal, SMEs have the opportunity through RET to become electricity prosumers. Whether it works as such in Senegalese SMEs is one of the questions we were able to address through qualitative interviews with 23 SMEs and 13 experts. Using qualitative content analysis, we examined what factors promote the adoption of RET by these SMEs. We also examined how well the established Unified Theory of Acceptance and Use of Technology model (UTAUT2) can serve as a guiding framework for this type of investigation. We find that effort expectancy is generally underestimated. Performance expectancy, when high, may influence the adoption process positively, while social influence does not seem to play a role. Both SMEs and experts point to customer service and government support for SMEs adopting RET as important facilitating conditions. The cost of RET is another factor influencing the adoption of these technologies. However, we regard the UTAUT2 as only partially helpful for the Senegalese context, due to the informal sector economy in Senegal. This leads us to add the factors knowledge, communication channels and entrepreneurial orientation. Moreover, we question the unequivocally positive notion of prosumerism for African contexts, as the idea draws its motivating power from a Western mindset.

Keywords: renewable energy; small and medium-sized enterprises (SMEs); unified theory of acceptance and use of technology 2 (UTAUT2); entrepreneurship; individual entrepreneurial orientation (IEO); informal sector economy; sub-Saharan Africa

1. Introduction

Small and medium-sized enterprises (SMEs) around the world play a significant role in the development of national economies. In Senegal, 95 percent of all enterprises are SMEs. They account for 20 percent of the GDP, around 30 percent of domestic valued added and about 40 percent of all employees [1]. In other economies in Africa and in the Global South generally, SMEs play an equally important role: 90 percent of the enterprises in the private sector of the Global South are SMEs [2]. The prominence of SMEs has led to increasing research into entrepreneurship, considered one of the most promising approaches to economic development and poverty reduction in Africa [3,4].

SMEs in Africa face serious challenges, including a lack of access to financial resources, government assistance, human capital, and infrastructure [4]. However, the lack of a stable energy supply could be the most daunting [5]. In a 2012 survey on the effects of power outages on firms in Senegal [6], 57 percent of the participating SMEs identified...
electricity as a major concern for their enterprise, while 55 percent said that the risk of power outages factors into their investment decisions.

Renewable energies (RE) as a distributed form of energy production could provide these enterprises with a stable source of energy. Renewables would also create opportunities for new business models for the SMEs, e.g., running RE-powered charging stations for mobile phones [7]. Moreover, from a macro perspective, a shift to renewable energies represents a preemptive strategy to mitigate climate change, especially in developing economies where rapidly growing energy demands would otherwise be met by burning hydrocarbons.

It thus becomes of interest to understand what factors influence SMEs, in our case in Senegal, to adopt RE and energy efficiency (EE) technologies. We are specifically interested in the decisions made by business operators who turn to RE technology for a stable energy supply. These enterprises make decisions to use, or not use, RE in the context of a business model that uses energy simply as infrastructure. Other SMEs might adopt RE technology as the foundation for a sustainable business model, as in the low-carbon charging service just mentioned [7]. However, we are interested in the thinking of the entrepreneur who needs a stable source of electricity to run an SME.

Most academic research on entrepreneurship has focused on developed economies [3], so the research into African entrepreneurship is limited. Devine and Kiggundu [4] conducted a systematic review of the existing literature and identified three lines of research, each with their respective focuses. One line of research has explored entrepreneurship in marginalized groups (e.g., women and youth), investigating education, work behavior and displacement. A second line has investigated the entrepreneurial firm, looking at forms of organization (SMEs and family business), capitalization (financial and social), social entrepreneurship and the informal economy. A third line has examined macro-socioeconomic conditions, addressing government assistance and policy concerns, poverty, corruption and internationalization.

Most of these studies, however, lack grounding in theory and are restricted to quantitative approaches. Scant research attention has been paid to the thinking of the entrepreneurs who are presented with opportunities to integrate renewable energies into their business operations [8]. Insight into how entrepreneurs in Africa make their decisions to adopt RE in their firms—or not—is sorely needed, but missing from the literature.

We seek to fill this gap by adopting a human-centered approach that focuses on the economic actors—the individual entrepreneurs—and the opportunities they have to adopt RE in their businesses. We base our approach on the theories of entrepreneurial action, looking into the processes by which opportunities for the adoption of RE technologies are formed and exploited. We use the framework of the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2), but extend it with insights from the Diffusion of Innovation Theory (DOI) [9].

Our central research question is: What considerations motivate Senegalese entrepreneurs to adopt RE in the operation of their SMEs? More specifically, we ask:

1. Which dimensions of the UTAUT2 matter for RE adoption in Senegalese SMEs?
2. What other influencing factors play a role in the Senegalese context?

To explore these questions, we conducted 36 qualitative interviews with entrepreneurs and energy market experts in Senegal, which we then analyzed for insights.

Our research provides an opportunity to advance knowledge of RE adoption factors in three ways. First, it fills a research gap about entrepreneurial opportunities to adopt RE technology in Senegal. Second, it uses UTAUT2 in a qualitative research design, a rarity as most UTAUT2-centered studies to date have used a quantitative design. Third, it investigates the UTAUT2 framework in the context of SMEs in sub-Saharan Africa, a first in the literature.

We proceed by outlining our research methods and then introducing the analytical framework built from the theories of entrepreneurial action and the UTAUT2 model. Within this framework, we present our results, followed by a discussion of our findings and our conclusions.
2. Materials and Methods

2.1. Research Method

To investigate the considerations that motivate Senegalese entrepreneurs to adopt RE in the operation of their SMEs, we conducted a qualitative interview study focusing on two different groups: Senegalese SMEs and experts in the Senegalese energy sector. We conducted 23 interviews from the first group and 13 interviews from the second. Table 1 lists the sectors and areas of expertise represented by the 36 interviewees.

Table 1. Profile of interviewees; source: authors.

| Sector                        | Interviewee                  |
|-------------------------------|------------------------------|
| Accommodation and Food Service Activities | SME 1, SME 2, SME 5, SME 7, SME 16, SME 17, SME 18, SME 20 |
| Information and Communication | SME 6, SME 14, SME 15; SME 23 |
| Agriculture, Livestock and Fishing | SME 3, SME 8, SME 12, SME 21 |
| Wholesale and Retail Trade    | SME 9, SME 10, SME 13, SME 22 |
| Construction                  | SME 11                        |
| Other Services                | SME 19                        |
| Intl. Development Cooperation | Expert 1, Expert 13           |
| Environmental Consultant      | Expert 2                      |
| Public Institutions           | Expert 3, Expert 5, Expert 6, Expert 8, Expert 9 |
| Senegalese RE Industry        | Expert 4, Expert 7            |
| Academia                      | Expert 10                     |
| Finance                       | Expert 11, Expert 12          |

As shown by this table, our study is not restricted to one industry, but includes SMEs across a wide range of economic activities. The SMEs operate in the cities of Dakar and Saint-Louis. The first is the capital and the largest and most populous city in Senegal, while the second is one of the country’s larger cities.

To complement the insights gleaned from these SMEs, we conducted interviews with 13 experts from the Senegalese energy sector. Our choice of experts in this study follows the recommendations of Döringer [10], who states “experts are considered knowledgeable in a particular subject and are identified by virtue of their specific knowledge, their community position, or their status” [10] (p. 1). Experts possess competencies by which they help shape the processes in their respective field, in contrast to laypersons who may have knowledge but lack the power that community position or status confers.

Table 1 illustrates that our sample includes experts who structure or help shape the relevance of RE in Senegal, based on their knowledge and possibilities for action. Our expert sample is not restricted to one area, but encompasses intersecting disciplines, with expertise in the public institutions of Senegal especially well represented.

In designing the interviews, we took into account the fact that RE technology is still not widely used in Senegal, so we needed to allow latitude for the interviewees. This led us to choose a semi-structured design. We also recognized that the two groups would work from different perspectives, so we developed guidelines for the respective interview partners, SMEs or experts. The guidelines were derived from the literature on barriers, success factors and capacity-building needs for RE implementation in the Global South, with a focus on sub-Saharan Africa. Accordingly, success factors are primarily stakeholder engagement at various levels [11,12], a high degree of ownership that can be fostered with local experts [13,14], sociocultural embedding to meet local needs [12,14], and adapted marketing and communication structures to promote the technologies and manage expectations [11,15].

Barriers are identified in terms of financial resources, such as high upfront costs and access to finance [13,14,16,17], and in the socio-cultural context, such as insufficient knowledge about RE technologies, lack of maintenance and misalignment of business
models [12,15,18–21]. However, shortcomings are also identified in political efforts, which are often seen as insufficient in terms of policy transparency, administrative procedures, lack of government support, and lack of cooperation and coordination among stakeholders [11,15–17,19,20,22,23].

Capacity building needs are particularly seen in education and training on RE in financial institutions [15], the lack of trained local staff for maintenance and repair services [15,19,24,25], and missing collaborations with national universities to access and integrate their knowledge [23].

The resulting interview design with its semi-structured, guideline-based approach allowed us to explore the perspectives of the interviewees without influencing them with ideas that we, as researchers, had already worked out [26].

All interview partners were first contacted by phone or email, which was followed in fall/winter 2019 by face-to-face interviews at the workplace of the SMEs and experts. In 2020, owing to the pandemic, we conducted additional expert interviews by phone. The interviews were conducted in French, English or German according to the preference of the interviewee. They were recorded, transcribed and then analyzed with the program MaxQDA [27]. To evaluate the transcripts, identify themes and quantify the qualitative data for comparison, we used qualitative content analysis, as developed by Mayring [28]. Coding of the transcribed interview material was conducted according to an extended UTAUT2 model, which we present in the following section.

2.2. Analytic Framework

To analyze the data from our study, we reviewed existing models and theories on technology acceptance and decided to use the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) as our theoretical framework because it offered the best fit to our research questions. However, we recognized the need to adapt the theory to Senegalese entrepreneurs, so we created new categories to extend its range to include dynamics in Senegalese SMEs. We explain the development of our framework in the following.

2.2.1. Models of Technology Acceptance

Since our study aims to better understand how entrepreneurs evaluate potential investments in RE technologies, models of technology acceptance are obvious candidates to frame the analysis of our interview data. Generally, there are two types of these models: models that capture decision-making processes of organizations, and models that focus on the decision-making processes of individuals. The latter seem best suited to our SMEs in that their decision-making processes most closely resemble those of individuals. The entrepreneur often decides without consulting others, the decision-making processes are mostly informal, and the entrepreneur bears the direct consequences of the decision, including, of course, the financial impact.

This is not the case for most employees in the context of organizational decision-making [29]. On the other hand, entrepreneurial decisions are not fully comparable to everyday individual decisions, because an entrepreneurial decision carries consequences that have to be considered and weighed carefully. A decision to employ renewable energy technology is hardly a spur-of-the-moment choice, but one that needs time and most likely some cost–benefit analysis, if for no other reason than to obtain financing.

Table 2 presents a number of models frequently employed to analyze individual decision-making about technology adoption. The header row lists the models, while the data rows summarize the variables included in each. All of these models have been used either in the context of renewable energies, in developing economies, or for analyzing entrepreneurial decision-making, albeit not necessarily for the combination of all three.
Table 2. Overview of models and theories on technology acceptance; source: authors.

| Model/Theory                      | Dependent variables                  | Independent variables                                      |
|----------------------------------|--------------------------------------|------------------------------------------------------------|
| Theory of Planned Behavior (TPB) | Behavioral intention to use innovation adoption | Attitude |
| Technology Acceptance Model (TAM and TAM2) | Actual use | Personal norms |
| Diffusion of Innovation (DOI) Theory | Behavioral intention to use usage behavior | TAM: External variables |
| Unified Theory of Acceptance and Use of Technology (UTAUT and UTAUT2) | Performance expectancy | TAM2: Subjective norm |
| Entrepreneurial Event Model (EEM) | Effort expectancy | Voluntariness, and image |
|                                  | Social influence | Job relevance |
|                                  | Facilitating conditions | Output quality |
|                                  | (Moderating variables: gender, age, experience, and voluntariness of use) | Result demonstrability |
|                                  | Perceived desirability (Attitude, Social norms) | Perceived usefulness |
|                                  | Perceived feasibility (cf. PBC) | Perceived ease of use |
|                                  | Volitional element (propensity to act) | |

Before looking at the models in more detail, we would like to stress one point. All these models are used far more frequently in quantitative studies than in qualitative designs. In the sample reviewed by Williams et al. (2015) [30], research on UTAUT was used in 155 survey studies while only 12 studies used interviews and four case studies and none of the studies used qualitative data analysis methods.

Moreover, the models are by no means independent of each other. A common starting point of many of the theories in this field is the Theory of Reasoned Action (TRA) together with the Theory of Planned Behavior (TPB) [31] that emerged from it. The TPB has broader scope than technology adoption and has been used to explain a wide variety of behaviors not necessarily technology related.

Additionally, building on the Theory of Reasoned Action is the Technology Acceptance Model (TAM) [32]. TAM has been described as “... the most influential and commonly employed theory for describing an individual’s acceptance of information systems” [33] (p. 752).

The Diffusion of Innovation (DOI) Theory also has broader scope than technology adoption, as it considers all innovations, not just technological ones. Nonetheless, it is widely applied to studies of the adoption of new technologies.

The Entrepreneurial Event Model (EEM) [34] also draws heavily on the TPB. Its construct perceived desirability uses attitude and social norms, two variables from the TPB [35], and its construct perceived feasibility mirrors Perceived Behavioral Control (PBC) in the TPB.

The Theory of Planned Behavior, the Diffusion of Innovation Theory, and the Technology Acceptance Model are combined in the Unified Theory of Acceptance and Use of Technology (UTAUT) [36]. The initial UTAUT looked primarily at employee decisions [29,37] and included the influencing factors performance expectancy, effort expectancy, social influence, and facilitating conditions. It developed further into UTAUT2 to capture consumer decisions [29] and added the factors hedonic motivation, price value, and habit. As such, it has been widely adopted in studies on technology adoption [38] and served as our starting framework.

Table 3 shows how the influencing factors from UTAUT2 have been operationalized in studies on decision-making about RE and EE technologies. Most of the studies were carried out in developing economies, which attests to the applicability of UTAUT2 to our study.
| Construct               | Definitions According to Venkatesh et al. (2003) (Original UTAUT) and Venkatesh et al. (2012) (UTAUT2) | Operationalization in the RE and EE Context |
|-------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------|
| **Performance expectancy** | “[…] degree to which an individual believes that using the system will help him or her to attain gains in job performance.” [36] (p. 447) | Reduction in dependence on power grid [39] Energy savings [38] Cost savings [38] Output increase [38] Safety [39] Helps to keep an eye on energy and water consumption [40] Helps to reduce electricity consumption [41] |
| **Effort expectancy**    | “[…] degree of ease associated with the use of the system.” [36] (p. 450)                        | Ease of obtaining information [38] User friendliness [38] Ease of use [38,39,41] Ease of understanding [41] Ease of installation [39] Ease of maintenance [39] Compatibility with existing appliances [39] Ease of learning to use [38,40] |
| **Social influence**     | “[…] degree to which an individual perceives that important others believe he or she should use the new system.” [36] (p. 451) | People who are important to the user think she/he should use it [38,39,41,42] People who have an influence on the user think that the technology is a cool innovation [40] Prestige of people who already use it is high [38] Media (traditional, social) encourage it [42] Government approves of the technology [38,42] Community encourages it [42] Positive experience by neighbors [39] Would not use it because I heard of theft of these systems [42] Would use it if friends used it [42] |
| **Facilitating conditions** | “[…] degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system.” [36] (p. 453) | Own resources [36,42] Own equipment [41] Own knowledge [38,40,42] Fits into lifestyle [42] Compatibility with existing systems [38] Instructions and support available [38,42] Heavily rely on after-sales service for maintenance [42] |
| **Hedonic motivation**   | “[…] the fun or pleasure derived from using a technology […]” [29] (p. 161)                      | Fun [40,41] Interesting [40] Entertaining [41] Exciting experience [39] User will be happy doing it [39] Satisfying to be among the first [39] |
| **Price Value**          | “[…] consumers’ cognitive tradeoff between the perceived benefits of the applications and the monetary cost for using them […]” [29] (p. 161) | Reasonably priced [40,42] Value for money [42] Good investment [42] Cost-effective [39] Affordable [39,42] Less expensive than conventional electricity consumption [42] Economically viable due to government incentives [39] |
| **Habit**                | “[…] the extent to which people tend to perform behaviors automatically because of learning […]” [29] (p. 161) | Currently using similar technology (app) [40,41] Already actively monitoring water and energy consumption [40,41] |
Most operationalizations of the UTAUT2 variables are consistent across the studies listed in Table 3. They also align with the definitions by Venkatesh and his co-authors in the original publications on the two models [29,36]. However, we noted discrepancies in some variables: Compatibility with existing systems appears as an item for measuring effort expectancy [39] as well as for measuring facilitating conditions [38] in the original publication by Venkatesh et al. 2003 [36]. Additionally, the operationalization of facilitating conditions with references to the user’s own resources [38] comes as a surprise, because the original definition by Venkatesh refers to conditions external to the user. Compatibility with one’s lifestyle appears as a construct for habit in [41], but also for facilitating conditions [42].

2.2.2. Extensions of the UTAUT2 Model

In the literature on the creation and diffusion of innovations in low-income countries, the UTAUT facilitating conditions have been identified as a major source of influence [43]. They have been shown by research not only to influence the intention to adopt technology (i.e., “Behavioral Intention” in Table 2) but also to have a direct effect on the actual use of that technology (“Use Behavior” in Table 2) [30].

However, past research has also pointed to the important differences that exist between developed and developing countries in innovation diffusion. In their comprehensive literature review of innovation diffusion in low-income countries, Zanello et al. [43] found that it depends heavily on knowledge diffusion. The lack of skills that would have been acquired were stronger educational systems in place often becomes a barrier for the diffusion of innovation.

Knowledge diffusion itself rests on communication, but in economies dominated by the informal sector, where few large firms operate and SMEs predominate, communication opportunities are limited. Exchange of work knowledge between employees is rare, employee mobility is limited, and communication problems arise between innovation owners from developed countries and innovation adopters from developing countries. Communication is further limited by underdeveloped road infrastructures, which hamper the movement of skilled people and new products.

These considerations lead us to add two more constructs to the UTAUT2 model: knowledge and communication channels from the DOI theory [9]. These build the basis for an entrepreneur to create opportunities for the adoption of new technologies in a firm, and we cannot take them as givens in the context of Senegalese entrepreneurs. Indeed, we are convinced they strongly influence Senegalese entrepreneurs making adoption decisions about RE technologies. We explain in the following our rationale.

In Rogers DOI [9], the stage of knowledge is the first phase of the innovation-diffusion process, followed by the phases of persuasion, decision, implementation and confirmation. Knowledge is crucial, because at the beginning of the process, individuals engage with innovations for the first time. Information-seeking and -processing activities enable individuals to form an attitude towards the innovation. The concept of knowledge that Rogers [9] develops goes beyond simple awareness of the innovation to include the individual’s interpretation of information, including knowledge of the proper use of the innovation and the functioning principles underlying its operation.

These considerations come under the knowledge dimension in our study, through which we seek to gain insights about what Senegalese entrepreneurs actually know or believe about RE. Dependent on this, entrepreneurs build their assumptions and attitudes in their decision-making processes, which we then address through the UTAUT2 categories.

What makes possible the growth of knowledge is an individual’s access to information, important at all stages of innovation diffusion [9] and related to existing communication channels. According to Rogers [9], communication might range from interpersonal to mass media channels; it can be passive (information about an innovation) or active (information that motivates one to actively engage in an innovation); and it can be disseminated by different sources ranging from government to private firms to NGOs. Rogers points to the importance of interpersonal networks as a communication channel.
in the innovation-diffusion process, since “the interpersonally communicated experience of near peers can substitute, in part, for the individual’s personal experience with an innovation (...)” [9] (p. 203).

Due to the importance of communication channels, we include them as a separate dimension in our study. We put a particular focus on the organization of entrepreneurs in networks as “near-peer” communication, since the use of RE technologies in Senegalese firms is still not widespread. By sharing information with others, entrepreneurs can obtain valuable information that they can evaluate for their own business context.

Our extended UTAUT2 model thus consists of the nine dimensions shown in Figure 1: knowledge, communication channels, performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, price value and habit. UTAUT and DOI have been combined in a previous study on energy-related technologies [44], while knowledge has been introduced as an additional factor for the adoption of solar PV in a developing country context [42].

Figure 1. Extended UATUT 2 model; source: authors.

3. Results

In this section, we present and discuss the findings from our empirical study by the nine influencing dimensions shown in Figure 1. We display the results from both the perspective of the SMEs and that of the experts. We find that knowledge, communication channels and facilitating conditions are central for the adoption of RE technologies in Senegalese SMEs.

3.1. Knowledge

The majority of SMEs stated that they had knowledge of RE and EE technologies. Only three admitted having insufficient or no knowledge. However, the positive self-estimation of the majority should be viewed from an insider’s perspective:
“The people watch TV and that’s how they know. But from a practical point of view, they don’t know anything. What it takes to get it, how it’s going to last. There’s all this information out there, that people don’t have a clue about.” (SME 6). All interview quotes in this study were translated from French into English by the authors.

This assessment is echoed by another SME explaining “Of course, we try little things. For example for biogas, we watch videos on YouTube and try to see how it goes.” (SME 21). Furthermore, almost all SMEs are interested in trainings fostering knowledge about RE and EE technologies.

A similar picture emerges when we look at the way in which the SMEs deal with the issue of energy in general. We find that they have little information about the energy contract options offered by Senlec (Société Nationale d’Electricité du Sénégal), the state-owned national electricity utility; which has a monopoly for transmission and distribution. More than a third (8/23) of the SMEs have no information at all about the existence of differentiated electricity tariffs, such as business tariffs. One SME admits “I can’t say for the moment because I didn’t really engage with that [electricity tariff].” (SME 14).

How experts view the knowledge level of SMEs in their country sheds light on the real level of knowledge SMEs operate from when evaluating RE and EE technologies. One expert expresses a general consensus about their competence, saying:

“They don’t know. And when they do know, they don’t have the ability to do. But if they know, they say ‘Okay, now that we know, how are we going to do it? With what means?’” (Expert 3)

Another expert identifies the information deficit as the major constraint to RE adoption:

“You know what the problem is? It’s the information. Can you believe it? When the persons are not informed, they can’t choose. And in general, small and medium enterprises or microenterprises are not informed about the possibility of producing their own energy in a renewable way. You have to demonstrate this. People need to see what you’re talking about. You want to do solar, make your business run on solar? Do a pilot project with solar and people will see it. ‘Is that it? Yes, I want to it.’ Because then they know what you’re talking about.” (Expert 4)

The lack of skills in business management and entrepreneurship is also recognized as a limitation to seizing the opportunities that lie in adopting RE and EE technologies (Expert 5). The SMEs’ level of information on current framework conditions is noted as lacking; for example, Expert 8 points to the possibility to generate electricity for self-consumption with plants with installed capacity ≤50 kVA, which has been regulated in the Electricity Act 1998 (Law no. 98-29) [45]. However, none of the SMEs in our sample was aware of this possibility.

To address these information deficits, the organizations of three experts work directly in knowledge diffusion. They offer training on topics that include environmental and climate challenges; project planning and financing; EE measures such as efficient lighting; and best practices for firms that want to implement RE measures. In addition, the experts mentioned other organizations in Dakar offering support, such as the Bureau de mise à niveau, the institution responsible for implementing and monitoring corporate modernization plans, which has an energy efficiency department, the National Rural Electrification Agency and the ECOWAS Center for Renewable Energy.

To summarize: information and knowledge are acknowledged by both SMEs and experts as important barriers to RE adoption.

3.2. Communication Channels

A dismal picture emerges when viewing communication channels accessible to Senegalese SMEs. We have already noted how policy support exists for RE deployment, but none of the SMEs know about it. Several organizations exist to provide support for integrating RE into a business, but none of the SMEs are aware of them. Contract options with
business tariffs are available from Senelec, yet few SMEs know about them. Information distribution through mass media plays at best a minor role. Only one SME actively uses YouTube to gain information for its business.

Networking organizations, an essential communication channel between firms, do not seem to be a crucial part of the entrepreneurial activities in Senegal, according to the majority of the SMEs interviewed. Only two SMEs reported that they were members of their respective industry association. However, questions related to energy are not yet discussed in these associations. The exchange in informal settings with former classmates or other firms is more common. However, this does not automatically lead to promising collaborations:

“We talk about this with our colleagues, with our network, but we just talk. (...) We discuss the problems of electricity but it is a discussion only. There is no progress, (...) how do we find the solutions?” (SME 8)

Few companies make strategic use of networks going beyond these loose exchanges; in our study, two strategic network actors have taken on the role of institutional entrepreneurs, being integrated into networks with links to the national governance level. SME 9 sees benefits from joining forces with firms whose competencies differ from its own, identifying diversity of knowledge as a success factor, increasing its own human capital. Both network actors pursue strategic goals, such as influencing the Senegalese government to request financial support from the Green Climate Fund of the United Nations or encouraging the government and other donors to favor solar energy over hybrid power plants. Besides these activities, however, nine of the 23 SMEs are not involved in any energy network activity at all.

The experts in our sample know only a little about the networks of companies that consume energy, but they do have insight into the networks of Senegalese entrepreneurs that offer renewable energy solutions. They note that networking is also still developing in the industry of RE technology suppliers, not just among RE adopters, who have mostly been on their own. Only in 2020 were two new associations founded. However, two experts express doubts about the ability of these and other networks or interest groups to influence national policy-making. Two reasons are given. First, there is no existing lobby considered capable of contributing quality ideas sufficient to influence decision makers. Second, decision makers are not interested in consulting with experts outside their established advisory group.

To sum up: mass media communication channels are insufficiently built out, if they exist at all, to reach the entrepreneurs. Networks, which can be an important communication channel, are clearly underdeveloped and do not contribute in Senegal to the diffusion of accurate practical knowledge about RE.

3.3. Performance Expectancy

All interviewees see benefits in the use of RE and EE technologies. The SMEs in our sample identified benefits in three domains. First, cost reduction, in the words of one SME:

“All I can tell you is that all we expect is to pay less, that’s all we expect from energy. When we talk about energy, we think cheaper.” (SME 8)

The second benefit derives from re-investing the money saved on energy into other business activities. One business owner explains:

“If we reduce that cost [electricity], there is a part of that cost that will be reused in the form of savings for other investment purposes to develop the business, especially we can invest that amount of money in the purchase of other materials we need.” (SME 19)

The third expected benefit is that RE serves as back-up during low tension/power outages. In the words of one SME, “It allows me to keep the light on even though there is actually a load reduction.” (SME 5)
Overall, the SMEs have a very positive perception of RE and EE technologies. The experts agree with the SME’s expectations, but also predict another opportunity for the future where the firms themselves become energy suppliers and thus develop new ventures. Interestingly, only one of the SMEs in our sample mentioned this opportunity, imagining an approach based on the French model:

“So it’s something that could work if, I wouldn’t say copy, but take the model of France with EDF so that the population, if they want, can invest for their own consumption and inject in case of surplus production.” (SME 10)

Performance expectancy is clearly a positive factor that can promote the use of RE among SMEs in Senegal.

3.4. Effort Expectancy

Only one SME provided a considered opinion on effort expectancy, expressing skepticism with regard to the use of RE technologies, considering the feasibility of implementation under the restrictions of an urban environment, such as the availability of space and potential energy losses along the supply cables. None of the other SMEs commented on the expected effort to deploy RE. Rather, their view is quite naive. They overlook the efforts needed to adopt RE technologies into their firms. This becomes evident particularly in their estimation of photovoltaic systems where a notion of plug-and-play simplicity prevails. In the words of one SME: “If it were me, I would take the solar. It’s very reliable now and you pay less. Once you buy the equipment, it’s over.” (SME 16). No thought is given to what the use of the sun will mean to his firm, nor to requirements such as installation, maintenance, or compatibility with existing appliances.

Effort expectancy, on the whole, does not seem to be a barrier for RE adoption, but not because of justifiable confidence. It is more likely that the rosy expectations belong to the prevailing knowledge deficit about RE.

3.5. Social Influence

When we look for the factor of social influence in our sample, we find little evidence that it plays a role in adoption decisions. Three SMEs expressed an awareness of climate change and the need for the decarbonization of the energy system:

“I’m in this because when we talk about solar energy, I think it goes straight to the heart of the matter, there’s no waste, only the greenhouse effect. We don’t use anything that also harms the environment.” (SME 9)

However, the reasons lie rather in individual values instead of a collective social influence or norm. The experts have little to say about social influence other than pointing to the importance of an environmental consciousness for the engagement in renewable energies:

“Internally, they [the SMEs] don’t have the staff dedicated to that. It just takes an environmental consciousness on the part of the entrepreneur to conduct environmental activities.” (Expert 3)

Therefore, overall, social influence apparently does not act as a supporting factor for introducing RE into Senegalese SMEs.

3.6. Facilitating Conditions

Among the SMEs in our sample, none expressed a positive opinion of existing facilitating conditions. Instead, they identified three mechanisms of state support needed to facilitate integration of RE and EE technologies into their firms.

First, the SMEs claim financial support is needed to invest in clean energy solutions. Only one SME, however, specified a need for support in the banking sector, where SMEs are not yet considered credit worthy. A second facilitating condition, mentioned by another SME, is a Feed-In Tariff (FIT) mechanism. This would enable SMEs to inject their
surplus into the energy grid, as is common in Europe. A third facilitating factor was named by two SMEs, who see the possibility to stimulate competition through a liberalization of the energy market, which would give SMEs the opportunity to freely choose their energy supplier. Unfortunately, only these four already mentioned SMEs formulated concrete ideas; the others simply expressed general criticism of the state.

A far more detailed picture emerges from the expert statements, which offer different perspectives on the state’s role in fostering RE technologies. On the one hand, experts described the state as very committed, due to the budget it spends on the energy transition, despite the urgent policy fields of poverty and health. In addition, various initiatives and agencies operate in RE in Senegal, some of which receive state funding. A major step towards reducing investment costs in RE was achieved in 2020, as import duties on energy technologies were abolished. Moreover, microcredit securitization has also been established to meet financing barriers. In this respect, however, more commitment from the state is called for, so that the specific needs of SMEs can be better addressed. One of the experts further explains:

“There is no problem for the demand of financing, because in Senegal microfinance is widely developed. There are many savings and credit cooperatives. On that side, there is no problem. The funds are there. But the problem is at the SME level.” (Expert 5)

On the other hand, fundamental concerns about the transparency of political goals, regulations and (donor) coordination exist. One expert points out that governmental or official development cooperation organizations often do not know the full details of the laws in effect. This is also reflected in our sample. Some experts call for a legal framework for grid-injections, while others claim that the regulation already exists, but its implementation is still unclear.

In addition to addressing the role of the state, SMEs and experts point to the limited maintenance and service offers and the guarantees given by suppliers as challenging:

“There are quite a few businesses today where people sell solar panels. Do they know how to do it? Do they know how to teach you? That’s something else. Can they install it? I’m not sure. But they sell solar panels.” (Expert 4)

However, no facilitating conditions to overcome this barrier were named. Providers of technology, service and maintenance are mostly concentrated in the city of Dakar or other urban centers, which leads to distributional constraints. For customers, this creates uncertainty about support, and for providers it means great effort to reach customers in a satisfactory manner. One business owner contends:

“…above all, the problem for Africans is maintenance continuity. And this kind of energy requires maintenance and renewing the equipment all the time. Because when they install the equipment, it’s not that the equipment is going to last ten years.” (SME 6)

A lack of the after-sales maintenance and support that might encourage technology adoption stems from conditions in the country:

“Companies that are based in Dakar, or in Saint-Louis, they actually find it difficult to work throughout the country because they are quickly confronted with logistics problems. They will also be faced with problems of maintenance and upkeep, and after-sales service, because they often need to have after-sales service relays at the local level. They do not necessarily have the financial and human resources to ensure these after-sales service.” (Expert 12)

In summary, SMEs tend to be vague about the need for government support and other facilitating conditions, and they sometimes call for support that experts believe already exists. This points again to the knowledge and communication deficits that play a central role in our findings. Policies intended to facilitate the adoption of RE technology only work if the intended beneficiaries know about them and how to make use of them.
3.7. Hedonic Motivation

In the interviews with SMEs and experts in our sample, pleasure derived from the new technology was not mentioned at all.

3.8. Price Value

Judgements by the SME and experts on the “price value” of RE—the trade-off between the perceived benefits of its application and the monetary cost of using the technology—coincide very well. Due to the costly importation of most technological components, it is not surprising that the question of price dominates all other considerations of many SMEs and experts. As one expert notes:

“A large solar panel to operate, for example, or an electric dryer where you can dry mangoes or bananas, it is very expensive and a company can’t afford it.” (Expert 3)

Moreover, both experts and SMEs are very critical of the quality of the products:

“You can buy a solar thing that costs nothing at all, it comes from China, you install it and after three months it is defective. Sometimes even after a week. We need people who can guarantee that when you put that [PV panel] on, you have quite some time without needing to do anything.” (SME 16)

3.9. Habits

Senegalese SMEs have little experience with the productive use of renewable energy, and this is reflected in our sample, precluding us from making any claims about habits. There are no learned RE behaviors, because, as the experts in our study emphasize, RE is still a novel idea in Senegal. Without long experience with the technology, companies cannot turn to legacy knowledge and routines.

However, the experts note two other factors affecting RE adoption in Senegal. First, one expert cites the outcomes of trainings on RE and a public campaign by Senlec for EE measures—both of which have already been implemented with little success—to claim that Senegalese citizens are not willing to change their energy behaviors. A second claims the Senegalese “do not act pro-actively, as it is not in the habits of the Senegalese”. Both observations highlight the significance of cultural constraints that limit RE adoption.

4. Discussion

Academic interest in African entrepreneurship has increased in recent years, but one area had remained unexplored until this study, namely, the factors influencing decisions of SME entrepreneurs on whether or not to adopt RE technologies. To investigate these influencing factors, we conducted a qualitative interview study that included 36 interviews, both with Senegalese SMEs (23) and experts from the Senegalese energy sector (13). We used the UTAUT2 model as an analytic framework but extended it by two factors we find critical for understanding our study group—knowledge and communication channels (Figure 1).

The reader should keep in mind that the UTAUT2 model was developed for and focused on actors in developed economies. Caution must be exercised when applying the model to the decisions made by Senegalese entrepreneurs. This was a primary motive for our choosing a qualitative interview study design with its open explorative approach. By allowing SMEs and experts to voice their own unfiltered views without trying to fit them into the parameters of a quantitative study, we were able to gain valuable insights into the thinking of Senegalese entrepreneurs about RE technologies.

As our study uses an extended UTAUT2 model, it necessarily addresses both the suitability of the model for understanding Senegalese entrepreneurship as well as the suitability of the prosumerism idea to the Senegalese context. In Europe, prosumers have profited greatly from the solar energy boom. The idea of producing energy both for yourself to use and to sell to others would seem to have appeal to any entrepreneur. However,
does it in Senegal? Can it serve as motivation for RE adoption in a country where the informal sector makes up the major portion of the economy?

The informal sector plays an important role not only in Senegal, but also in developing economies worldwide, where it accounts for up to 60 percent of a nation’s GDP [46]. In Senegal, the informal sector contributes 41.6 percent to the nation’s GDP, according to the International Labor Organization (ILO) [47]. Basing their results on 2018 data, the ILO estimates that informal employment accounts for 90 percent of total employment in Senegal with more than 70 percent of this taking place in informal sector SMEs.

Past research has already pointed to the importance of providing energy to enterprises in the informal sector and in informal settlements as a means to improve productivity and living conditions in cities in the Global South [48]. However, the characteristics of the informal economy—the fact that it is not regulated by governments, it is not taxed, it can only grow to a certain size, and it depends on middlemen to connect entrepreneurs to their customers—mean that entrepreneurs in that economy are driven more by necessity than opportunity [4].

4.1. Dimensions of the UTAUT2 Influencing RE Technology Adoption by Senegalese SMEs

Table 4 presents the nine dimensions of our extended UTAUT2 model, with bulleted items under each dimension noting important observations and relevant SMEs from our sample listed to the right. Looking first at the standard UTAUT2 dimensions, we see extensive commentary from our interviewees on the dimensions of performance expectancy, facilitating conditions, and price value. Performance expectancies are high, but commentary on facilitating conditions is largely negative, with the SMEs unanimous in their general criticism of the government. Commentary on price value is also negative, focusing on high investment costs and low product quality.

| Dimension                        | SMEs                                                                 |
|----------------------------------|----------------------------------------------------------------------|
| Knowledge (extended model)       |                                                                      |
| Insufficient knowledge of RET    | 5, 8, 21                                                             |
| Sufficient knowledge of RET      | 1–4, 6–20, 22–23                                                     |
| Interest in trainings on RET     | 1–14, 16–23                                                          |
| No knowledge of business electricity tariffs | 7, 9, 14–15, 17, 19–21    |
| Communication channels (extended model) |                                                        |
| Use of mass media channels       | 21                                                                  |
| Organization in informal networks | 8–10, 17–19                                                          |
| Organization in strategic networks | 3, 9                                                                |
| No organization in networks      | 1, 5–6, 11–12, 14, 20–22                                            |
| Performance Expectancy (UTAUT2)  |                                                                      |
| Cost reduction in general        | 2–3, 6–8, 15–17, 20, 22                                               |
| Re-investment of savings in other business activities | 3, 11–12, 19, 23                                           |
| Back-up option during low tension/power outages | 5, 7, 12, 19, 23                                         |
| Effort Expectancy (UTAUT2)       |                                                                      |
| General skepticism               | 1                                                                   |
| Unreflective high expectancy     | 16                                                                  |
| Social influence (UTAUT2)        |                                                                      |
| Awareness of climate change      | 2, 9–10                                                             |
| Facilitating conditions (UTAUT2) |                                                                      |
| General criticism of governmental support | 1–23 (all)                                                        |
| Needed: support (banking sector, feed-in tariffs, liberalization of the energy market) | 8–10, 21                                                              |
| Needed: maintenance, after-sales services and guarantees | 4, 6, 8, 16                                                            |
| Hedonic motivation (UTAUT2)      | none                                                                 |
| Price value (UTAUT2)             |                                                                      |
| Criticism of high investment costs | 3–5, 7, 10–11, 15–16, 19, 22                                     |
| Skepticism of product quality    | 4, 8, 16                                                            |
| Habits (UTAUT2)                  | none                                                                 |
Our study did not distinguish between formal and informal SMEs, as that was not our research focus. However, given the preponderance in Senegal of informal sector entrepreneurs whose decisions are driven more by necessity than by opportunity, it is not surprising that for many of our SMEs, investment costs are a formidable adoption barrier.

On the other hand, it may seem surprising that social influence does not play a greater positive role among our SMEs. Other studies that have applied the UTAUT or UTAUT2 to RE adoption in economies of the Global South suggest the importance of social influences in encouraging potential adopters to investigate and evaluate the technology and to share their knowledge about it [38,42,49]. While we did find that our SME entrepreneurs were generally aware of climate change challenges, we did not find the kind of social influences at work that would promote RE adoption.

Along the UTAUT2 dimension of effort expectancy, there is commentary from only two SMEs, and that commentary, both in its sparseness and in its content, reveals another adoption barrier in the two extreme views expressed. Both hinder realistic RE adoption: SME 1 vastly overstates the effort, while SME 10 vastly understates it.

Regarding habits, we only obtain the meta-perspective of the experts who note that RE is still a new idea in Senegal, and so habitualized experiences are missing from SME practices. Nor did any of the SMEs in our study express any expectations of pleasure to be derived from the use of RE technology, meaning no evidence of hedonic motivation was found.

We find that the entrepreneurs in our sample tend to view RE adoption from the perspective of constraining factors rather than recognizing entrepreneurial opportunities. They attribute the responsibility for creating support programs and other enabling factors to the government and seem to overlook their own entrepreneurial responsibility to create opportunities.

However, we also find that government policies designed to assist RE adoption, including financial incentives and microfinancing opportunities, exist in Senegal, but knowledge of these instruments and how to use them is lacking among the Senegalese SMEs we interviewed. This underscores limitations both in the available communication channels and in the engagement that entrepreneurs have with those channels. The necessities of day-to-day business take the full attention of our SMEs, and so they do not actively engage with new innovations or what in the West would be called strategic planning. Even the limited networking activities that exist do so to serve primarily social purposes; only two of our 23 SMEs engage in what would be called strategic networking.

From our study context, we find that UATUT2 is not yet sufficiently appropriate to meet the reality of decision making by SMEs in Senegal. As revealed through our extensions, important indicators are missing that cover above all awareness-raising and low-tech learning. We still know little about entrepreneurial behavior and its dynamics, directly linked to the characteristics of informal firms, which remains an understudied context in entrepreneurship studies [46]. The problems of applying the UTAUT2 model in Senegal lead us to our second research question.

4.2. Additional Influencing Factors in the Senegalese Context

While in developed economies entrepreneurs supposedly have sufficient knowledge and access to communication channels to acquire new knowledge and thus be able to evaluate technological innovations, we cannot de facto assume the same conditions exist for Senegalese entrepreneurs. From this recognition and based on Rogers DOI [9], we added to our analytical framework the dimensions of knowledge and communication channels that are shown in Table 3.

Our results show that knowledge is crucial at two levels of the decision-making process. First, in the awareness-forming phase, entrepreneurs must first learn that they can use RE technology to become prosumers. Without awareness of this opportunity, entrepreneurs cannot evaluate and interpret the technological innovations for their own purposes and cannot decide rationally for or against the use of RE. However, knowledge is
needed beyond this critical phase of awareness of an entrepreneurial opportunity. Our findings show knowledge is needed to form the intent to act and to carry it out. For example, the entrepreneurs need information about the complexity of the technologies, local markets, after-sales service, best practices and financing options.

The readiness of entrepreneurs to exploit external knowledge, to recognize and evaluate the advances of technological innovations, and to transfer what they learn to the context of their firms depends on the formal and informal information channels the entrepreneurs use and actively shape. Zanello et al. [43] found internal factors of the firms, such as education and managerial skills, highly influential on the creation and diffusion of innovation in countries in the Global South. The human capital of the entrepreneur, i.e., his or her networking capabilities and knowledge about appropriate RE options, are seen as a particularly supportive mechanism for the adoption of RE technologies. However, we found lower levels of knowledge and networking activities in our sample, which is why this effect does not emerge.

As fruitful as the dimensions in our extended model are in understanding the factors influencing the decision-making of Senegalese entrepreneurs, we are convinced that the scope of investigations in the Global South should be widened to include additional factors that help us better understand the attitudes and considerations of informal sector entrepreneurs in the African context. Specifically, we find the concept of individual entrepreneurial orientation (IEO) fruitful, itself derived from the concept of entrepreneurial orientation (EO) developed and extended for the organizational level of firms [50]. Numerous studies that have applied EO to investigate an organization’s strategic choices have concluded that “entrepreneurial orientation reflects an overall posture consisting of deep-rooted beliefs and values associated with a tendency to be simultaneously proactive, risk taking and innovative” [50] (p. 98). Outside organizational contexts, studies that take the three behavioral factors of proactivity, risk-taking and innovativeness at the individual level to explain entrepreneurial decision and actions are rare. The few studies that have used IEO to investigate developing economies include Musara and Nieuwenhuizen [46] in South Africa, Goktan and Gupta [50] with a multi-country study in the US, Hong Kong, India, and Turkey and Fatima and Bilal [51] in Pakistan.

As we have already shown, integrating the DOI dimensions of knowledge and communication channels contributes significantly to the understanding of entrepreneurship in Senegal. We think it would be helpful to add the IEO factors of proactivity, risk-taking and innovativeness to better understand the decision-making processes of SMEs in the formal and informal economies of Senegal. With this combination of the UTAUT2 model and relevant aspects from DOI and IEO, the factors influencing the adoption or non-adoption of RE into the businesses realities of Senegalese entrepreneurs could be better understood.

5. Conclusions

From the answers to our research questions, we can draw implications for firms in the RET context as well as for central and regional governments. We conclude there are opportunities, both to address the internal capabilities of the entrepreneurs and to provide external support to enable entrepreneurs to make a valid decision about the adoption of RET.

With regard to the internal factors, we would like to emphasize the importance of promoting the attitude and skills that allow entrepreneurs to engage with new technologies in their own context. These include networking capabilities and vehicles for knowledge diffusion. Here, we see a mandate for external support by knowledge carriers and brokers such as Senegalese universities and RET suppliers to cooperate more closely and to establish networks of SMEs. These activities should meet the needs of the Senegalese SME community and address the needs of both formal and informal firms. By exchanging information on RET between heterogeneous actors, the knowledge available in the country could be better disseminated.
In addition, more attention should be paid to improving communication channels. Existing information and support mechanisms must be developed and presented in such a way that they reach out to their intended recipients and they should be able to access them via simple structures. It is noteworthy, for example, that there is a gap between the needs for government support expressed by entrepreneurs in our interviews and the structures already put in place by the government that already at least partially meet those needs. Additionally, there are uncertainties with regard to the quality of and the prices asked for PV systems. These uncertainties could be reduced by RET suppliers who provide the SMEs with transparent information and offers.

5.1. Addressing Senegal’s RE Policy from Two Strategic Points

Given the ongoing efforts of the Senegalese government to promote RE in general, we would like to address policy from two strategic points. First we would like to come back to the role of the informal sector. Knowing that in Senegal 95 percent of all enterprises are SMEs and 70 percent of the informal employment takes place in informal enterprises, we see informal firms as important promoters of the energy transition. Even if individual SMEs are not the largest consumers, they are enormously dependent on a stable and affordable energy supply. To empower these firms, which make up almost half of Senegal’s GDP, measures are needed that target the needs of the entrepreneurs in the informal sector to make existing policies accessible for them and promote them in their role as one of the stakeholders in the energy transition.

Second, we ask why the adoption of RE technologies by SMEs, i.e., their transformation into prosumers of electricity, does not receive more support from the Senegalese government—especially since SMEs form the backbone of the country’s economy. Governmental efforts seem to focus either on the incumbent state-owned energy supplier, Senelec, or on the electrification of small rural communities, which do not have access to the public grid. SMEs in cities like Dakar or St. Louis that have access to the grid are left behind, without support in their transition to prosumers.

This finding can serve as an impetus to question the unreservedly positive Western notion of prosumers [52–55] and to look into perceptions of the prosumer phenomenon in an African context. A survey of energy experts in Africa [56] revealed that among several energy trends—including the growing importance of renewables, introducing competition to the electricity market, and distributing energy resources—the trend of consumers becoming prosumers came in dead last in all categories: deemed least popular in the electricity sectors, least recognized by policy makers and least beneficial for the country. The survey also revealed that prosumerism enjoys conspicuously less regulatory support in African countries.

We cannot answer from our interview study whether it is a deliberate decision by policy makers and regulators in Senegal not to actively support SMEs in becoming prosumers. However, a World Bank report provides indications on power sector reform in countries of the Global South and characterizes the implications of prosumers for grid operators, utilities, and regulators as follows: “The advent of prosumers […] able to deploy decentralized generation, storage, or demand–response solutions complicates the task of planning, which affects both generation expansion and grid development […] [57] (p. 135). Add to this the fact that Senelec is already struggling to keep the grid stable with limited amounts of renewable power and very few prosumers, and it does not take much imagination to understand possible reservations among Senegalese policymakers about prosumerism in the electricity sector. However, distributed generation by prosumers can also help to reduce the stress on the grid and the necessity to invest in its extension [58].

Besides the technical problems of integrating prosumers into grid management, there are also social and financial reasons for Senelec to be wary about rising numbers of prosumers. Generally, prosumers are more affluent than the average electricity consumer and the takeoff reduction by the former increases the burden of fixed grid costs that is distributed on the latter under a volumetric grid tariff [52–54]. Thus, for example German
RE legislation with its historically generous FIT for prosumers has been criticized as “[…] regressive, redistributing income shares from the distribution’s bottom to its top.” [59] (p. 1342). Additionally, in an African context, becoming a prosumer involves some investment, so it is usually not the poorest stratum of society that embraces this new opportunity. Thus, a study from South Africa finds that “[…] while disruptive technologies offer potential opportunities to develop infrastructure that is more responsive to environmental and social imperatives, they also threaten critical revenue from South Africa’s wealthy consumers that cross-subsidizes electricity services for the poor and other essential municipal public services.” [60] Therefore, trying to keep relatively wealthy entrepreneurs in the grid can be rational for Senelec and the government from a social justice perspective.

Not only policy makers but also researchers seem to marginalize prosumerism in the African context. Studies looking into prosumerism in sub-Saharan Africa are extremely scarce and they tend to overlook social issues while conveniently focusing only on technical questions [61]. The same applies for developing countries in other regions, e.g., Asia [62]. A rare exception is the Study by Khan [63].

Summarizing the above discussion on prosumers, one should not draw overly simple conclusions, as a variety of actors with different and potentially conflicting interests and goals are involved in the socio-technical arrangements of energy systems. While SMEs have a legitimate interest in becoming at least partially independent from the unpredictable and perceivably expensive public grid, and while an increased share of renewables is positive from an overall environmental perspective, in the short term, it is understandable that the interests of Senelec and the government in keeping relatively affluent entrepreneurs in the energy system and not oversstretching their capacity for grid management would prevail.

5.2. Suggestions for Future Research

With regard to these findings, we suggest six avenues for further research:

- In the largely understudied context of RE adoption by African SMEs, further qualitative studies should be conducted in other sub-Saharan settings. More research is needed on how African entrepreneurs perceive specific influencing factors to allow a more meaningful picture of the decision making of these entrepreneurs to emerge. Once we have a better understanding of these factors, quantitative studies could follow to determine their specific influencing variables.
- Additionally, research should pay special attention to the specific conditions of informal firms. Given the importance of the informal sector for African economies, this field should be considered by more scientists in the future.
- Valuable insights could be derived from studying SMEs that have already adopted RE technology. These insights could reveal the factors underlying affirmative RE adoption decisions.
- Given that entrepreneurial skills are important for the entrepreneur’s attitude and engagement with innovation, these skills and their contribution to behavioral intent should be better explored on a region-specific basis, e.g., by using the IEO factors.
- The dominance of Western models in the entrepreneurship literature leaves room for further research to test whether the models, which have so far proven suitable in developed economies, can also be applied in countries of the Global South. A critical examination of the influencing factors is urgently needed and should be further developed to understand the processes within nonwestern contexts.
- Likewise, the nearly unequivocally positive notion of electricity prosumerism and partial independence from the grid should be revisited in an African context. Examining policy makers’ and utilities’ representatives’ views on prosumerism would increase our understanding of their decision-making processes.
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