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EXECUTIVE SUMMARY OF THE THESIS

Evaluating inclusivity of business model delivery systems: an in-depth analysis of the mini-grid industry

TESI MAGISTRALE IN MANAGEMENT ENGINEERING – INGEGNERIA GESTIONALE

AUTHOR: ANDREA PACENTI

ADVISOR: VERONICA CHIODO

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1. Introduction

The advancing debate concerning the unequal distribution of well-being has claimed the necessity to design new strategies for fostering social growth [1]. The realization of untapped opportunities belonging to marginalized contexts has further encouraged business actors to take over a primary role, as enablers of new economic paradigms in charge of overcoming urgent global challenges [2]. In recent years, a new economic system has come out, labelled as inclusive economy, that pursues to exploit market opportunities for generating positive social impact for disenfranchised members [3]. Many organizations have started proposing new models and approaches focused to provide commercially viable solutions aimed to tackle neglected problems [4]. As one of the global issues stressed by the Global Agenda 2030, energy access represents an urgent topic that attracts much attention [5]: nowadays, 775 million people living in remote areas cannot access basic services due to electricity lacks [6]. Among the rural electrification solution designed to tackle this issue, mini-grids are raising attention in the last years: thanks to their adaptability to customer needs, they are capable to provide the necessary capacity for an entire community, sourcing multiple services and improving the overall livelihood conditions [7]. Due to their managerial complexity, mini-grids require innovative business models capable to integrate technical, organizational, economic and social dimensions, in order to simultaneously foster socio-economic impact and ensure commercial advantages for providers [8]. The inclusive logic could represent a decisive perspective capable to redirect the business strategies adopted for mini-grid systems, by suggesting innovative business models specifically designed for addressing income-constrained groups, that at the same time could ensure fruitful market opportunities for energy providers [9]. The present research applies the inclusive business's logic to mini-grid systems, by providing an inclusive evaluation framework and testing it through 13 case studies belonging to Kenyan and Rwandan sites. More specifically, the research aims to test whether the inclusive orientation of value delivery models raises additional value for mini-grid systems. By measuring two indicators that encompass the key inclusive dimensions of

delivery systems in mini-grid projects, the paper evaluates the contributions of an inclusive configuration toward the commercial potential of a mini-grid, as well as regarding its capability to generate social impact.

2. Literature Review

A multi-content review was performed, to integrate the literature belonging to the inclusive business domain with the papers specifically devoted to mini-grid contexts.

2.1 Inclusive business

In the early 2000s, academics recognized the presence of huge unexplored sectors composed of low-income groups. The Base of the Pyramid (BoP) theory, by exhibiting the commercial potential within these market segments, integrated poor for the first time in the global economy, thus revolutionizing the way to conceive poor contexts [10]. Alongside, international communities revealed the urgency to address marginalized members in order to promote their well-being, recognizing previous mistakes made by the cooperative development system during the previous century, and claiming new responsibilities for private entities. The paradigm's shift from poor to inclusive growth furtherly claimed the necessity to reach marginalized contexts, stressing the importance regarding *how* these customers should be addressed: inclusive growth started focusing not only on the outcomes but even on the process that occurred to promote socio-economic welfare [11]. The growing awareness around these topics has contributed to defining a new economic system, the inclusive economy, that aims to expand opportunities for marginalized members, eradicate poverty and reduce inequalities [12]. Innovations spread out, searching for new actions aimed at connecting disenfranchised individuals with opportunities capable to foster socio-economic growth [11]. As a consequence, entire businesses, labelled as inclusive businesses, started pursuing new strategies, attempting to design innovative business models devoted to providing profitable solutions to neglected problems [4]. Recent papers have tried to map the complexity of inclusive business models, by conceiving them as specific types of sustainable models, that specifically address income-constrained groups through new value creation and delivery systems [4]. The importance of the engagement of the target addressed, the necessity to involve other actors and the inherent purpose to address neglected issues of beneficiaries represent key elements that distinguish inclusive business models from their antecedents. Currently, existing literature does not propose any evaluation framework capable to assess inclusive business models, revealing an open gap between the theoretical conceptualization of such systems, and their practical application to on-field case studies.

2.2 Mini-grid industry

The Global Agenda 2030 has stressed the urgency to provide energy access to unelectrified areas, in order to enable better living conditions and eradicate inequalities. As an issue that affects mainly rural villages [6], energy can enhance the livelihood of entire communities populating these contexts, by enabling appliances and equipment devoted to domestic, collective and productive uses. Among the rural electrification solutions designed to address the energy issue, the mini-grid has been characterized by growing attention from researchers and practitioners in recent years. Indeed, mini-grids allow addressing the peculiar needs of rural communities, by customizing the offer according to the demand of the recipients [13]. Moreover, mini-grids could enable fruitful market opportunities, offering recipients multiple uses of electricity, such as productive use by sourcing income-generating activities [7]. Nevertheless, despite their commercial potential, researchers and practitioners have not defined yet a widely accepted recipe for simultaneously capturing profitable market opportunities and fostering socio-economic growth in the community [9]. Recent studies have claimed for designing innovative models devoted to integrating value creation and delivery mechanisms with measurable social and economic outcomes [8], in order to account for the opportunity offered by mini-grid systems along every dimension, thus enhancing its value generation potential [14].

3. Objective

Nowadays, researchers belonging to the inclusive domain have not agreed on a comprehensive

evaluation framework able to measure the inclusive orientation of a business model, that simultaneously accounts for its impact on measurable outcomes. Alongside, mini-grid academics are trying to define approaches capable to account for the theoretical potential offered by mini-grid systems, translating into an effective achievement of the results forecasted in terms of commercial gains and socio-economic impact. The present research aims at covering these intersectional gaps, by proposing an inclusive configuration of the business model and evaluating it toward mini-grid systems, representing the first attempt to apply such logic to this specific context. The paper focuses the analysis on the value delivery system of the business model, due to its crucial role in achieving the acceptability of the beneficiaries in BoP contexts.
The research question addressed by the paper is formulated as follows:

RQ 1:

"What is the added value of an inclusive configuration of the delivery system for mini-grid energy systems?"

To address the question, the research is articulated along three hypotheses, that measure two key aspects of any inclusive delivery system, namely the way to address users, labelled as 'inclusive go-to-market strategy', and the ability to reach an entire community, defined as 'local embeddedness'. The hypotheses test the significance of these indicators by measuring their contribution to the achievement of three outcomes, either belonging to economic performances or to socio-economic impact parameters. The list of hypotheses is articulated as follows:

1. H1: A high level of inclusive go-to-market strategy contributes to explaining the occurrence of a high degree of revenue per user captured by the energy provider;
2. H2: A high level of inclusive go-to-market strategy contributes to explaining the occurrence of a high degree of electrification density covered in the village;
3. H3: A high level of local embeddedness contributes to explaining the occurrence of a high degree of entrepreneurial activity in the community.

4. Methodology

To address the hypotheses, the research has performed the following methodological process. Firstly, a framework was developed, with the aim to map, by adopting an inclusive lens, the whole business model for mini-grid systems. Subsequently, the research describes the data collection process adopted, which has allowed to gather of relevant information belonging to 13 mini-grids in African rural contexts. Ultimately, a data analysis methodology has been selected, in order to reach quantitative results regarding the hypotheses, through the application of the framework to the data collected.

4.1. Evaluation Framework

By taking the roots of traditional and sustainable business models, the framework relied on a widely adopted logic, i.e. the business model canvas [15]. In addition, following its inclusive purpose, the framework couples economic with social impact indicators, and highlights value creation and delivery processes specifically devoted to engaging and addressing income-constrained groups. The indicators that compose the framework are designed for evaluating the mini-grid sector: to elaborate them, knowledge belonging to mini-grid literature was applied, in order to address the specificities of the sector selected for the analysis.

Dimensions	Indicators	Measures
Value proposition	Reliability	# power outages
	Energy Availability	daily avaiability evening availability
	High Quality	# voltage problems
	Environmental footprint	% of renewable penetration
Value creation	Involvement of the Value Network	presence of impact funds collaboration of the value network
	Efficiency of the O&M System	productive efficiency number of maintenance events level of fuel consumption
	Level of Digitalization	digitalization rate
Value delivery	Local Embeddedness	social parntership social networking linkages with entrepreneurs
	Inclusive Marketing Strategy	affordability level availability level awareness level acceptability level
Value capture	Commercial Viability	total turnover total cost of power
	Growth	electrification density growth in consumption
	Economic status	entrepreneurial activity employment rate poverty rate
	Education Level	# children at school
	Health Condition	life expectancy # of diseases in the village average number of people in the hospital

Table 4.1: Evaluation framework

The value proposition, that for mini-grid is identified as the provision of electricity, is based on

a set of indicators that evaluates the technical performances of the offer. The value creation system encompasses all the activities designed to develop, operate, maintain and innovate the system, incentivizing the key roles of value network and digitalization as enablers of profitable energy systems. The value delivery assesses the inclusive extent of the provider to address the beneficiaries, by measuring the way to address users and communities in BoP rural contexts. Ultimately, the value capture system encapsulates both economic and social outcomes, in order to assess both the commercial and social dimensions of the impact generated by the mini-grid system.

4.2. Data collection process

The data collection comprised the preparation and delivery of three types of questionnaires, devoted respectively to providers, users and municipalities. The questionnaires target the three key stakeholders that participate in a mini-grid project, allowing them to gather relevant information about the types of business activities designed, as well as the social and economic performances achieved after the implementation of the system. The questionnaires were submitted to 13 mini-grids implemented in Kenyan and Rwandan sites, previously selected according to the operability of the system implemented and the willingness to collaborate shown by the stakeholders addressed.

4.3. Analysis method

The analysis of the hypotheses has been computed by adopting the Qualitative Comparative Analysis (QCA), i.e. an approach devoted to measuring the significance of the indicators proposed, by evaluating their contribution to the occurrence of specific outcomes. QCA is a semi-quantitative method that allows testing the synergistic effects of multiple causes on the occurrence of a given outcome [16]. Business academics are exploring this method as a substitute for traditional inferential statistics tools since it allows to catch the complex ecosystem by testing multi-conjunctural causation [17]. In addition, QCA provides significant results even when applied to low-data samples [16]. For the following analysis, a specific type of QCA has been adopted, the fsQCA, thanks to its capability to assess discrete values, transforming them into fuzzy sets [16].

5. Data analysis and findings

5.1 Data analysis

The data analysis has followed two steps: attributing values to the input and outcomes selected, by designing aggregation formulas specifically devoted to each parameter, and furtherly applying the fsQCA, relying on the relationships selected in the hypotheses. The first phase consisted of the definition of ad hoc aggregation formulas, designed to link the indicators proposed in the framework with the variables directly observable in the questionnaires. Regarding the input, i.e. local embeddedness and inclusive go-to-market strategy, the formulas were elaborated by exploiting existing knowledge belonging to inclusive literature, as well as some mentions of academic papers specifically devoted to mini-grid contexts. Tables 5.1 and 5.2 depict the values attributed to the two inputs for some of the case studies in the analysis.

INDEPENDENT VARIABLE	Gakira	Rwamacumu	Rutenderi	Nyakabanda
Local embeddedness	**0,2475**	**0,66**	**0,144375**	**0,45375**
Social networking	0,75	0,75	0,1875	0,375
Community Engagement	5	5	2	3
Relative value of 'Community Engagement'	1	1	0,25	0,5
Presence of local technicians	0	0	0	0
Social partnership	0	1	0	1
Presence of local NGO	0	1	0	1
Linkages with entrepreneurs	0	0,25	0,25	0
Productive use support	0	0	1	0
Delivery of equipment	0	1	0	0
Support of local business creation	0	0	0	0
Education on mini grid productive use	0	0	0	0

Table 5.1: Computation of local embeddedness

INDEPENDENT VARIABLE	Nyakabugo	Nyamira	Faza	Lokichogio
Inclusive go-to-market strategy	**0,666666667**	**0,611666667**	**0,33333333**	**0,388333333**
Affordability	1	0,335	0	0,165
Avg % on income	4	3	1	2
Relative value of 'avg % on income'	1	0,67	0	0,33
Access to credit	1	0	0	0
Availability	1	1	1	1
Presence of digital payment	1	1	1	1
Acceptability	0	0,5	0	0
Presence of livelihood creation	0	0	0	0
Presence of training support	0	1	0	0

Table 5.2: Computation of inclusive go-to-market strategy

Regarding the outcomes, the analysis followed a similar procedure: based on the observable variables gathered in the questionnaires, an aggregation formula was computed for each indicator. In addition, the formulas were designed to attribute a relative value to each parameter, to allow a comparison among different mini-grids. The tables 5.3, 5.4 and 5,5 report the values attributed to the three outcomes, showing the numbers for some of the mini-grids in the analysis.

REVENUE PER USER	Gakira	Rwamacumu	Rutenderi	Nyakabanda
Average payment collection per month per user	missing	0,86	3,28	2,22
Average payment collection per month	missing	904,8123195	1790,182868	577,4783446
Customer served	missing	1053,00	546,00	260,00

Table 5.3: Computation of revenue per user

ELECTRIFICATION DENSITY	Nyakabugo	Nyamira	Faza	Lokichogio
Electrification rate	0,322580645	0,75	missing	0,353378797
Households served	60	150	6000	570
Total number of households	186	200	missing	1613

Table 5.4: Computation of electrification density

ENTREPRENEURIAL ACTIVITY	Nyakabugo	Nyamira	Faza	Lokichogio
Number of IGAs / households served	0,333	0,027	0,133	0,074
Total number of IGAs	20	4	800	42
Commercial businesses	20	0	800	42
Industries	0	0	2	0
Farming and agricultural activities	0	0	0	0
Flower farms	0	0	0	0
Processing plants	0	4	3	0
Households served	60	150	6000	570

Table 5.5: Computation of entrepreneurial activity

After the computation of the values for both independent and dependent variables, the fsQCA was performed, to evaluate the relationships mentioned in the hypotheses. The research assessed the variables in both aggregated and disaggregated versions: while the former takes as an input only the value of the independent variable, providing results toward the significance of the entire parameter, the latter considers its attributes, thus assessing even the synergies between the factors that identify the variable. By providing a truth table analysis, the fsQCA enumerates the possible configuration of the input in analysis, providing a raw consistency value to each of them. Subsequently, the system computes the solutions, considering only the configuration that had reported a raw consistency higher than 0.75 [16]. The solution identifies a list of combinations that contribute to explaining the occurrence of the outcome, computing a consistency and a coverage value to each of them, as well as to the whole solution, thus allowing to quantify of the significance of the results obtained.

5.2 Findings

The analysis conducted on the first and the second hypotheses, regarding the impact of inclusive delivery systems on the commercial performances captured by the provider, suggest positive results toward the achievement of the outcomes. Although the aggregated analysis does not provide any significant results, the disaggregated one shows the relevance of two parameters, i.e. acceptability and availability, in achieving commercial advantages. More specifically, the former contributes, with a consistency factor close to 1, to achieve a high electrification density, thus allowing the provider to convince villagers of the potential of the solution proposed. The availability, through a consistency factor equal to 0.52, contributes to raising the revenue per user, meaning that, even if with low significance, it contributes to convincing recipients to exploit a higher use of electricity. Figure 5.1 and 5.2 display the qualitative representation of the relationship between inclusive go-to-market strategy and, respectively, revenue per user and electrification density.

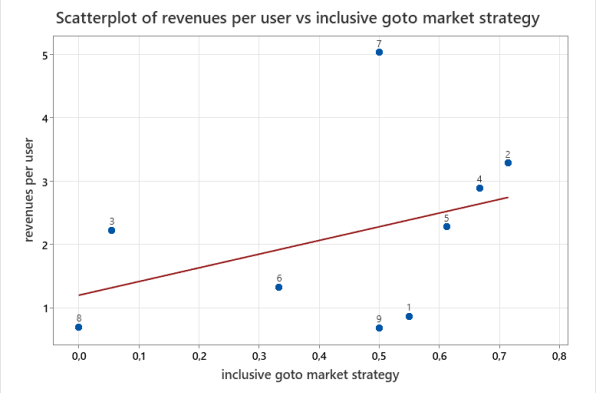

Figure 5.1: Descriptive statistics for the hypothesis H1

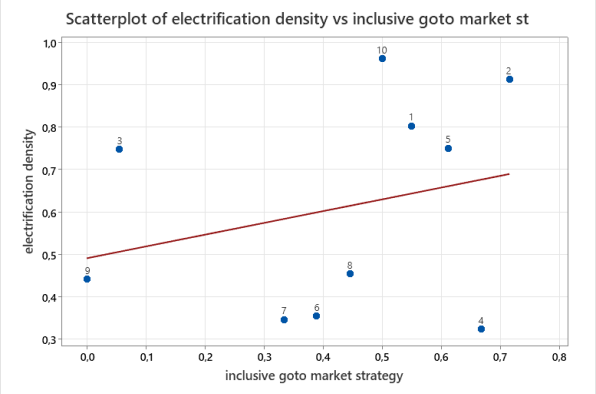

Figure 5.2: Descriptive statistics for the hypothesis H2

Concerning the impact of the inclusive delivery system on socio-economic outcomes, the analysis does not provide equally positive results. The entrepreneurial activity, which accounts for the number of income-generating activities existing in the village, is not affected by the 'local embeddedness'; additionally, the findings reveal that the higher the level of embeddedness, the lower the value of entrepreneurial activity, as can be seen even from the qualitative graph depicted in the Figure 5.3.

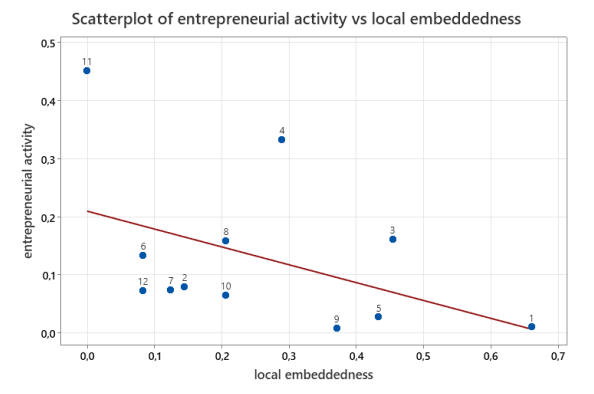

Figure 5.3: Descriptive statistics for the hypothesis H3

6. Discussion and future research

The framework elaborated in the research proposes an innovative approach to map and measure 'inclusiveness' in business model evaluation, revealing many contributions to both the mini-grid industry and the inclusive research domain. The findings achieved through the analysis of mini-grids case studies provide answers to the question formulated in the research, regarding the achievement of value generation by applying an inclusive logic toward business model evaluation. More specifically, the findings suggest that an inclusive delivery model applied to mini-grid systems, despite its contribution toward expanding commercial advantages for the provider, does not automatically foster social growth. These results, besides claiming additional research based on higher sample sizes, highlight the complexity for mini-grid providers to propose strategies capable of simultaneously enabling commercial advantages and socio-economic impact. Moreover, the achievement of significant results in sector-specific case studies allows for extrapolating best practices that are relevant to any inclusive business domain. By analyzing mini-grid case studies, the paper provides a replicable approach to measure the inclusive extent of a business model: the framework suggests a way to map inclusiveness along different dimensions, and the analysis enables the evaluation of the additional value generated by the indicators, by measuring their contribute on measurable outcomes. The thesis presents some shortcomings. On one hand, the low data sample and the unavailability to measure some on-field parameters have reduced the significance of the analysis. As such, future studies on mini-grid business models should test the indicators proposed through a higher and more complete sample. On the other hand, the choice to focus on delivery system has neglected synergistic effects of other business activities, belonging to the value creation domain of the business model; as a consequence, the research did not address the business model in its whole conceptualization, but limited the analysis to only some dimensions. These limitations suggest to inclusive academics to furtherly adopt the framework, replicating it in other sectors and industries. In addition, by applying the framework to the whole value capture and delivery system, future studies should analyze whether a holistic assessment of the inclusive business model allows expanding the impact both in the economic and social dimension.

7. Conclusions

The research represents the first attempt to measure 'inclusiveness' in the business model evaluation domain, by proposing an innovative approach to map and evaluate its impact on the added value generated, focusing on delivery systems. The analysis towards the mini-grid industry represents a novelty in this sector-specific research domain since no papers to date has adopted the inclusive logic for evaluating mini-grid business models. Although the findings reveal not completely successful results, the analysis may enhance future applications by practitioners and researchers belonging to this field, attempting to tackle the debated concern between commercial viability and social impact generation. In addition, the framework elaborated in the research suggests an innovative approach potentially meaningful for other sectors and industries, due to its applicability to other inclusive business domains. Furthermore, the methodology exploited to address the analysis, i.e. the fsQCA, raises the innovativeness of the analysis conducted, since it represents a first example of a method that gains popularity in the business domain but it is still not exploited for evaluating inclusive business case studies. Ultimately, the research raises knowledge regarding the attempt to map and conceptualize inclusive business models, paving the way for other researchers for evaluating the framework for every aspect of the business model, with the final goal to close the gap between the theoretical

conceptualizations of inclusive systems, and their effective application on real case studies.

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