



What combination of features are associated with scalable and sustainable last-mile service delivery models? A Qualitative Comparative Analysis

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Oct 9, 2023

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Abstract

This study explores the features of successful last-mile service delivery models for the poor. We define success in terms of two main outcomes — the scale of impact and the sustainability of the business model. Through a Qualitative Comparative Analysis (QCA) of 35 organizations across a variety of sectors, such as agriculture, health, education, finance, energy, and water and sanitation, we arrive at a two-fold conclusion about the most prevalent combination of business model features associated with scale and sustainability. For achieving scale, a combination of four features was sufficient (but not necessary) — a pull product, an asset-light capital investment strategy, a narrow customer base, and a vertically integrated business model. For achieving sustainability, a wide customer base was sufficient (but not necessary). Together, these reveal a tradeoff between sustainability and scaling, especially around customer segments. The QCA is supplemented by an in-depth qualitative case study analysis of three selected organizations to uncover additional factors behind the success of alternate models that deviate from the QCA results. We find that clarity in vision, blending technology with people, evidence-driven decision-making and adaptive learning, and strong value propositions for multiple stakeholders were key characteristics of successful last-mile delivery models with features different from the QCA conclusions.

1. Introduction

Despite remarkable strides in poverty reduction, significant development challenges remain. Roughly 3.6 billion people lack proper sanitation, 2 billion are deprived of clean water (Bayram, 2023), 940 million remain without electricity (Ritchie & Roser, 2022), and 700 million are illiterate (Literacy, 2016). Many such challenges are now part of the UN's Sustainable Development Goals, set to be achieved by 2030. Scaling up sustainable solutions to address the needs of billions is crucial for tackling these persistent global challenges.

Unfortunately, programs by organizations working at scale (such as multilaterals, governments, and aid agencies), despite good intentions, too often fail to reach the underserved communities at the 'last mile,' especially in complex areas of front-line service delivery (Prichett & Woolcock, 2004; Prichett et al., 2010). On the other hand, there are several extraordinary local initiatives, often emerging from grassroots efforts or social enterprises close to the 'last mile,' but these rarely scale (Bold et al., 2018; Cooley & Guerrero, 2016; Guerrero & Walton, 2015). Adding to the difficulty, the private sector, which is the most adept in scaling innovations, rarely works with the poor because of their low purchasing power and exacting circumstances.

Scaling up has become increasingly prominent in the economic development literature in the last three decades. The early foundations of scaling up in development were laid

by Uvin, who started the work of building definitions, taxonomies, and paradigms (Uvin, 1995; Uvin et al., 2000). This began to expand into frameworks, cases, and best practices for scaling up in specific sectors, especially in agriculture (Hancock et al., 2003; IIRR, 2000; Linn, 2012; Pachico, 2004) and health (Simmons et al., 2007). In parallel, there was very important work on understanding specific pathways, approaches, frameworks, and practices to scale in development (Cooley & Kohl, 2006; Chandy et al., 2013; Hartmann & Linn, 2008).

Recent literature pertinent to this paper delves into business models designed for effective last-mile service delivery. This is grounded in the realization that genuine scalability requires business models to be tailored to the needs and circumstances of the underserved (Kubzansky, 2013). A notable contribution to this strand is a book by Tinsley and Agapitova (2018b), which systematically evaluates such business models in the education, health, energy, water and sanitation, and waste sectors. Their book characterizes the 40 most effective business model archetypes from 300 social enterprises. It also provides some cross-cutting lessons on how to reach the poor—creating consumer awareness, managing last-mile distribution, making offerings affordable, and using information technology as an enabler. In another publication, they focus on social enterprise models in the agriculture sector that enhance access to finance, productivity, post-harvest value, and value chain and market linkages, presenting 9 business model archetypes derived from the cataloging of 100 agriculture enterprises (Tinsley & Agapitova, 2018a). Last but not least, Deloitte (2017) analyzed 20 case studies to assess the extent to which model features, such as product preference, asset intensity, and customer base, affect the ability of an enterprise to reach the last mile.

Using a sample of 35 last-mile service delivery organizations, this paper aims to identify the combinations of business model features (related to product preference, asset intensity, customer base, vertical integration, and community engagement) associated with success, that is, high levels of scale and sustainability. It contributes to the existing literature on business models for last-mile service delivery in two main ways.

First, the use of qualitative comparative analysis (QCA) in this paper, a set-theoretic method that derives the combination of model features necessary and sufficient for success across various cases, is novel in the scaling literature, which has typically relied on case study methods. The application of case studies in the existing literature is not without reason. Case studies are more amenable to capturing the complex nature of scaling up in development, which inevitably involves multiple actors, entities, and processes whose interactions are unpredictable and constantly evolving (Widner et al., 2022).

The benefit of QCA is that it is an extension of the case study method that finds generalized patterns across multiple cases. It essentially applies logic to identify the

most prevalent combination of model features associated with scale and sustainability. It is designed for contexts of multiple case studies where the relationship between outcomes and inputs is typically complex and nonlinear (Blackman et al., 2013). In fact, QCA has been recommended by many complexity-based evaluations (Bamberger et al., 2015), including an Adaptive Evaluation (Gokhale & Walton, 2023), and is commonly applied to business management (Wagemann et al., 2016). This aligns well with the complex conditions that dictate last-mile service delivery. Moreover, QCA recognizes the possibility of multiple factors and their diverse combinations being drivers of success, which differs from many standard impact evaluations (such as RCTs and quasi-experiments using regressions), which focus on identifying single features that lead to success (Legewie, 2013). Finally, QCA can infer from small samples (Rihoux & Ragin, 2008), which makes it suitable for analyzing organization-level data, which can be relatively scarce.

The second contribution to the existing literature is the use of three selected case studies to delve into successful last-mile delivery organizations with alternate combinations of model features. Although QCA pinpoints the most common feature combinations, it doesn't capture the full range of diverse model attributes seen in scalable and sustainable organizations. In-depth case studies shed light on the varied strategies and mechanisms that underpin success in these distinct models. Moreover, it allows us to go beyond model features and consider aspects of the organization (such as its vision, culture, structures, and use of evidence) that are also likely to contribute to scale and sustainability. The paper examines three cases, One Acre Fund, Project Shakti, and mPharma, using a scaling-up framework developed in Imago Global Grassroots (Guerrero et al., 2023) that builds on initial work from Cooley and Kohl (2006).

The QCA results show that a combination of four features was sufficient (but not necessary) for scale— a pull product, an asset-light capital investment strategy, a narrow customer base, and a vertically integrated business model, while a single feature was sufficient for sustainability—a wide customer base. These results present an important tradeoff between scale and sustainability, especially around customer bases. One potential explanation could be that the same combination of features associated with scale and replicability might impede sustainability due to their high risks and costs. For example, wider customer bases have fewer risks and greater margins relative to narrow customer bases that simply focus on the underserved. Our findings from the in-depth case studies indicate that successful last-mile delivery models, which deviate from QCA conclusions, consistently exhibit a clear vision, involve seamless integration of technology and human expertise, center decisions anchored in empirical evidence and adaptive learning, and offer compelling value propositions for diverse stakeholders.

The rest of the paper is organized as follows. Section 2 describes how we define and measure key variables of interest (such as the degree to which an organization serves the last mile, scale, and sustainability) and model features. Section 3 describes the

paper's broad methodology, including the sample selection criteria, data collection methods, and rationale for using QCA and the case study analyses. Section 4 describes the QCA process and the solutions for scale and sustainability. Section 5 delves into the three selected cases of alternate models to scale and sustainability that deviate from the QCA solution, culminating in a discussion of overall patterns. Section 6 concludes.

2. Definitions and Measurement

2.1 KEY VARIABLES OF INTEREST

2.1.1. Last Mile Service Delivery

Private companies define 'last mile delivery' in the context of products as "the very last step of the delivery process when a parcel is moved from a transportation hub to its final destination—which, usually, is a personal residence or retail store" (*What Is Last Mile Delivery?*, 2023). However, in the context of development, the last mile refers to delivering essential services to improve the quality of life, especially for poor, underserved, and excluded communities. The last mile in development depends not only on geographic factors, such as hard-to-reach rural locations or the neglected slums of megacities, but also economic, social, and cultural factors that prevent access to communities that are less well integrated with core processes of delivery. The delivery failure to the last mile may be of private goods or services but is also often associated with services that the government would ideally provide. In many situations, the limited governmental capability and financial constraints at the national, state, and local levels obstruct the efficient distribution of essential services to the impoverished, including water, electricity, education, health, and agricultural support. (Tinsley & Agapitova, 2018b)

We use three parameters to assess the degree to which an organization serves the last mile (which we henceforth refer to as the degree of **last-mileness**):

- Reach: This is qualitatively based on the degree to which an organization provides services in remote areas that are disconnected from traditional centers of service delivery either due to distance, topography, or lack of other kinds of basic infrastructure, such as a road. A high reach implies the organization could provide services in remote areas to a large extent; conversely, a low reach implies the organization could provide services in remote areas to a much lesser extent.
- Economic poverty: This aspect focuses on whether the business model includes poor communities as part of its target group. Public provision of essential services to poor communities often suffers because of the following two reasons—first, the perceived inability of the population to generate revenue for the public provider or second, the fact that these localities may exist as informal settlements (such as slum areas) which the public provider isn't legally mandated

to reach. Lack of income further dictates whether or not people can purchase essential services from private providers.

- Socio-cultural exclusion: Another important parameter that is included in our definition of 'last mile' is the intentional inclusion of marginalized and excluded identities as one of the target groups of the business model. This could be based on race, gender, caste, religion, age, etc. Designing a business model that overcomes the barrier of identity-based exclusion is often more challenging, which is why this criterion is essential to identifying an accurate level of last-mileness of an enterprise.

The table below highlights how we coded low, medium, and high levels for each parameter described above. Unfortunately, due to a lack of precise data, each level is measured by simple, often binary or categorical metrics.

Table 1- Classification of the three parameters of last-mileness

Parameters	Low	Medium	High
Reach	Urban	Urban and Rural	Rural
Economic Poverty	USD 25 or more per day	Between USD 10 and 25 per day	Less than USD 10 per day
Socio-Cultural Exclusion	No such targeting	NA	Targeting based on 1 or more of vulnerable identities

These three parameters combine to form a measurement of the degree to which an organization is providing last-mile services in the sense used in this paper (see table below)

Table 2- Criteria for the degree of last-mileness

Degree to which an organization serves the last-mile	Criteria
Low	Any combination with at least 2 (out of 3) low parameters
Medium	Any combination with at least 2 (out of 3) medium parameters or Any combination of low, medium, and high parameters
High	Any combination with at least 2 (out of 3) high parameters

As the paper centers around understanding core features related to successful last-mile enterprises, a 'medium' or 'high' level of last-mileness was essential for an organization's business model to be included as part of the sample for the study (i.e., our selection criteria).

2.1.2. Scale

Scale is a key outcome of interest. Typically, scale is defined in relation to the proportion of the target population reached or impacted, ideally both directly and indirectly. However, the number of people affected by an organization is typically difficult to estimate, and data on this is either (publicly) unavailable or not sufficiently rigorous and reliable. As a result, in this study, due to practical considerations, scale has been defined based on (a) whether the organization has undergone a process of scaling up with substantial increases in size and reach and (b) whether it can adapt to distinct contexts. More specifically, we use two main metrics — the number of locations scaled to (less or more than 5) and whether the scaling process occurred within the country¹ or the expansion was done beyond national borders. While the former reflects the extent to which the process of replication has been standardized and mastered, the second depicts the ability of the organization to contextualize its model to vastly different contexts and highlights its structural resilience.

The table below highlights the criteria for categorizing models into different scale levels — low, medium, and high.

Table 3- Criteria for the degree of scale

Degree of scale	Criteria
Low	Have not scaled / currently in first scale-up process or Have scaled to less than 5 other locations (within the country)
Medium	Have scaled to less than 5 other locations (outside country) or Have scaled to more than 5 locations (within the country)
High	Have scaled to more than 5 locations (outside country)

¹We are cognizant that some countries are large and diverse (e.g., India), so even within country allows for a measure of the ability of an organization to adapt to different contexts. We have treated these edge cases carefully, taking into consideration the size and diversity of the country.

2.1.3 Sustainability

Sustainability is another key outcome of interest for this study. We have defined sustainability as an organization or business model's ability to continue providing its services in the future without disruption. This can be understood through a variety of parameters, such as:

- Financial stability: Whether an organization is at least at a break-even level (no profit, no loss) where their revenue from service provision equals their direct spending on service provision.
- Diversity of funding sources: This is based on both the number and type of funders an organization relies on for their service delivery. A more sustainable organization in this regard has more than 5 big funders, and their type ranges from government, multilateral, and bilateral institutions to private foundations and companies.
- Credibility: This is assessed via the organization's credentials, the awards and grants it has received, its membership in global conferences, and, again, the diversity and credibility of its funders. Credibility can also be assessed by an organizations' buy-in with the local and influential stakeholders relevant to its model. This could be the beneficiaries themselves but could also mean national, state, and local governments, government agencies, and other Civil Society Organizations (CSOs).
- Embeddedness of an organization within other systems: Building on credibility, this parameter assesses the interaction of an organization's business model with other existing government and private systems. As several actors in the system rely on the organization and its business model, it is more embedded into the system, more secure and stable, and ultimately sustainable.
- Partnerships with other stakeholders (e.g., government and business): This reveals whether businesses and governments recognize the organization as a key expert in the field and partner with them not only for delivery but also for the design of frameworks, capacity building, and policy design.

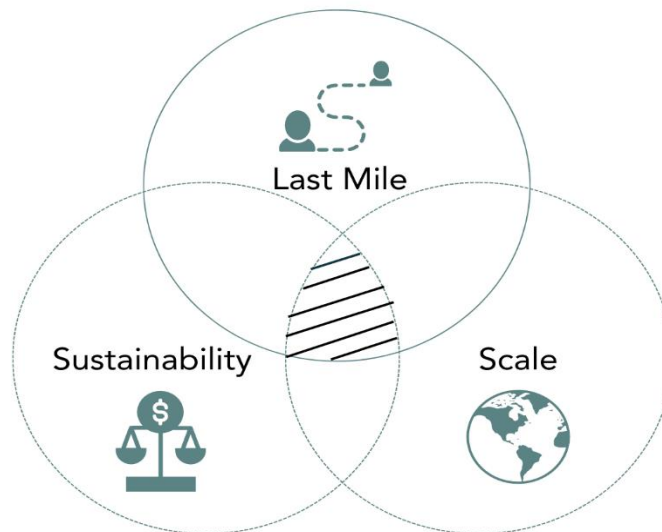
Table 4 highlights how these parameters were categorized into degrees of sustainability — low, medium, and high.

Table 4- Criteria for the degree of sustainability

Degree of sustainability	Criteria
Low	Less than 50% financial stability ² <u>without</u> excellence in the other parameters mentioned above
Medium	Less than 50% financial stability ³ combined <u>with</u> excellence in the following parameters - credibility, diversification of funding, working with and embedded well in the system
High	Greater than 50% financial stability ⁴ combined <u>with or without</u> excellence in the following parameters- credibility, diversification of funding, working with, and embedded well in the system or 100% financially stable and reinvesting profits into further improving model and scaling or Profitable (without grants)

This paper aims to unpack the model features associated with the overlap of last-mileness with sustainability and scale. While crucial for large and enduring impact, scalability and sustainability of last-mile models are difficult to achieve. We will analyze cases (both success and failures) to extract learnings on what business model features and other organizational features can help scalable and sustainable last-mile models.

Figure 1- The scope of the study



² Less than 50% of the revenue comes from services provided by the organization/model

³ Less than 50% of the revenue comes from services provided by the organization/model

⁴ More than 50% of the revenue comes from services provided by the organization/model

2.2 MODEL FEATURES

The paper aims to understand the relationship between two outcomes—scale and sustainability— and certain features of last-mile business models. These business model features (used interchangeably with the terms 'inputs' and 'model features' in the paper) are defined below.

Table 5- Model Features (Deloitte, 2017)

Product Preference	Pull	Products in high demand, with established value and accessible markets, that can be leveraged immediately with minimal risk tied to uncertain user preferences. (e.g., essentials like water, electricity, and food)
	Push	Products and services with unclear immediate value or uncertain future benefits (e.g., insurance and preventive healthcare)
Asset⁵ Intensity	Asset-light	Business models that require minimal upfront physical capital and have low marginal costs (e.g., a mobile phone app).
	Asset-heavy	Business models characterized by high-cost structures arising from a large physical presence, intricate distribution channels, and a skilled workforce (e.g., a clinic network)
Customer Base	Narrow	Serving a specific and narrow group of people - especially the most vulnerable, marginalized, and underserved communities.
	Wide	Providing services to a wider group of people by including those that might not be the most excluded or marginalized (e.g., higher-income customers or people based in an urban area) to be able to cross-subsidize the poor directly or indirectly.
Vertical Integration	A vertically integrated model supports the supply chain at different levels. One way to do this is to manufacture the product and deliver it.	

⁵ Assets" typically refers to physical assets or capital-intensive resources such as physical retail stores, factories, warehouses, machinery, or infrastructure.

Community Engagement	<p>These are business models that engage the community to create buy-in and enhance the sustainability of the model. Engagement with the community can be done in many forms, such as the establishment of micro-entrepreneurs, employing the local community within the model, and, in some cases, utilizing their expertise in decision-making.</p>
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3. Methodology

The overall methodology of the paper relies heavily on qualitative information on the input and outcome indicators of the 35 models. However, once collected, this information was analyzed in two ways – (a) Qualitative Comparative Analysis (Ragin, 2014) and (b) In-depth Case Study Analysis. The combination of the two did justice to the breadth and depth of information available and collected and to the patterns and relationships we aimed to decipher.

3.1 SELECTION CRITERIA AND SAMPLE

The cases or organizations lay down the foundation of this paper. We used the following criteria:

- Last-mileness: Given the aim of the paper, an important selection criterion was whether these models were serving the last mile at a 'medium' or 'high' level, based on the measurement metric defined in the previous section.
- Representation of multiple sectors: We purposively selected organizations representing a wide range of development sectors in the realm of last-mile service delivery to identify common features across sectors. Our study includes organizations working in traditional development sectors, such as agriculture, finance, education, healthcare, water and sanitation, and energy. Additionally, we also look at individual cases from certain sectors that are not as ubiquitous in the discourse. These include housing, pharmaceuticals, fast moving consumer goods (FMCG), and climate resilience.
- Representation of different parts of the world: The sample business models also cover a large part of the developing world. However, South Asia and Africa are better represented geography-wise, as compared to Latin America and South East Asia.
- Representation of different degrees of success within scale and sustainability: We also wanted to ensure that there was sufficient heterogeneity in outcomes (scale and sustainability) to allow for sharper contrast and comparison.
- Availability of public information: The last criterion, which is implicit and a potential source of bias, is that information on the organizations is readily

available via the website of the organization or on other platforms via reports, podcasts, cases, and videos.

Appendix A of this paper provides a list of the 35 organizations selected and their basic details.

3.2 DATA COLLECTION

As mentioned above, data was collected through a variety of sources - websites, reports, podcasts, cases, and videos. And while the depth of the data was preserved in detailed documents, a lot of the data was also converted into quantitative binary or categorical variables to be able to analyze the data for the QCA.

The starting point for the data collection was the following reports that have helped tremendously in shaping the narrative and findings of this paper.

Table 6- Reports used in the study

Report	Published by	Year
Reaching deep in low-income markets: <i>Enterprises Achieving Impact, Sustainability, and Scale at the base of the pyramid</i>	Monitor Deloitte	2017
Private Sector Solutions to Helping Smallholders Succeed: <i>Social Enterprise Business Models in the Agriculture Sector</i>	World Bank Group	2018
Reaching the Last Mile: <i>Social Enterprise Business Models for Inclusive Development</i>	World Bank Group	2018

Supplementing the information available in these reports was the following:

- The websites of the organizations were a great resource for understanding the mission and vision of the organization and the features of the service delivery model.
- Financial Reports available on the websites were also utilized to understand the level of sustainability.
- Videos and podcasts helped convey the fundamental aspects of the organization models for the in-depth case studies. Sources for this include but are not limited to the Skoll Foundation podcast (Berelowitz , n.d.), Ted Talks, and Duke University's case studies called Scaling Pathways (2016). In certain situations, for example, in the case of One Acre Fund, an interview with a member of the organization was also conducted to understand the organization better and have the benefit of the perspective of an insider.

3.3 ANALYSIS

As mentioned above, two main methods of analysis are used in this study - (a) Qualitative Comparative Analysis (QCA) and (b) In-depth Case Study Analysis. The alignment of these to the aim of the study and details of the analysis process are provided in this section.

3.3.1 Qualitative Comparative Analysis (QCA)

Rationale

A Qualitative Comparative Analysis was used because several of its features (Legewie, 2013) aligned extremely well with the aim of the study and the context of its content.

- First, a QCA is one of the few monitoring and evaluation methodologies that has the ability to quantitatively assess qualitative case data. While it requires in-depth knowledge of cases (which, in this instance, are organizations with last-mile service delivery models), it is also capable of generating findings that can be generalized across wider populations (INTRAC, 2017). This worked extremely well with the range and variability of the available data.
- Second, a QCA works best in the context of multiple case studies where the relationship between outcomes and inputs is complex (Blackman et al., 2013) and not necessarily direct and causal. We believe this aligns well with the real-life conditions that dictate last-mile delivery and the unfolding reality of social impact among the models that were analyzed.
- Third, the method aims to establish necessary and sufficient conditions, recognizing the possibility of multiple factors and their diverse *combinations* being drivers of success in a situation. This configurational approach is ideal as it focuses on identifying not one single feature that leads to success (as in many standard impact evaluations) but rather a *combination* of factors together, leading to the possibility of success within scale and sustainability.

Design:

There are two main types of QCAs - "crisp" and "fuzzy" set. A crisp QCA is dichotomous and includes cases with either "in" or "out" membership in relation to a particular input feature, comparable to a binary variable with two values. A fuzzy set, on the other hand, allows space for cases with features that exist in the interval between 0 and 1 while retaining the two qualitative states of full membership and full non-membership (Ragin, 2000; Ragin et al., 2008).

In this study, fuzzy set QCA (fsQCA) was used as both the success outcomes (scale and sustainability) had three categories (low, medium, and high) even though all the inputs were binary. Other key features of the study design are mentioned below.

- Sample: While the QCA can be applied to a sample size in the range of 12 to 200, the typical (or ideal) sample size ranges between 15 and 50 (Legewie, 2013). For this reason, the QCA was conducted with the entire sample of 35 models, and independent analysis within sectors was not considered.
- Outcome (dependent variable): As mentioned in previous sections, two main outcome variables are analyzed - scale and sustainability. Both of these were non-binary categorical variables with three levels - low, medium, and high.
- Model Features (also called input conditions): As mentioned before, we investigate five model features: engagement with the community, product type, asset intensity, customer type, and vertical integration. All the model features are binary.

The process followed for the QCA analysis is laid out in Section 4.

3.3.2 In-depth Case Study Analysis

The QCA allows for more quantitative, set-theoretic, and logic-based analysis of the entire sample, enabling us to arrive at the most prevalent combinations of model features that are associated with scale and sustainability. The in-depth Case Study Analysis serves a dual purpose.

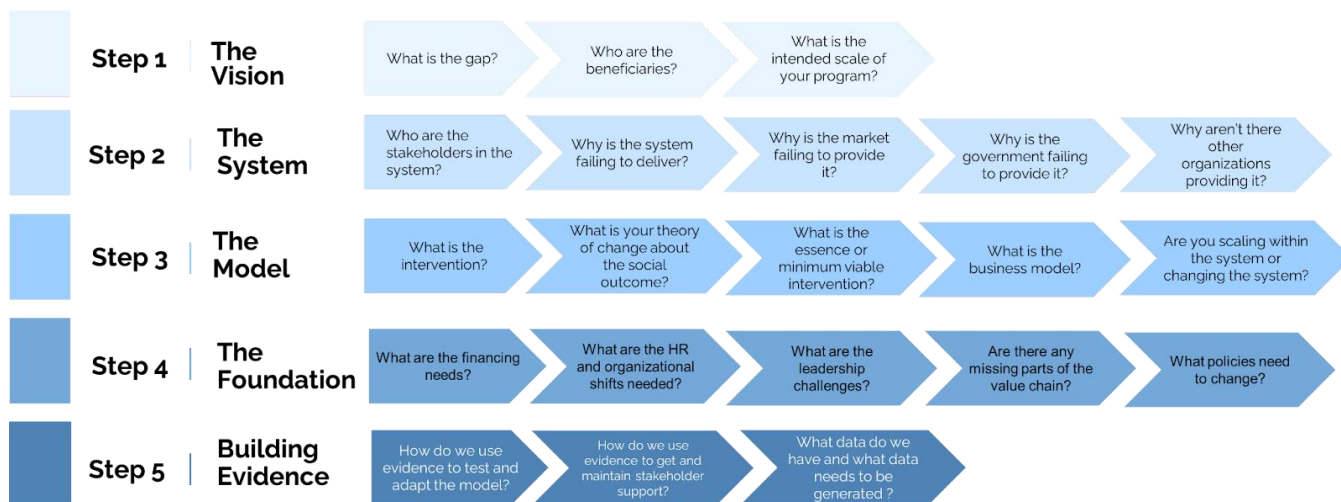
First, it spotlights and delves into the models of organizations with alternate combinations of model features that also led to scale and sustainability. There is no one definitive path to scalability and sustainability. While the QCA offers the most prevalent combination of features, it falls short of exploring the heterogeneity and diversity in successful organizations. The in-depth cases allow the space to understand what other mechanisms may have contributed to these alternative models succeeding.

Second, the model features, while important, can be limiting and overlook the intangible (and often difficult to quantify) aspects of the organization running the models that were also crucial for scale and sustainability. This includes organizational features like their vision and mission, the organizational structure, culture, etc. The case studies allow for these aspects to be fleshed out.

The case study sample is smaller, consisting of three organizations. These cases were selected because they stand out as exceptional examples across various sectors. They achieved both scale and sustainability using a set of model features that differ from the most common ones identified in the QCA. The organizations in the sample include One Acre Fund, Project Shakti, and mPharma.

The framework we used to analyze the cases evaluates an organization by looking at its vision, system, model, foundation, and evidence (Guerrero et al., 2023). Figure 2 illustrates the framework.

Figure 2- The Scaling Up Framework



What's unique about this framework is that it not only considers the technical aspects of a model and organization but also incorporates intangible elements that are crucial for an organization's success. This broader approach allows us to cover various factors that can influence whether an organization succeeds or fails.

4. Most Prevalent Model Features associated with Scale and Sustainability: Findings from the QCA

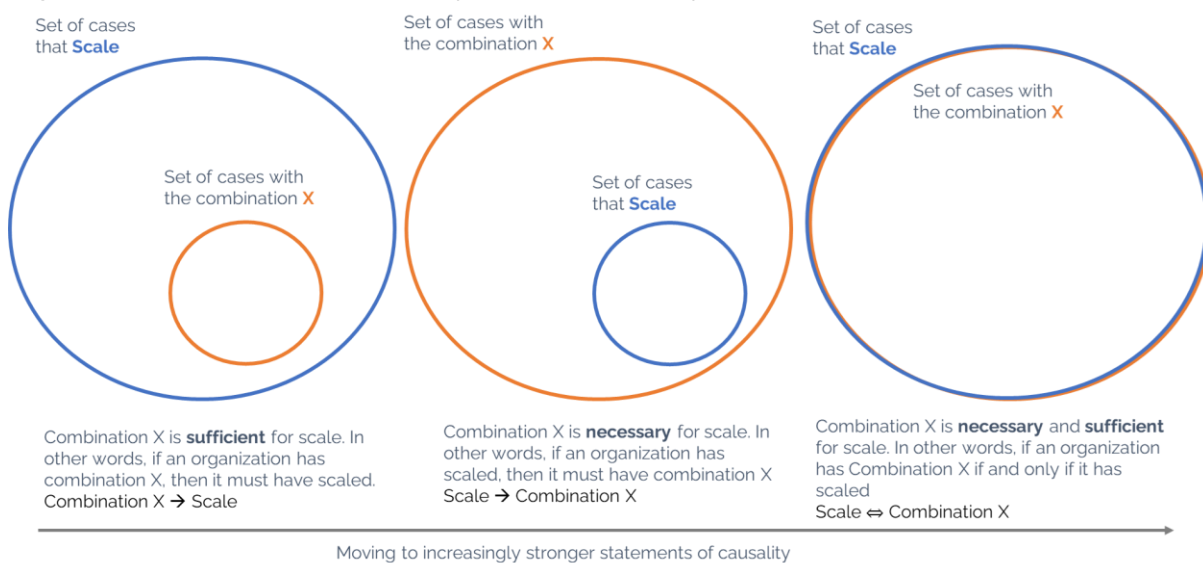
QCA as a technique was initially developed during the 1980s as a “macro-comparative approach” to complex social and political conditions, but also as a “small-N” approach, involving a small number of cases (Rihoux & Ragin, 2008). It is now most commonly applied to business management, comparative politics, and sociology (Wagemann et al., 2016). In QCA, the **solution** or final output is a logical assertion about the combination of **inputs** (in our context, business model features) that is sufficient and/or necessary to achieve an **outcome** (in our context, scale or sustainability). This determination is based on a set of cases (in our context, various organizations engaged in last-mile delivery within international development).

Theoretically, a specific combination of model features is deemed **sufficient** for achieving a particular outcome, like scale, if all organizations in the sample with that exact combination have achieved scale, even as other organizations may have achieved scale without possessing this specific combination of features. A combination of model features is deemed **necessary** for a particular outcome, like scale, if that exact combination is present in all organizations in the sample that have scaled, even as that combination may also be present for organizations that did not scale. Sufficiency and

necessity, on their own, are relatively weaker statements of causality. A specific mix of model features is sufficient and necessary if it is the only combination that results in a particular outcome, like scale. A combination of features that is sufficient and necessary is a powerful statement of causality.

The concepts of sufficiency and necessity can be expressed visually using simple set theory (see Figure 3). Suppose a particular combination of model features is sufficient for an outcome, such as scale. In that case, all organizations with that exact combination of features in the sample must be a subset of the organizations that scale. Conversely, if a particular combination of model features is necessary for an outcome, such as scale, then all organizations that scale must be a subset of the organizations with that exact combination of features. When a particular combination of model features is both necessary and sufficient for an outcome, then the set of organizations with that combination of features and the set of organizations that scale are equivalent in the sample and, as depicted in the figure below, overlap perfectly.

Figure 3- Theoretical Necessity and Sufficiency



In complex social sciences and practical applications, clear-cut examples of proper subsets for necessity, sufficiency, or both, are rarely found. As a result, we often set more flexible solution cutoffs. For instance, instead of requiring that the set of organizations with combination X be a proper subset of the set of organizations that scale to establish sufficiency, we may consider it sufficient if at least 80% of organizations with combination X achieve scale. Section 4.1.2 discusses these cutoffs.

In this paper, we use the fuzzy set QCA methodology to evaluate a set of 35 last-mile models to understand the relationship between the necessary and sufficient inputs for successful outcomes.

Section 4 is organized as follows. Section 4.1 outlines the QCA process, explaining the preparation of data, choice of cutoffs, and interpretation of solutions. It has dual goals —

to introduce QCA to an audience unfamiliar with the method and to specify and provide the rationale behind the cutoffs and assumptions used to run the QCA. Section 4.2 outlines the actual findings of the QCA as it pertains to last-mile service delivery models.

4.1 THE QCA PROCESS

FsQCA 4.0 was the software that was used to conduct the analysis. This section outlines each step of the process, including the interpretation of solutions. One caveat. Throughout this section, we provide an explanation using the analogy of a crisp set QCA (in which all the variables are binary) to more simply convey the intuition behind the method. The results, which use a fuzzy set QCA (with non-binary categorical outcome variables), have similar intuition, although their calculation requires more sophisticated set theory. The software undertakes these fuzzy set calculations, but we omit complicated verbal interpretation of these calculations to convey the intuitions to the reader more clearly. For a full understanding of set theory, see the FsQCA manual by Ragin et al. (2008).

4.1.1 Calibration

The steps taken proposed by Ragin are as follows (Ragin et al., 2008).

Step 1 - Coding and inputting data: This involves coding all variables in an interval from 0 (full non-membership) to 1 (full membership) to prepare for calibration and analysis.

Step 2 - Construction of the Truth Table: A truth table has all the possible combinations of inputs (in this case, business model features) as individual rows. For example, one theoretically possible combination of inputs for an organization is that it (1) has a push product, (2) is asset-heavy, (3) has a narrow customer base, (4) is vertically integrated, and (5) involves engagement with the community. In fact, this is actually the combination of business model features for One Acre Fund, one of the organizations in the sample. Given that we have 5 binary inputs, there are 32 (2^5) possible combinations of input conditions, and thus 32 rows.

In a crisp QCA, for each combination in a row, the columns include information on the number of cases in which the particular combination led to each binary outcome. For example, this would include the number of organizations in the sample with high scale, and the number with low scale, for each possible combination of model features.

In general, the truth table converts the data into a form that allows the logic-based analysis of causality to take place and makes it possible to identify which combination of model features is sufficient or necessary.

Step 3 - Setting the Consistency threshold: Consistency refers to the extent to which the set of organizations with a specific combination of model features realized the outcome of interest (i.e., reached scale or sustainability). It can range between 0 and 1, where 1 is a situation in which the entire set of organizations with a particular combination of

model features realize the outcome (i.e., they scaled or are sustainable). Given that instances of consistency of 1 are rare in complex settings, especially for combinations that a present in many organizations, we need to set a threshold close to 1 that is good enough for sufficiency and necessity.

For this study, we set a minimum consistency threshold of 0.8 for a fuzzy set QCA, in line with general practices. The rationale behind this is explained in the next section on 'Solutions and Findings' under the heading "Rationale behind Cutoffs for determining Necessity and Sufficiency"

BOX 1

Consistency

Formally, "consistency" measures the degree to which a relation of necessity or sufficiency between a combination of inputs and an outcome is met within a given data set. It resembles the notion of significance in statistical models.

More simply, in a crisp QCA, consistency for a particular combination of input conditions is the proportion of cases for which the outcome is realized out of the total number of cases that have that particular combination. For the sake of illustration, suppose among all the organizations with a specific combination of model features (for instance, a push product and asset-heavy model), 80 % achieve scale. This would imply a consistency of 0.8 for this particular combination of model features.

Step 4 - Setting Prime Implicants:

On a basic level, this involves making logical simplifications and removing redundancies from complex logical expressions of combinations of model features to form a much simpler representation of the solution (a process called logical minimization).

For the sake of illustration, suppose we find that a sufficient condition for scale is the following:

**Either Pull and Asset Light and Narrow
or Push and Asset Light and Narrow**

In Boolean algebra, the solution of the QCA above can be expressed as the following:

Pull*Asset Light*Narrow + ~Pull*Asset Light*Narrow → Scale

where 'and' is replaced by '*' and 'or' is replaced by '+'. Note that 'Push' is equivalent to 'Not Pull' so '~' represents negation.

Notice that there is a simpler expression that is equivalent to the one above.

Asset Light * Narrow → Scale

This is because the condition above says that for scale, a sufficient condition is a business model that is asset-light and has a narrow customer base. Now, as long as the model is asset-light and has a narrow customer base, it may also have either a push or pull product or service. These are just further categories of the class of organizations that are asset-light and have a narrow customer base. In set theory, Pull*Asset Light*Narrow and ~Pull*Asset Light*Narrow are simply subsets of the set Asset Light*Narrow.

The new simplified expression is called a prime implicant, and it combines statements that differ in only one element (push versus pull).

Often, with many inputs, there are several ways in which one can present the same information, and setting prime implicants involves choosing expressions to use to present the information. Simplification can be done using a prime implicant chart and picking the minimum prime implicants that cover all the logical implications.

Final Step - Run the QCA

With these four steps, we have the inputs and assumptions required to produce the QCA solution, that is, a logical statement of the combination of inputs that is sufficient and/or necessary for the outcome. Note that there is potentially another prior step of setting simplifying assumptions, but that is only relevant for one type of solution, which we will explore in the next section.

4.1.2 Solution and Findings

Types of Solutions

As mentioned earlier, in general, the solution of any QCA is a sufficient or necessary condition for the outcome. In our application, the solution is a combination of model features that is sufficient and/or necessary for (1) scale and (2) sustainability. A QCA offers three different solution types - a complex solution, a parsimonious solution, and an intermediate solution.

BOX 2

Different Types of Solutions of a QCA (Legewie, 2013)

The complex solution "does *not* allow for any logical minimization or simplifying assumptions to be included in the analysis." (Legewie, 2013). Consequently, the solution (a combination of model features that is necessary or sufficient) is not at all reduced in complexity and does not help with easy interpretation, especially when operating with several model features.

The parsimonious solution reduces the solution to the smallest possible logical statement of inputs, using logical minimization with "prime implicants." The decisions on logical remainders are made without regard to theoretical or substantive arguments and without any ex-ante simplifying assumptions.

The intermediate solution incorporates selected simplifying assumptions (typically informed by theory or literature) to reduce the logical expression in the complex solution. It is important that these simplifying assumptions are backed with theoretical and/or empirical knowledge, as they are used to influence the solution.

Choosing solution types depends on which offers the most meaning and value and which solution best meets the cutoff criteria. Before we explain the cutoff criteria, we briefly delve into simplifying assumptions, which are used only for Intermediate Solutions.

Setting Simplifying Assumptions for the Intermediate Solution

This involves specifying our assumptions (typically based on theory or research) about how the inputs (in our case, model features) relate to the success outcomes (in our case, scaled or sustainable organizations). It is typically the penultimate step (step 5) before running the QCA model. As mentioned in the box above, these assumptions only impact the 'Intermediate Solution'. They are used to simplify the logical assertion of the solution based on ex-ante knowledge of relationships.

The five inputs, their default type (that is, what is coded as a 1 in the binary operation), their associated abbreviation in the QCA, and our assumption about whether the default would be present or absent for the achieved outcome is presented in the table below. The simplifying assumptions below are chosen based on our theoretical and conceptual understanding of the content.

Table 7- Simplifying Assumptions for Intermediate Solutions

Model Features	Default	Abbreviation	Assumption for Outcome 1: Scale	Assumption for Outcome 2: Sustainability
Engagement with community?	Yes	E	Present	Present
Product Type	Pull	P	Present or Absent	Present
Asset Intensity	Asset light	AL	Present	Present
Customer Base	Narrow	N	Present	Present
Vertical Integration?	Yes	V	Present	Present

Nonetheless, given that we are not fully assured about our simplifying assumptions, we do not use the Intermediate Solutions, which take these assumptions into account, for the final results and interpretation.

Rationale behind Cutoffs for Determining Necessity and Sufficiency

Cutoffs are essential because, in nearly all real-life applications, we rarely get clear-cut cases for necessity and sufficiency. There are cutoffs for two main metrics, both of which are used to measure the extent to which a solution is sufficient and/or necessary for the outcome. The first metric, consistency, is already introduced and is a measure of the significance of the result. The second metric, coverage, explained in the box below, measures the extent to which the result is representative of the occurrence of the outcome.

BOX 3

Coverage (Legewie, 2013)

Once it has been established that a condition or combination of conditions is consistent with necessity or sufficiency, the coverage provides a measure of empirical relevance. The analogous measure in statistical models would be R^2 , the explained variance contribution of a variable. Coverage values are between 0 and 1.

Coverage, in a crisp QCA, for a particular combination of inputs, is the number of cases in which an outcome is realized for that combination, divided by the total number of cases in which the outcome is realized in the sample. For the sake of illustration, suppose 10 organizations sharing One Acre Fund's specific combination of model features were sustainable, and the total number of organizations that were sustainable (across combinations) in the sample is 20. This implies a coverage of 0.5 because half of the sustainable organizations in the sample have the combination of features of One Acre Fund.

To decide on cutoffs for this paper, we benchmark using the international relations and business management literature, which is the most common use for QCA analyses.

In most cases, the established standard cutoff for consistency is 0.75, and lower values tend to require significant justification (Ragin, 2009). In the international relations literature, consistency scores range between 0.70 to 1.00 (Ide & Mello, 2022), and in the business management literature, it is between 0.65 and 0.96 (Wagemann et al., 2016). For coverage, there is little consensus in the literature. A review of thirty-seven papers on international relations found that nine do not report coverage, while the remaining had scores between 0.32 and 1 (Ide & Mello, 2022). In business management, coverage is very low, between 0.039 to 0.47 (Wagemann et al., 2016).

Considering these benchmarks, to establish *sufficiency*, we have chosen a consistency cutoff of 0.8 and a coverage cutoff of 0.1. Roughly, in crisp QCA terms, this means a particular combination of features is deemed sufficient in this paper if (1) at least 80% of organizations with that exact combination scaled, and (2) organizations with that exact combination represent at least 10 % of all organizations that scaled in the sample. We

picked a high consistency cutoff because we wanted to ensure that the set of organizations with the solution combination of model features has a high proportion of organizations that scaled (i.e., we expect a high significance). This cutoff is also consistent with international relations and business management literature. We chose a low coverage cutoff, partly influenced by the business management literature, which has low cutoffs and is most relevant, given that we are working on organizational features. More importantly, we think that explanatory power or representativeness (measured by coverage) is relatively less important for causality (the main interest of this paper) than it is for prediction, in which we want the logic model to explain most of the variation in the data.

For *sufficiency* and *necessity*, we have chosen a consistency cutoff of 0.8 and a coverage cutoff of 0.8. Roughly, in crisp QCA terms, this means a particular combination of features is deemed sufficient and necessary in this paper if (1) at least 80% of organizations with that exact combination scaled, and (2) organizations with that exact combination represent at least 80 % of all organizations that scaled in the sample. We wanted much stricter cutoffs for sufficiency and necessity, as is standard, because necessity is a much stronger statement of relations between input conditions and the outcome.

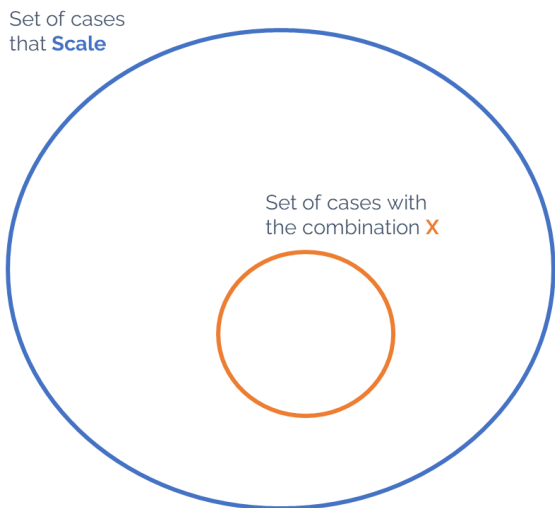
Illustrating Cutoffs and Solutions Using Set Theory

In mathematical set theory, establishing sufficiency involves ensuring that the set of organizations with the solution combination of model features is a large enough⁶ subset of the set of organizations that have been scaled (i.e., consistency of 1). However, achieving this in practical application is difficult, and we typically rely on assigning cutoffs based on the minimum conditions for sufficiency as determined by the literature (see section above). The figure below provides a simplified illustration (based on the crisp QCA analogy) of what these sufficiency cutoffs imply using basic set theory. Note that this figure is intended to convey the general idea rather than the exact mechanism, as the process and representation differ for fuzzy set applications with more than two categories.

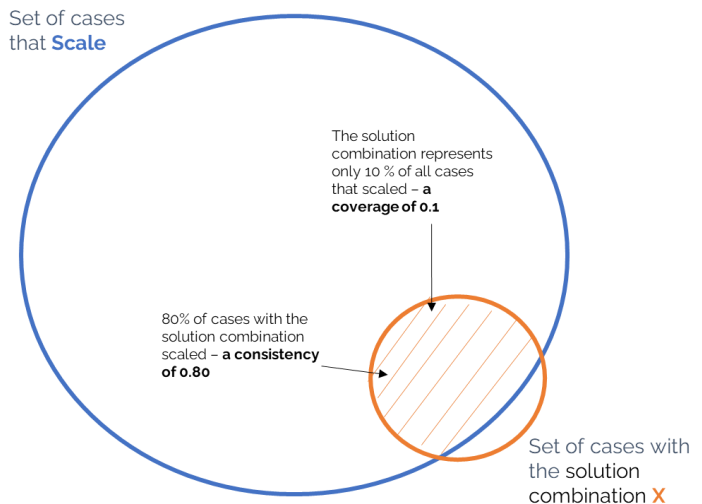
⁶ In the context of QCA, the concept of "large enough" is critical. Theoretically, even if there is only one organization with a specific combination of model features that has also scaled, that set of one organization could still be considered sufficient for scale (because it is still a subset of the set of organizations that achieved scale, albeit the smallest possible subset). However, in practical terms, such an instance is not very insightful for making broad conclusions. We require the subset to be large enough for it to be relevant for the study. This is why there is a coverage cutoff for sufficiency.

Figure 4- Solutions Cutoffs for Sufficiency

Theoretical Condition for Sufficiency



Minimum Conditions for Sufficiency in QCA



The cutoff for **sufficiency** is a minimum **consistency of 0.8** and a minimum **coverage of 0.1**

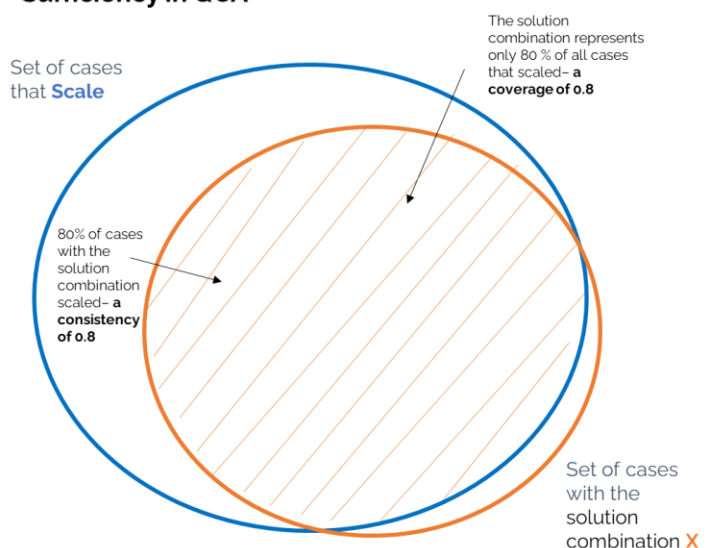
Similarly, establishing both sufficiency and necessity in formal set theory requires that the set of organizations with the solution combination of model features and the set of organizations that have been scaled are the same (i.e., consistency and coverage of 1). However, this, too, is rarely achievable in complex settings, and we need to rely on cutoffs. The figure below provides an illustration of what these sufficiency cutoffs imply. As before, it is important to note that this figure is intended to convey the general idea rather than the exact mechanism, as the process may differ for fuzzy set applications.

Figure 5- Solution Cutoffs for Necessity

Theoretical Condition for Necessity and Sufficiency



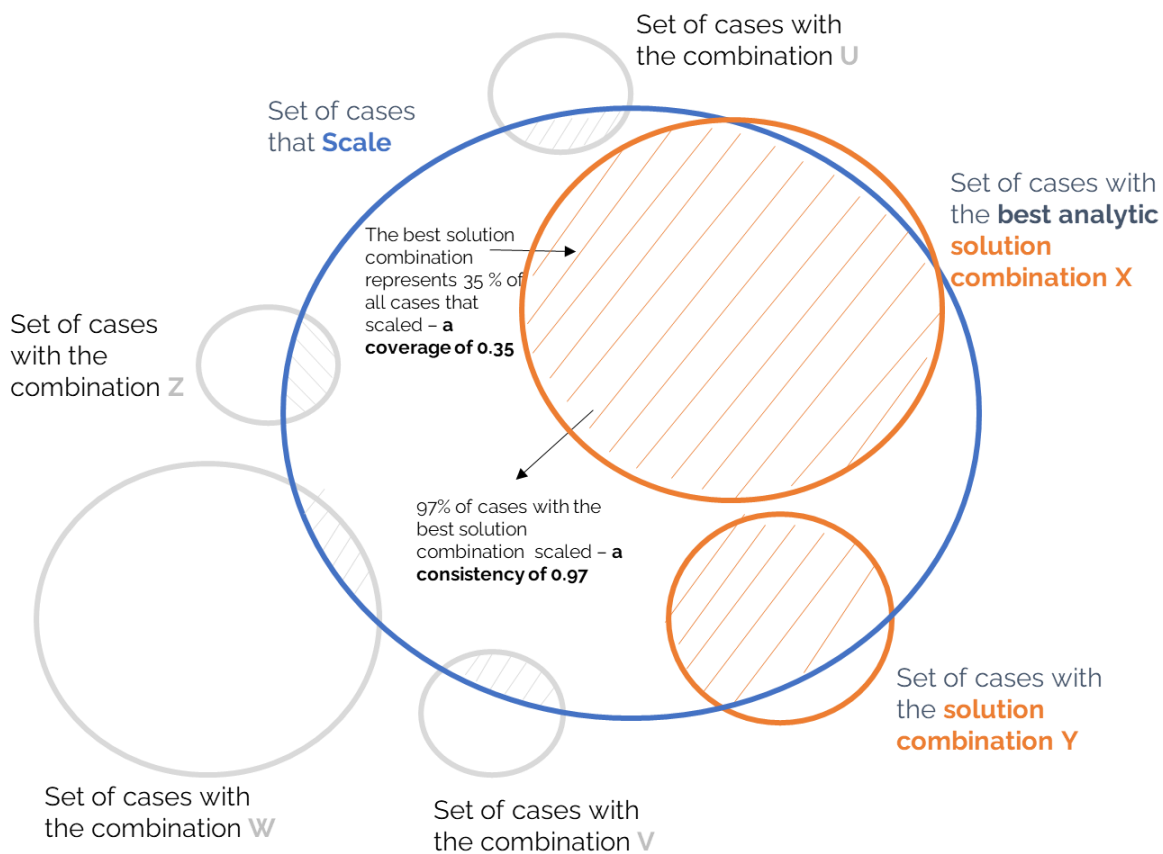
Minimum Conditions for Necessity and Sufficiency in QCA



The cutoff for **necessity and sufficiency** is a minimum **consistency of 0.8** and a minimum **coverage of 0.8**

Finally, in an intuitive sense, a solution refers to a set of organizations with a specific combination of model features that exceed the minimum cutoffs for consistency and coverage. The best analytical solution is a set of organizations with a particular combination of model features that exceeds the cutoffs by the highest margin. Consider the purely fictional example in the figure below. The set of organizations with model feature combinations U, V, W, and Z do not meet the minimum cutoffs for sufficiency. The sets of cases or organizations with model combinations X and Y both meet the cutoff criteria for sufficiency. Still, solution X has better coverage and consistency and, therefore, is the best analytical solution.

Figure 6- An example of a QCA solution



As depicted, there are typically a variety of combinations or mixes of model features that are associated with scale or sustainability without meeting the cutoff criteria (e.g., combinations U, Z, W, and V), and a smaller set of solutions that meet the criteria of sufficiency (e.g., Solution Y). What we refer to as the 'best' analytical solution focuses purely on better consistency and coverage numbers. More simply put, these are the most prevalent or common mix of features associated with scale or sustainability. Other "solutions" or individual mixes of model features merely associated with scale or sustainability are feasible alternatives and may, for instance, be more relevant to specific sectors or scaling strategies."

Occasionally, the best analytical solution may not be as transparent as there is a tradeoff between consistency and coverage when choosing between two or more solutions. In these cases, one can consider both as valid alternatives or consider picking one based on carefully studying the organizations in each set or using knowledge from the literature, wherever possible.

So far, we have simply discussed theoretical explanations of the QCA process, the cutoffs used in the study, what solutions may look like, and how they may be intuitively interpreted. In the following section, we discuss the results from our data set of 35 organizations that engage in last-mile service delivery to understand which combination of model features are associated with scale and sustainability.

4.2 RESULTS FOR SCALE

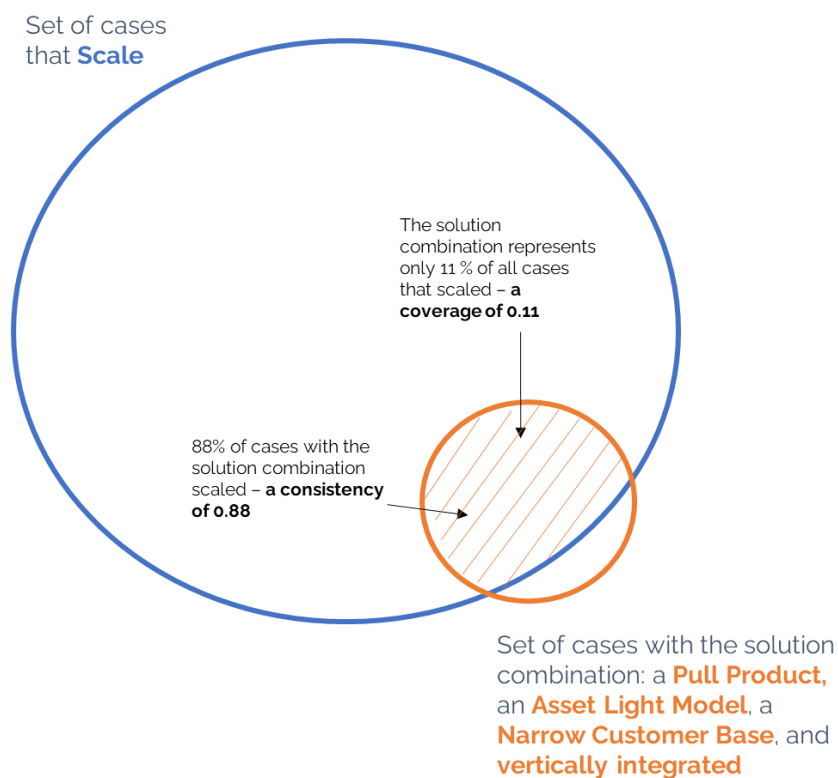
We start with solutions for scale. The table below presents the three different solutions, along with their consistency and coverage values.

Table 8- QCA Solutions for Scale

Model	Complex	Parsimonious	Intermediate
Solution	P*AL*N*V	P*AL*V	P*AL*N*V
Consistency	0.88	0.88	0.88
Coverage	0.11	0.11	0.11

Since all three solutions have the same levels of coverage and consistency and nearly identical conclusions, the decision about which solution to choose is trivial. We notionally decided to go with the complex solution, as it is slightly more precise and informative than the parsimonious solution, without adding too much complexity in interpretation. Moreover, the complex solution, unlike the intermediate one, isn't biased by our simplifying assumptions about the presence and absence of certain inputs for scale. This solution achieved a consistency score of 0.88, surpassing the threshold of 0.8, and also met the coverage threshold with a score of 0.11, exceeding the required 0.1 threshold. Intuitively, this very roughly means (in our 'crisp' QCA analogy) that almost 88 percent of organizations with the complex solution combination scaled, and this covered about 11 percent of all organizations that scaled. A simple illustration of the chosen complex solution for scale using set theory is below.

Figure 7- Illustration of the chosen solution for Scale (using the crisp set analogy)



The complex solution highlights that a combination of four input conditions is sufficient (but not necessary) for scale:

- A pull product (P) with inherent demand (like water) and accessible markets
- An asset-light model (AL) with minimal physical capital and up-front costs
- A narrow customer base (N)
- Vertical integration (V), requiring a presence in different parts of the value chain

While three of these conditions individually align with our theoretical understanding of the model — asset-light, narrow customer base, and vertical integration — the fourth clarifies a doubt on whether a pull or push product is more enabling for scale. Finally, the combination of pull products with vertical integration is interesting. One would expect that a product with demand and markets already has an integrated supply chain that organizations can leverage. However, despite high demand, it seems like supply chains are still not equipped to reach the last mile in developing contexts, and thus, organizations need to step in with vertical integration. This is a phenomenon we also see in many cases outside of our sample, most notably in BRAC's poultry farming program, which began in the 1970s, in which they had to build the entire value chain (from chicken rearers, para-veterinary workers and vaccines to incubation facilities, government hatcheries, and trucking) piece by piece over two decades (Smillie, 2009).

Out of the 35 organizations in our dataset, 24 had medium or high levels of scale. Only three of them possessed the combination of features identified in the solution: Urban Planet Mobile (UPM), Evidence Action, and Solar Sister; a consequence of the coverage

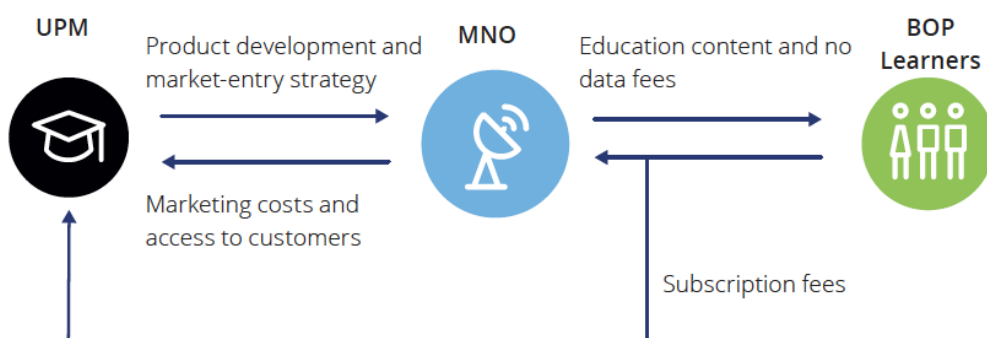
being very close to the minimum cutoff of 0.1, and thus, not as representative of the set of organizations that had medium to high scale. Among these three organizations, two have achieved a 'high' level of scale: Urban Planet Mobile, which has expanded to 45 countries, and Evidence Action, which is actively working in 9 countries. Solar Sister is present in two countries and is at a 'medium' scale level.

While the 'pull product' aspect of the solution is extremely clear in the cases of Evidence Action and Solar Sister, which provide safe drinking water and sustainable sources of energy and electricity, respectively, UPM also does an excellent job in choosing to provide a service that is essentially 'pull' in nature—English language lessons. While anecdotally known, the demand for English language lessons has also been proven by a report launched by the Cambridge English Language Assessment in 2016. The study conducted via a Global Employer Survey revealed that English language skills are important for over 95% of employers in many countries and territories where English is not an official language (English & Symonds, 2016). Another study conducted by the Center for Economic Policy Research also shows that in India, English speakers earn 34% higher wages than others, which is evidence of a strong market need (Aimme et al., 2010). Despite high demand, research revealed that other players in the market are not supplying this product in an affordable and accessible manner. Governments don't focus on providing these services to adults; private players charge high prices.

The three models in the solution combine the pull nature of their products or services with an asset-light delivery. By assets, we mean physical assets or capital-intensive resources. Evidence Action centers its solution on chlorine dispensers that are installed directly next to untreated water sources. UPM does the same by leveraging existing Mobile Network Organizations (MNO) infrastructure to provide daily educational content via phones and the Internet to customers needing these services most. Solar Sister has established an asset-light model through the development of last-mile entrepreneurs called 'Solar Sisters.' Through a micro consignment model, Solar Sister entrepreneurs get a 'business in a bag,' a start-up kit of inventory, training, and marketing support to bring clean energy directly to their customer's doorsteps (*Solar Sister | Uganda, Rwanda, South Sudan, 2009*).

These three models combine these features with vertical integration of their supply chain to enhance their ability to scale. Evidence Action builds the dispensers for safe water based on rigorous research by Michael Kremer, then "leverage behavioral economics, community partnerships (including over 54,000 volunteers) and finally implement an efficient last-mile network to achieve an average adoption rate of over 60%" (Safe Water Now, n.d.). Solar Sister's model is also centered around two main tasks - developing efficient and portable solar technology and recruiting and training new entrepreneurs to supply it at the last mile, enabling high vertical integration. In the case of UPM, a high level of vertical integration can be seen in the chart below.

Figure 8- The UPM Value Chain (Deloitte, 2017)



BOX 4

Intersectionality of issue areas (*Solar Sister* | Uganda, Rwanda, South Sudan, 2009)

Solar Sister's model lies at a unique and interesting intersection of three extremely pertinent issue areas - women's empowerment, energy poverty, and climate change. The first two are linked with last-mile delivery but not climate change, which creates an economic case for a subsidy. Its simple asset-light model not only makes energy accessible to communities in Africa but also enables the development of a climate-sustainable energy infrastructure across the continent. Over its 10-year lifespan, each solar lantern is projected to offset approximately 600 liters of kerosene, reducing about 1.5 tons of carbon dioxide (CO₂) emissions. Moreover, it creates economic opportunities for women through the delivery of its model. The benefits of these direct impacts then spill over into other sectors, such as education and women's decision-making in the home.

"The last mile is also about energy justice: we are committed to reaching people who are still waiting for access to clean power because of where they live."

- Solar Sister ("Energy Access in Last Mile Communities," n.d.)

Finally, all three organizations have a narrow customer base. This, too, makes intuitive sense as a narrow customer base allows for targeted and people-centered solutions for the base of the pyramid. The approach and model designs of Urban Planet Mobile, Evidence Action, and Solar Sister exhibit an understanding of the community and a passion to cater to their needs.

4.3 RESULTS FOR SUSTAINABILITY

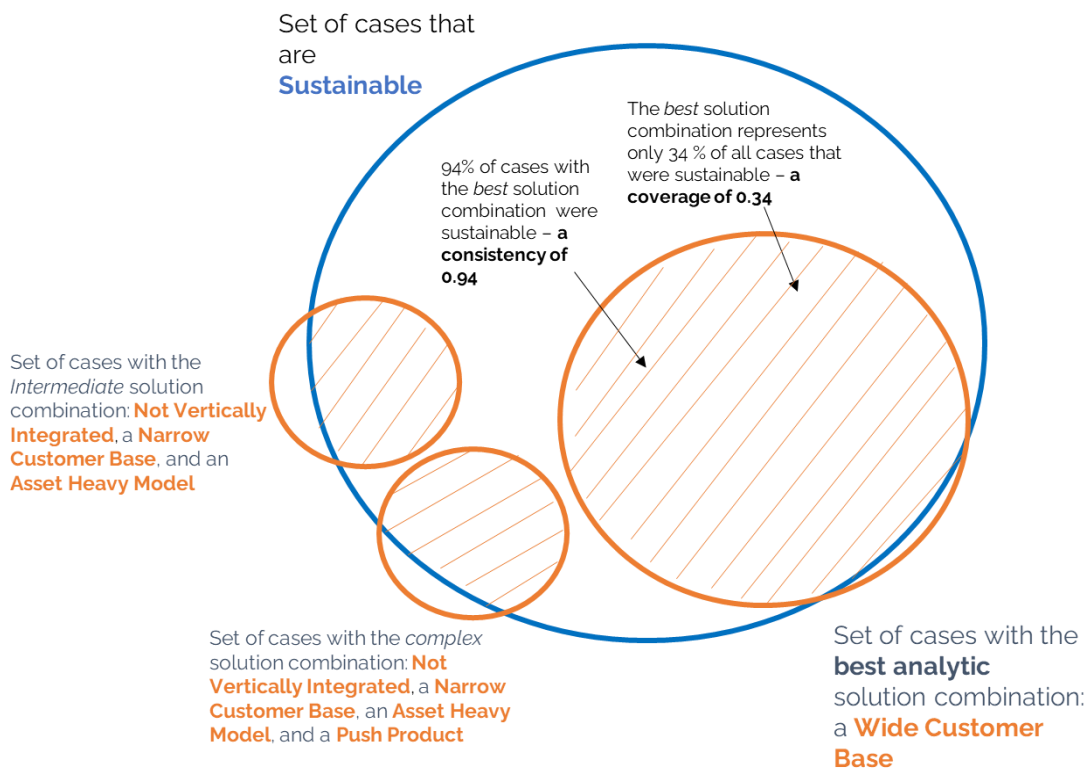
The table below presents the three different solutions for sustainability, along with their consistency and coverage values.

Table 9- QCA Model Solutions for Sustainability

Model	Complex	Parsimonious	Intermediate
Solution	Not V*N*Not AL*Not P	Not N	Not V * N * Not AL
Consistency	.915	0.94	.915
Coverage	0.12	0.34	0.12

The results indicate that the best analytical solution that outperforms the rest in terms of coverage and consistency is the parsimonious solution. As mentioned earlier, the best analytic solution is simply the most common mix of model features for sustainability. In contrast, the other solutions offer alternate, less prevalent mixes of features which are also feasible. We focus on the parsimonious solution in the rest of this section. The parsimonious solution achieved a consistency score of 0.94, easily surpassing the threshold of 0.8, and met the coverage threshold with a score of 0.34, exceeding the required 0.1 threshold. Intuitively, this very roughly means (in our 'crisp' QCA analogy) that almost 94 percent of organizations with the parsimonious solution combination (a wide customer base) were sustainable, and this covers about 34 percent of all organizations that were sustainable in the sample. A simple illustration of the solutions for sustainability using set theory is below.

Figure 9- Illustration of the solutions for sustainability (using the crisp set analogy)



According to the QCA solution, organizations catering to a wide range of customers are most commonly associated with sustainability. This makes intuitive sense— a broad customer base allows for greater financial stability, enhancing the ability of the business model to cross-subsidize the poor and reducing financial risk. Out of the 35 organizations in our dataset, 30 had medium or high levels of sustainability. Among these, 12 cases fulfilled the best analytic solution combination of a wide customer base, including Aldeia Nova, Ekutir, BIMA, Zoono, Finae, Telemedicine Africa, Praava, mPharma, Sanergy, Burn Manufacturing, M-Kopa, and Patrimonio Hoy. Of these, ten had 'high' levels of sustainability, except for mPharma and Sanergy, which had medium levels of sustainability. The higher representation of organizations with this solution combination (12 out of 30) results from the coverage being significantly higher than the minimum cutoff of 0.1.

A wide customer base represents the capability of a business model to cater to a wide range of communities either by meeting a need that is common among them and delivering it through a mechanism accessible by all, or by modifying their product to suit the needs of different types of customers (that is, product segmentation). For example, BIMA caters to a wide range of customers by providing their insurance and telehealth services through partnerships with Mobile Network Organizations (MNOs), which is accessible to and affordable for all. However, they ensure the buy-in of low-income customers by providing a simple product, reduced upselling, and easy-to-understand educational materials. On the other hand, Burn Manufacturing developed a new stove targeted at commercial customers to support its service delivery to its lower-income customer base, which is widely dispersed. Sanergy takes this concept of product segmentation a step further, where its business model is two-fold and caters to the extremely different needs of two distinct types of populations (Deloitte, 2017). It depends on processing the waste from toilets used by very poor urban dwellers and converting it to fertilizer, which is sold to relatively small-scale farmers (40+ hectares).

While these organizations have effective, sustainable business models with a wide customer base, there are quite a few instances of organizations with narrow customer bases that were also sustainable. In fact, both the complex and intermediate solutions have a narrow customer base as one of the features that, combined with other model features, are associated with sustainability, albeit with less prevalence in the sample. Some examples of sustainable organizations with a narrow customer base are One Acre Fund (OAF), The Living Goods Story, and LiveWell Clinics. While OAF targets only the poorest of farmers, it maintains its sustainability by establishing global credibility and developing a value proposition for investors and philanthropists. An ex-Harvard Business School founder with a compelling narrative and a motto of "Farmers First" adds to the exclusivity of their approach. The Living Goods Story applies a similar approach. Despite a narrow base, they work with a wide range of partners that further embed them in the system and add to their credibility. LiveWell Clinics does something innovative. While they cater mostly to low-income urban communities, they ensure that 40% of them are

associated with government insurance schemes and, therefore, can drive their revenues upwards.

4.4 SUMMARY

The QCA presents us with two significant findings. First, a combination of four features - a pull product (P), an asset-light (AL) capital investment strategy, a narrow customer base (N), and a vertically integrated model (V) was sufficient, but not necessary, to achieve scale. Second, while a wide customer base (Not N) was sufficient for achieving sustainability, it was not necessary. Taken together, however, these results present an important tradeoff between scale and sustainability, especially around customer segments. A narrow customer base, in combination with other factors, is sufficient for scale, whereas a wide customer base is sufficient for sustainability.

One potential economic interpretation is that while model features like P*AL N* V are commonly associated with scale in the sample due to high demand, ease of implementation at scale (owing to low physical capital requirements), a targeted approach (enabling standardized minimum viable products without extensive customization), and vertical integration (enhancing the model's resilience against systemic scaling challenges), these strengths for scaling can actually impede sustainability due to high costs. A narrow customer base, for example, means serving low-income customers with slim profit margins due to limited purchasing power. Additionally, vertical integration is expensive and time-consuming, demanding patient capital investment. In contrast, a wide customer base, typically associated with sustainability in the sample, enables an organization to reach middle-income customers with greater purchasing power. This, in turn, may facilitate scaling to include the deprived and low-income segment if the design allows reaching both groups. This tradeoff demands further research and is beyond the scope of this paper.

The QCA's strength is in being able to analyze multiple cases in complex contexts and in the fact that it uses logical inference to consider the combination of factors that are necessary or sufficient for the outcomes of interest in this study- scale and sustainability. However, using information on only five quantifiable model features — product preference, asset intensity, customer base, vertical integration, and community engagement— is limited, as it does not consider the intangible (often difficult to quantify) aspects around internal organizational functioning. To address this, we use an in-depth case study analysis to supplement the QCA to gain deeper qualitative insights into the important drivers of scale and sustainability for business models targeting the last mile, especially for those alternate cases that deviate from the QCA solutions.

5. Alternate Model Features associated with Scale and Sustainability: Findings from Case Study Analyses

In the previous section, we analyzed the most prevalent model features associated with scalability and sustainability using a QCA of 35 organizations. This section transitions to a case study analysis of three successful organizations (in terms of scale and sustainability)⁷ that possess distinct model features and employ strategies that diverge from the solutions presented in the QCA. Using a scaling-up framework developed by Imago Global Grassroots, we delve into each organization's vision, addressed system failures, model, business foundation, and use of evidence, using publicly available information (Guerrero et al., 2023).⁸ The case study methodology offers valuable insights into the intricacies of organizational designs and specific model elements—components that are often challenging to quantify but are instrumental in comprehending the mechanisms that enable scale and sustainability.

Section 5 is organized as follows: Section 5.1 outlines each case, and Section 5.2 has the overarching lessons across cases.

5.1 CASES

This section examines the case of three organizations – One Acre Fund, Project Shakti, and mPharma. As shown below, through these cases, we examine organizations with medium to high levels of scale and sustainability whose model features are inconsistent with the QCA solutions for scale or sustainability.

Table 10- The selection of cases

Case	Scale Level	Consistent with QCA Solution for Scale?	Sustainability Level	Consistent with QCA Solution for Sustainability?
One Acre Fund	High	No	High	No
Project Shakti	High	No	High	No
mPharma	Medium	No	Medium	Yes

⁷ We also did an in-depth analysis of three models that failed to attain medium-to-high levels of scale and sustainability in the health sector, namely Livewell, Praava, and Swasth Foundation to learn. We have omitted them from this paper, in part to maintain a focused scope, and in part because we need more information to distill learning. We hope that other researchers take on the task of learning from failures to scale as much as successes.

⁸ Note while we made an attempt to gather as much information as possible for these cases, there still may be information gaps, particularly related to financial data

5.2.1. One Acre Fund

Founded in 2009, One Acre Fund (OAF) empowers over 1.5 million smallholder farmers across East Africa by offering them agricultural products on credit coupled with training on best farming practices (2022 Annual Report | One Acre Fund, 2022). Since its inception, the organization has scaled to nine countries throughout Sub-Saharan Africa. Their model has been sustainable, with an impressive loan repayment rate of 96 % (2022 Annual Report | One Acre Fund, 2022) and a high social return on investment (SROI), with \$3.9 in new income and assets for every \$1 in donor funds. The table below highlights their model features in comparison to the QCA solution (What Is Social Return on Investment?, 2017).

Table 11- One Acre Fund's Model Features

	Scale	Sustainability
Common Pathway (Sufficient condition)	P*AL*N*V	Not N
One Acre Fund's Approach	Not P* Not AL * N*V	N

As shown in the table above, One Acre Fund's model features differ from the QCA solution. While they execute a vertically integrated model and have a narrow customer base, unlike the QCA solution for scale, OAF is asset-heavy and provides a push product. Moreover, unlike the QCA solution for sustainability, OAF caters to a narrow customer base, supporting subsistence farmers most in need of their services. The box below unpacks some of the ingredients that allowed OAF to scale and be sustainable despite deviating from the QCA solution.

BOX 5
One Acre Fund
(High Scale and High Sustainability)

The Vision

Where is the gap?
Over 50 million Sub-Saharan African smallholder farmers can't produce enough food to feed their families, are isolated from markets, and face malnutrition and poverty (Wudil et al., 2022).

Who are the beneficiaries?
Smallholder farmers across 9 African countries - Kenya, Rwanda, Burundi, Tanzania, Uganda, Zambia, Ethiopia, Nigeria, and Malawi. The average farmer is a 45-year-old woman owning anywhere between half to several acres of land, with over half of her income coming from agriculture.

The System

Who are the stakeholders in the system?
The system's stakeholders include smallholder farmers, the government, the private sector, and other parties involved in the agricultural value chain.

Why is the government/market system failing to deliver?
Mainstream financial products often overlook the credit needs of smallholder farmers. Despite government efforts to support them, achieving full coverage and last-mile delivery remains

challenging due to resource constraints and competing priorities of the state. While other organizations like [Juhudi Kilimo](#) and DrumNet offer similar solutions, they've yet to achieve the necessary scale to address this issue comprehensively.

What are the leverage and resistance points within the system?

A main leverage point that OAF has identified is the government. They maintain a special government relations team that works on compliance, government procedures, risk and issue resolution, relationship management, and policy.

The Model

What is the technical innovation?

The model emphasizes delivering proven goods and solutions to the "last mile." One Acre Fund provides quality farm products on credit, such as high-yield seeds and fertilizers, coupled with training on best practices, such as appropriate use of compost and microdosing fertilizers. The loans are repaid over the growing season. Their innovation lies in the "Farmer's First" approach, balancing farmer-centric services with business practices. This includes convenient repayment cycles and product deliveries near farmers' homes, ensuring they cater to the most remote clients and locations.

What is the theory of change for the organization and the system?

One Acre Fund lays down the foundation for a virtuous cycle whereby farmers increase their productivity and incomes and thus remain loyal to the organization. The overarching theory of change posits that enhanced inputs combined with training on optimal practices will foster self-sufficiency. This, in turn, results in increased crop yields, allowing farmers to achieve an income surplus after loan repayments, which can then be reinvested in their further advancement.

What is the business model?

One Acre Fund covers 72 percent of its costs through service fees and interest payments from farmers and 28 percent of its costs from donor funding (*2022 Annual Report | One Acre Fund, 2022*).

The Foundation

What are the financing needs?

Most of OAF's initial capital was from "friends and family" and funders supporting early growth. After proving its model's impact and cost-effectiveness, it secured larger foundation grants for backend processes.

What are the HR and organizational shifts needed?

OAF has a special scaling innovations team that develops solutions to challenges understood through its reporting and tracking mechanisms. The team tackles common obstacles that appear during organizational growth, such as increased operational complexity, insufficient resources, and inflexibility in adjusting models.

Building Evidence

How do they use evidence to test and adapt the model?

One Acre Fund uses its SROI tool (calculated by dividing the monetary impact of their intervention for farmers by the costs (Arrillaga-Andreessen & Hoyt, 2003). In their own words, "for every dollar we spend, we aim to put more income in farmers' pockets." (*What Is Social Return on Investment?*, 2017). They use this tool to guide decisions about clients and programmatic expansion within and across countries. One Acre Fund plots growth paths with this tool: one for higher-need regions and another for lower-need regions (CASE at Duke, 2021). In areas where programs are operating above their healthy growth path, One Acre Fund often recommends accelerated growth and considers experimenting with the addition of new impact areas. In addition, One Acre Fund periodically conducts impact evaluations (typically RCTs or difference-in-difference studies) to more precisely measure their impact on crop yields and farmer profits and confirm internal estimates (*Rigorous Evaluations*, n.d.).

How do we use evidence to get stakeholder support?

One Acre Fund carefully measures two levels of impact: the direct-level impact on farmers reached and the system-level impact to ensure that the underlying system is operating more

efficiently and effectively. This data is then used to gain buy-in from various stakeholders - governments, donors, and farmers (CASE at Duke, 2021).

What are the baseline and data requirements?

Before entering a new market, they follow a rigorous three-step model of (a) market analysis via desk research, (b) on-site market analysis through primary data collection to gain a better understanding of the market, and (c) small pilots with 100-200 farmers, followed by larger pilots of 500-1,500 farmers, to verify core metrics and inform decisions on whether to launch full operations. (CASE at Duke, 2021)

Several aspects of OAF could account for their success despite their model features deviating from the QCA solution. We mention a few key insights that may explain their remarkable success.

One insight is the importance of embedding goals like scale and last-mileness into the organization's core mission and model. Founder Andrew Youn saw the challenge of productivity and food security in Africa as one of last-mile service delivery and scale from the very beginning. He has always been “really interested in whatever helps us to achieve scale” (Nardella, 2019), and audacious goals around scale (to serve ten million farmers by 2030) have been present since the organization was founded. Moreover, OAF's motto of “Farmers First” helps consistently focus on solving the challenge at the last mile for stakeholders right at the end of the value chain. Placing nearly all of their employees based in rural areas, relying on field officers to gain trust within the communities, offering a profitable value proposition to farmers, and ensuring their needs are met from different angles (training, credit, inputs, etc.) are all strategies that serve that goal. OAF provides its basic set of services through a standard operating model centered around a ‘District Operating Unit.’ Each District Operating Unit includes a field director, 6–10 field managers, 30–50 field officers, and a bookkeeper. At scale, a district can serve about 10,000 farmers.

“A warehouse is a really interesting thing. It's a nice physical manifestation of the work that we do and of real hopes and dreams. Every sack in this gigantic warehouse piled 40'-50' high means an opportunity for somebody. That's the beauty of a warehouse: It reminds you of the scale and importance of what we're doing.”

- Andrew Youn (Nardella, 2019)

Another key insight is their use of evidence to standardize scaling systems while maintaining agility for modifications and innovation. The standard processes were developed through a robust and data-driven approach to testing, monitoring, and innovation. As highlighted in Box 5, One Acre Fund developed an SROI tool to inform its expansion strategies. This tool, offering real-time feedback, underscores the need for adaptability in different countries. While they maintain a standard approach, they tailor their strategies when necessary. For example, in Rwanda, they've partnered with the

government to scale farmer training, adapting their model to the local context while upholding their mission.

Lastly, another key to their success is their pragmatic approach to 'sustainability' and a nuanced grasp of its trade-offs. While they currently have a 1:3 ratio between grants and service revenue, their goal isn't to completely eliminate reliance on grant income. OAF is dedicated to serving the poorest farmers, showing a deep commitment to the last mile. While this limits higher revenue generation, they recognize their unique appeal to philanthropic sources. By meeting the development expectations of funders, they believe they can maintain support, ensuring their model's sustainability,

In conclusion, One Acre Fund exemplifies a model that effectively combines last-mile delivery, operational sustainability, and scalable reach. Diverging from the QCA solution, their success, despite being asset-heavy, having a push product, and a narrow base, stems from a clear scale-focused vision, evidence-driven decisions that balance standardization and adaptation, and a pragmatic approach that emphasizes cost recovery alongside the need for philanthropic support.

5.2.2 Project Shakti

Launched in 2001, Project Shakti (meaning 'strength') is a corporate social responsibility initiative of Hindustan Unilever Limited (HUL), the Indian subsidiary of Unilever. It involves training rural women, known as "Shakti Ammas," to become local entrepreneurs and distribute HUL products (such as soaps, detergents, sanitizers, etc.) in their communities, often in areas where traditional distribution channels are less effective or viable. Shakti Ammas are paid a commission based on their sales and typically earn about double their average household income. The project has scaled to 18 states in India, covering approximately half of all Indian villages (Singh, 2021) and about 190,000 ammas (Kantar Public, 2023). It is an important driver of HUL's rural growth, and the Shakti network was particularly robust when Covid-19 disrupted supply chains (Singh, 2021). Project Shakti has been replicated and adapted in several countries, including Ethiopia, Nigeria, Ghana, Egypt, Sri Lanka, Pakistan, Bangladesh, and Colombia (*Helping SME Retailers Grow*, n.d.).

The table below compares Project Shakti's model features to the QCA solution, which shows the most common set of features for scale and sustainability.

Table 12- Project Shakti's Model Features

	Scale	Sustainability
Common Pathway (Sufficient condition)	P*AL*N*V	Not N
Project Shakti's Approach	Not P* Not AL *N* V	N

Like One Acre Fund's example, while Project Shakti has a vertically integrated model and narrow customer base, unlike the QCA solution for scale, Project Shakti is asset-heavy and provides a push product. Moreover, unlike the QCA solution for sustainability, Project Shakti caters to a narrow customer base- namely rural communities. The box below unpacks some elements that allowed Project Shakti to scale and remain sustainable.

BOX 6
Project Shakti
(High Scale and High Sustainability)

The Vision

Where is the gap?
There are two main gaps. First, as urban markets saturate, FMCG companies are eyeing rural areas, home to 70% of India's population, but largely untapped. With rising per-capita incomes, these rural regions offer new growth for consumer goods companies, accounting for nearly half their revenues in emerging markets. Second, economic opportunities for women in low-income communities are limited, with low and declining female labor force participation (Thampi, 2020).

Who are the beneficiaries?
While HUL gained reach, revenue, and advantages over competitors, two other communities benefited from the project: rural consumers and women micro-entrepreneurs at the heart of the model.

The System

Who are the stakeholders in the system?
Key stakeholders include rural women micro-entrepreneurs under Project Shakti, rural customers at the last mile, and partners in the value chain, for example, Self-Help Groups, NGOs, and district administrators.

Why is the government/market system failing to deliver?
Navigating rural markets is challenging. They are scattered over large geographic areas and are often not well connected by roads and transport. Poor penetration of electronic media, means more costly communication strategies like word of mouth or community building are more effective

What are the leverage and resistance points within the system?

A key leverage point identified by the project owners in certain locations was that they could deliver other services through the entrepreneur, increasing their value added to communities. This included the Shakti Vani program, which trained women on health and hygiene issues (Rangan & Rajan, 2007). Another innovation was the iShakti program, an Internet-based rural information service that creates access to relevant information on health, agriculture, education, and vocational training through the iShakti community portal (Rangan & Rajan, 2007). Another leverage point was accessing existing systems to reach scale. Instead of HUL directly reaching many women, they reached them through the existing Self-Help Group (SHG) network under the National Rural Livelihood Mission.

The Model

What is the technical innovation?

The innovation serves dual purposes: reaching rural consumers and empowering local women by training them as entrepreneurs for a cost-effective last-mile distribution network. To implement this, HUL tweaked and carefully adapted products for rural market preferences in branding and size and established a credit system for micro-entrepreneurs, eliminating the need for upfront investment. Finally, HUL invested in training and capacity building to account for low literacy.

What is the theory of change for the organization and the system?

The overarching theory of change is that training rural women in selling consumer products can help HUL overcome the challenges of reaching the last mile, building a network of local champions that can create awareness and positive word of mouth for their products, and also help gauge demand and preferences. In turn, women entrepreneurs can earn income from their sales commissions, which would motivate other women to participate in selling these products.

What is the business model?

'Shakti Ammas' are trained to understand distribution and the HUL product range. They then distribute consumer products to local retailers and village households, helping expand HUL's customer base. 'Shakti Ammas' are supported by a team of Rural Sales Promoters (RSPs). RSPs coach Shakti entrepreneurs, enhancing their sales, distribution, negotiation, and communication skills (Kantar Public, 2023). On average, an RSP covers 2-5 villages six days a week.

The Foundation

What are the financing needs?

Given the for-profit nature of this industry and its goal, the financing needs emerged from investments and existing profits. In 2019-20, HUL's spending on the Shakti network of 190,000 women entrepreneurs spanning 18 states in India was INR 530 million, which is approximately USD 6.3 million (Singh, 2021). We could not find precise details of training costs, distribution, etc.

What are the HR and organizational shifts needed?

The HUL team recognized that adaptations were necessary for the project to expand across countries to suit each unique environment. This involved engaging with governments, partnering with local entities, identifying target markets, and ensuring a consistent product supply after establishing the supply chain. As the model was introduced in various countries, local offices took the lead in financing and operations.

Building Evidence

How was evidence used to test and adapt the model?

While Unilever uses regular market data to gauge profitability and other business metrics, it also tracks diverse Shakti Amma metrics, such as earnings relative to local jobs, stores opened, frequency of stock pick-up from distributors, villages reached, alternative credit sources, and the potential to generate additional revenue beyond HUL sales. These metrics on each Shakti Amma are used as feedback to improve the model. By focusing on diverse metrics and prioritizing long-term outcomes over immediate financial performance, Project Shakti has been allowed to thrive (Narsalay, 2015).

Why was Project Shakti able to scale and remain sustainable despite having model features that deviated from the QCA solution? Part of the answer lies in HUL's vast resources and profits, which funded the capital investments needed upfront to build the network. We discuss some key insights that may explain Project Shakti's success below.

One important insight from Project Shakti's scaling journey is how well their model adopted the concept of Economics of Mutuality, much before the idea was formally introduced (*Economics of Mutuality*, n.d.). The Shakti model fulfilled the company's needs and the needs of rural women looking for work opportunities and remote communities that weren't often the core focus of larger companies. HUL centered its delivery on women micro-entrepreneurs: a large, economically vulnerable group seeking paid work. By understanding their needs, HUL crafted a compatible model ably supported by RSPs. Recognizing initial incentive challenges, they offered rewards for home visits irrespective of sales and extra incentives for selling brands popular in the region.

Another important insight from Project Shakti is the significance of market analysis in aligning products with customer needs, a strength honed by HUL's extensive experience in penetrating new markets. They started with a curated list of 150 products for India, adapting them to rural preferences, such as introducing low-cost sachets for those with limited income (Rangan & Rajan, 2007). Understanding the women entrepreneurs' challenges, they implemented a credit system, providing products first and collecting payment after establishing customer networks. Throughout, detailed sales data guided refinements, ensuring the model's sustainability.

A third insight is Unilever's dedication to expanding Project Shakti internationally, empowering country offices to adapt the model based on local nuances (Vijayraghavan, 2009). They effectively replicated the model using Unilever's global network, capitalizing on the country teams' local insights and established contacts. In Pakistan, for instance, the Shakti Amma equivalent is 'Guddi Baji', who not only sells beauty brands like Lux and Fair & Lovely but also educates girls on hygiene and community practices (Shashidhar, 2013). In Bangladesh, they're named 'Saubhagya,' meaning good luck, and the initiatives are known as Project Joyeeta in Sri Lanka (Agarwal, 2010). The program also made its mark in Colombia, focusing on areas with scarce job opportunities (*Becoming a Micro-Entrepreneur in Rural Colombia*, 2019).

Though the foundational idea of Project Shakti remained consistent, the flexibility to adapt ensured its widespread success.

In summary, unlike the QCA solution for scale, Project Shakti offers a push product and is asset-heavy, and, unlike the QCA solution for sustainability, it has a narrow customer base. Project Shakti was able to achieve success with these model features, in part due to its patient upfront investment. But equally important is its win-win model that benefits not only HUL and its rural customers but also its cadre of women micro-entrepreneurs. Moreover, its emphasis on data-driven market research to meet customer needs and its openness to adaptation as it enters new markets lays the foundations for scale and sustainability.

5.2.3 mPharma

mPharma is a health tech startup founded in Ghana in 2013 to improve access to medicines by providing innovative financing and inventory management solutions to hospitals, pharmacies, and patients (*mPharma Annual Impact Report, 2021*). One of their flagship initiatives, Mutti, combines a patient loyalty program with a network of affiliated community pharmacies, offering members benefits like discounted medicines, flexible payment plans, medical consultations, and telehealth diagnostic services (Njanja, 2022). mPharma has expanded to Nigeria, Zambia, and Kenya and is initiating operations in Uganda, Malawi, Rwanda, and Ethiopia (*mPharma Annual Impact Report, 2021*).

The table below compares mPharma's model features with the common model features associated with scale and sustainability identified in the QCA solution.

Table 13- mPharma's Model Features

	Scale	Sustainability
Common Pathway (Sufficient Condition)	P*AL*N*V	Not N
mPharma's Approach	Not P* Not AL *Not N* V	Not N

While mPharma's model is vertically integrated, unlike the QCA solution for scale, it is asset-heavy, offers a push product, and caters to a wide customer base. mPharma's features, however, match the QCA solution for sustainability identified, as it also caters to a wide customer base, involving patients and pharmacies. Box 6 delves into the mPharma model.

BOX 7

mPharma
(Medium Scale and Medium Sustainability)

The Vision**Where is the gap?**

Two critical issues persist in Africa's healthcare sector. First, most low-to-middle income earners visit pharmacies before clinics, often self-medicating. For instance, in Ghana, 55% of the patients opt for a pharmacy when first experiencing symptoms, while in southern Nigeria, 60-90% of patients self-medicate (Njanja, 2022). Second, the drug supply chain is broken and riddled with challenges, including several middlemen, inflated drug prices due to markups at each level of the value chain, the sale of counterfeit medicines, and shortages.

Who are the beneficiaries?

The main beneficiaries are the pharmacies and patients

The System**Who are the stakeholders in the system?**

In addition to patients and pharmacies, doctors, government entities, and private pharmaceutical companies form the key group of stakeholders.

Why is the government/market system failing to deliver?

Limited resources in many African countries result in health being under-prioritized. Pharmaceutical firms face misaligned incentives, and middlemen often prioritize personal gains over better health outcomes.

What are the leverage and resistance points within the system?

The main points of leverage are technology, along with networks of pharmacies and patients. Inadequate forecasting was one of the drivers of supply chain inefficiency. To remedy this, mPharma employed Bloom, a user-centered point of sales technology system that uses operational data and predictive analysis to forecast demand. The other issue and point of resistance is the middlemen, who put mark-ups on the price. For this, was important to have networks of pharmacies (to negotiate bulk discounts) and patients (to be able to pay in installments) to help bring costs down.

The Model**What is the technical innovation?**

mPharma's high-level innovation is to combine primary care with drug distribution centers. Their tech-based data management system helps manage drug supply and inventory issues. They buy in bulk to get discounted medicines on behalf of pharmacies. Patients can pay in installments, and they cap drug prices for people living with chronic diseases.

What is the theory of change for the organization and the system?

mPharma's theory of change is simple—better-stocked pharmacies and better-informed, trained, and supported pharmacists will lead to improved access to primary care. This enables better health outcomes among the communities in which such a pharmacy is located.

What is the business model?

The mPharma model has continued to evolve while always remaining patient-centered and aiming to deliver good quality healthcare. Its different stages are highlighted below (Koning & Arora, 2022).

EPN: In 2014, mPharma launched a mobile and web-based Electronic Prescription Network (EPN) app, allowing doctors to track real-time medicine locations and availability. This network also gathered data on disease profiles, demographics, and medicine demand and supply. By 2015, they began monetizing this data for pharmaceutical companies which became the core business model. However, a gap existed: while they accessed doctors' prescription data, they lacked similar access to pharmacies' dispensing data, limiting their ability to diagnose retail trends. In addition, overpriced drugs affected mPharma's revenue from this model.

VMI: In 2016, mPharma began to implement a Vendor Management Inventory (VMI) model, overseeing inventory for a network of hospitals and pharmacies that subscribed at no cost. The VMI technology helped mPharma gather pharmacy dispensation data, which gave it deeper healthcare insights. By providing drugs on a consignment, pharmacies could allocate more working capital to business operations, with their revenue based on patient sales rather than drugs supplied to hospitals. As the VMI network expanded, mPharma was able to secure bulk discounts from suppliers, lowering drug prices. In essence, mPharma was able to cut the middlemen to unlock gains. This disrupted the traditional "pay-for-supplies" approach offered by distributors with a new model. VMI soon became the primary service offering.

QualityRx conversion franchising model: Despite the VMI model generating cost-savings by eliminating middlemen, pharmacies still grappled with high operating expenses, which they passed onto patients. mPharma's "Quality Rx" aims to support local pharmacy owners. They offer an array of services, including interest-free loans up to USD 8,000 for store enhancements and signage in return for a profit-sharing agreement. This initiative, paired with their patient loyalty program, "Mutti," which allows subscribed patients to pay in installments and earn rewards, and the "Bloom" technology, helped unlock gains across the system. It resulted in 30-100% revenue growth for pharmacies (with 53% directly from QualityRx), and a 25% gross margin for mPharma (Koning & Macomber, 2021).

The Foundation

What are the financing needs?

mPharma's early exploration phase, in which it searched for its business model, required significant capital. mPharma managed to secure a Series C round of 17 million USD, and a Series D round of 35 million USD (Njanja, 2021; Njanja, 2022). The latest funding aims to expand to new markets and enhance in-pharmacy consultations and telehealth services that were initiated during COVID-19. Prominent investors include CDC group (the UK development arm), JAM Fund (a venture capital firm founded by Tinder co-founder Justin Mateen), Breyer Capital, and Shravin Bharti Mittal of Bharti Global Limited, an Indian conglomerate, among others.

What are the HR and organizational shifts needed?

mPharma's HR strategies are tailored for employee growth and retention (*mPharma Annual Impact Report*, 2021). They stand out in Africa as among the few firms that offer stock options. They promote internal training and development (e.g., partnering with Harvard Business School's e-learning portal), and emphasize internal promotions. Their leadership brings in distinct, complementary skills. CEO and co-founder Gregory Rockson has a healthcare and policy background (Koning et al., 2021). Co-founders James Finucane, a mathematician and web developer, serves as CTO, while Daniel Shoukimas, blending art, design, and technology, is the Chief Product Officer (Skoll | James Finucane, n.d.; Skoll | Daniel Shoukimas, n.d.). Their board

includes distinguished professionals from the pharmaceutical industry, such as Helena Foulkes, former president of CVS Pharmacies, and Daniel Vasella, ex-CEO of Novartis.

Building Evidence

How do we use evidence to test and adapt the model?

Evidence and data have been central and have informed model shifts throughout. Each of their models has been piloted. The VMI model started as a demo and test project with the pharmacy of the University of Ghana Hospital in collaboration with Novartis who agreed to provide the medicines directly to the pharmacy as opposed to going with a distributor (Wu, 2022). The Quality Rx was launched after a successful pilot in 2018 (*mPharma Annual Impact Report, 2021*). In 2019, mPharma partnered with the Bill and Melinda Gates Foundation, and ran a pilot, under the GoodHealth brand to replicate the Quality Rx model with patent and proprietary medicine vendors (PPMVs), which are often the first point of contact for patients seeking healthcare. This pilot was very successful, and average monthly sales of PPMVs have increased substantially, even tripling in some cases (*mPharma Annual Impact Report, 2021*). In addition to pilots, mPharma regularly uses data from various systems to monitor and manage inventory and its customer loyalty program.

What are the baseline and data requirements?

For a VMI solution, three types of data are required: (a) supply data of the store, (b) dispensation data, and (c) stock count data.

How has mPharma achieved scale and sustainability despite deviating from the QCA solution? There are three potential reasons.

The first reason is their ability to pivot and adapt based on feedback and evidence. Transitioning from EPN to VMI, they shifted their focus from doctors to pharmacies, achieving sustainability and extending their reach. This adaptation to context and refinement of their services has continued as they layered onto their VMI model services like QualityRx, the Mutti membership for patients, and, more recently, Good Health PPMVs. This evolution and constant learning have served them well and helped them expand to other African markets.

The second reason is their deep understanding of the system. mPharma's grasp of the pharmaceutical and healthcare landscape is profound. They actively engaged with manufacturers, pharmacists, and doctors early on, discerning their incentives and challenges. Recognizing technology as the missing link, they invested in it from the outset, fostering patient-centric innovations and ensuring they met intended outcomes.

The final lesson is a clear narrative and communication, which has been crucial to raising funding rounds as they search for their business model. mPharma's commitment to a straightforward narrative simplifies their intricate models. While the technicalities operate in the background, their public communications spotlight the pharmacy and patient needs. This clarity, evident in their promotional materials, ensures patients and pharmacies easily recognize the value mPharma offers.

5.2 OVERALL PATTERNS

In the previous section, we conducted an extensive deep dive into three organizations serving the last mile that had medium to high levels of scale and sustainability despite deviating from the QCA solution. While One Acre Fund, Project Shakti, and mPharma, are vertically integrated and have a narrow customer base, consistent with the QCA solution for scale, they all offer a push product and are asset-heavy models, deviating from the QCA solution for scale. In addition, One Acre Fund and Project Shakti both have a narrow customer base, deviating from the QCA solution for sustainability.

We already distilled some potential reasons that might explain each of their successes despite following alternative pathways to scale and sustainability. In this section, we look across the cases to uncover overarching lessons that may have contributed to their admirable levels of scale and sustainability. These lessons, we hope, might be of use to other organizations looking to attain scale and sustainability.

Clarity in vision

A consistent theme across these organizations is their clarity of vision, which serves as a guiding light, framing not only what evidence they collect but also helping them to make the needed pivots and adaptations to scale and become sustainable. The vision outlines who the organizations are serving. For One Acre Fund, their "farmers first" motto has consistently guided their team, helping them create a sustainable, scalable service bundle tailored to farmers. It informs how they measure success, based on crop- yields, profits to farmers, their ability to withstand shocks, and their quality of life. Similarly, mPharma's bold vision of "an Africa in good health" with everyone having access to safe and affordable medicine is powerful. It was the anchor that allowed them to shift from electronic prescriptions to vendor inventory management. The vision also influences how mPharma defines impact— it measures the revenues of the pharmacies in its network and also routinely looks to reduce the price of medicines to patients. Project Shakti has a twin vision— to empower rural women to earn their own income and to expand the reach of Unilever's consumer products to rural areas. Their vision is also reflected in how they measure success. Along with profitability they also carefully track the well-being of Shakti Ammas, measuring their earnings relative to local jobs.

A combination of technology and people

Though technology is frequently championed as a scaling tool, the success of the organizations studied underscores the importance of blending it with grassroots engagement and human connection. One Acre Fund harnesses technology by integrating mobile money for loan repayments, utilizing tablets for efficient farmer registration, and deploying chatbots to offer timely agricultural advice. But this is only possible because of One Acre Fund's strong on-the-ground presence with field officers who maintain direct relationships with farmers and help familiarize them with these technology tools. Similarly, while Project Shakti uses mobile phones to keep track of sales and place orders, the backbone of their model is the 190,000 Shakti Ammas and

the cadre of Rural Sales promoters who coach them. Finally, mPharma's Bloom technology is central to its efficient end-to-end inventory management. However, without its vast networks of pharmacies and patients, mPharma would not be able to satisfy its vision.

Evidence-driven decision-making and adaptive learning

Most enterprises aim to incorporate data-driven decision-making, a standard often set by investors and funders. Yet, only a select few models successfully integrate this approach to facilitate learning and improvement throughout. Central to One Acre Fund's strategy is its rigorous emphasis on evidence. Their method calculates "dollar impact," which monetizes the value of crops and services adopted by their clients using a quasi-experimental methodology. By juxtaposing this value against operating costs, One Acre Fund effectively guides its program expansions and other pivotal decisions. Moreover, One Acre Fund is constantly piloting, initially with 100-200 farmers, and eventually with 500-1000 farmers to continually tweak their model and make it work in new contexts. Similarly, Project Shakti, aiming for market penetration, integrates real-time data analysis for revenue growth. They closely monitor villages reached by Shakti Ammas, their frequency of stock pick-ups, and stores opened. These metrics, along with direct feedback on demand from Shakti Ammas are used to improve and change the model for it to better fit consumer tastes. Finally, mPharma utilizes pharmacy-generated data to ascertain patient needs and optimize medication availability. They continually pilot new interventions and services, to inform their model shifts.

Establishing an economics of mutuality

All three cases were able to provide a value proposition for themselves, their key beneficiaries, and funders. One Acre Fund was able to recover 70% of its costs from loan repayments to farmers, improve farmers' yields and profits, and satisfy philanthropic funders with high social returns on investment. Project Shakti has fulfilled the company's goal to penetrate rural areas, the rural women's need for greater livelihood opportunities, and rural customers' demand for household goods. Finally, mPharma was able to get bulk discounts to pharmacies, lower costs and allow flexible payment plans for patients, and attract private capital with its value proposition of eliminating the middlemen. They continually tested, piloted, and tweaked their model and their product or service offering to ensure that all these key stakeholders' needs were sufficiently met.

6. Conclusion

What combination of model features of an organization are most commonly associated with scale and sustainability? A QCA of 35 organizations reveals that a combination of four features is sufficient (but not necessary) for scale— a pull product, an asset-light capital investment strategy, a narrow customer base, and a vertically integrated business model. The QCA also reveals that a wide customer base is sufficient (but not

necessary) for sustainability. A case study analysis of three sustainable organizations at scale with model features that deviate from the QCA solution uncovers several other factors behind scale and sustainability—clarity in vision (with scale and sustainability at the center), the use of human networks and technology, an ability to constantly learn and use evidence to inform decisions, and a compelling value proposition for multiple stakeholders involve.

This study is not without limitations. First, measurement of concepts like scale and sustainability can be open to interpretation, difficult to define precisely, and prone to bias due to confidentiality and public image concerns of organizations. Second, we have a relatively small sample size due to a paucity of reliable and publicly available data— this is especially true for the case study analysis. Third, the 35 chosen organizations with public information will likely mature and survive long enough to be studied (selection bias). Finally, QCA as a method is limited by the model features, in the sense that there may be other logically possible but empirically absent features. Moreover, it is susceptible to Type I errors.

Nonetheless, we see this paper as beginning to uncover and understand what it takes to scale. Quite a few avenues of further research emerge from this paper. First, we discovered an unexpected tradeoff in the QCA solutions to scale and sustainability— a narrow customer base (in combination with other factors) was associated with scale. In contrast, a wide customer base was associated with sustainability. Understanding to what extent this tradeoff between scale and sustainability holds, its drivers, and how we may overcome the tradeoff seem important areas for further investigation. Second, we focused mainly on cases with the QCA solution and those without the QCA solution (through case studies) that scaled and were sustainable. We did not carefully examine the organizations that did not scale at all and what may be the drivers of that- which would also be important.

Appendix A - List of Organizations

Sector	Model/Organization Name	Established in
Agriculture	RUDI	2004
	Aldeia Nova	2012
	Digital Green	2006
	<i>Ekutir</i>	2009
	One Acre Fund	2009
	Juhudi Kilimo	2009
	R4 Rural Resilience Initiative	2011
Finance	Dvara Holding	2008
	<i>BIMA</i>	2011
	Fundación Capital	2009
	Zoona	2009
Education	FINAE	2006
	STIR Education	2012
	Omega Schools	2007
	<i>Urban Planet Mobile</i>	2007
	Invincible Outsourcing/Maharishi Insitute	2007
	Bridge International Academies	2009
Health	Telemedecine Africa	2008
	Armann	2008
	Aakar Innovation	2011
	Livewell	2009
	Praava	2016
	Swasth Foundation	2011
	Mpharma	2013
	The Living Goods Story	2006
Water and Sanitation	TakaTaka Solutions	2011
	Sanergy	2010
	Water Health	2008
	Evidence Action	2013
Energy	Devergy	2010
	Burn Manufacturing	2011
	Solar Sister	2008
	M-Kopa	2011
Misc - Housing, FMCG	Patrimonio Hoy	1998
	Project Shakti (older)	2001

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