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A Customer Centric Lens for Good Agricultural Practices

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About INNOVATE:

INNOVATE – Adoption of Agricultural Innovations through Non-Traditional Financial Services, is a three-year initiative implemented by MEDA and funded by the International Development Research Centre (IDRC). MEDA and its partners are assessing the potential of non-traditional finance to enable large scale adoption of agricultural innovations among women and men smallholder farmers in South Asia, South America and East Africa. The research and learnings will contribute to developing policy and programming recommendations.

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Summary

Industry actors need to broaden and expand on Good Agricultural Practices' (GAP) agronomic perspective (e.g. "how to grow") to include a business case orientation centered on specific markets. Fundamentally, adopting GAP is a business investment decision that includes optimizing additional revenue and risk-based decisioning making by smallholder farmers. In order to adequately address these factors, it is necessary to:

1. **Emphasize the market context**, not only the agronomic and growing practices;
2. **Adopt a customer centric perspective** that treats smallholder farmer segments differently; and
3. **Adopt a business orientation** to promote the business case and the value proposition.

Introduction

Good Agricultural Practices (GAP) addresses a wide variety of farm production and post-harvest practices that contribute to food safety, food quality and environmental stewardship. The Food and Agriculture Organization of the United Nations (FAO) has been a key influencer and promoter of GAP since the early 2000s. More recently, countries are defining their own GAP standards and regulations even as commercial firms are incorporating GAP into their supply chains and procurement decisions, encouraging their suppliers to conform to GAP certifications such as GLOBALG.A.P, BRCGS food safety and International Featured Standard (IFS).

As countries and firms move to GAP adherence, more attention and effort has been directed towards smallholder farmers, who risk being displaced and excluded from markets that demand GAP standards. These more recent efforts add to a complex history attempting to provide agronomy and agricultural extension support to farmers – often with mixed results. How can market actors that promote GAP, such as buyers, international NGOs, FAO and government ministries, best promote the business case to smallholder farmers to invest in these practices?

These topics arose as MEDA staff reflected on the experience of partner organizations in the INNOVATE innovation portfolio. Organizations in the portfolio operated with a variety of assumptions regarding smallholder farmers' decision-making and propensity to adopt new products, technologies and practices. From this experience and an associated literature review, MEDA decided to explore an adaptive approach to GAP promotion focusing on market incentives, customer centricity and smallholder decision-making. This paper advocates (1) understanding the underlying incentives for farmers by (2) segmenting farmers based on their behavior and current practices, (3) identifying the most appropriate practices for each segment factors and (4) identifying potential pathways for adopting and maintaining GAP by each segment. Adaptive GAP requires buyers and implementers to take a customer centric approach - understanding the market incentives, experiences, motivations, aspirations, and constraints of farmer segments and tailoring products and services to their specific contexts and needs.

1. What are Good Agricultural Practices?

Good Agricultural Practices have originated from a variety of sources: commercial retailers, grower associations, government ministries and international organizations – to ensure safe food supply for consumers. In the late 1990s, European supermarket chains established farm management practices developed from European supermarket chains and their supplying farmers were codified into EurepGAP to address consumer concerns regarding food safety and quality. In 2003, FAO built on these practices and defined Good Agricultural Practices as "practices that address environmental, economic and social sustainability for on-farm processes, and result in safe and quality food and non-food agricultural products" in their first major publication.[1] The FAO framework identified ten general components: "soil management, water management, crop and fodder production, crop protection, animal production, animal health and welfare, harvest and on-farm processing and storage, energy and waste management, human welfare, health and safety and landscape conservation."[2] Early movements to develop GAP standards drew from and built upon existing standards such as those of the International Organization for Standardization Standards Organization (ISO) as well as established private sector market specifications responding to consumer protection concerns and niche market trading requirements.

While GAP provides market advantages, implementing GAP comes at a cost, including:

- Producers need to upgrade practices and equipment
- Compliance and traceability require improvements to record-keeping and information systems
- Infrastructure upgrades are necessary to improve working conditions
- Compliance, inspection and verification actions require new support, adding to operations costs
- Increased attention towards residue testing and certification requires specific labor skills and upgrading human capital.

1 Development of a Framework for Good Agricultural Practices, Committee on Agriculture, 17th Session, Food and Agriculture Organization of the United Nations, Rome, COAG/2003/6.

2 Jill Hobbs, Incentives for the adoption of Good Agricultural Practices, FAO Working Paper Series #3, Food and Agricultural Organization of the United Nations, Rome, November 2003.

A host of international organizations (e.g. FAO, IFAD, IFPRI, AGRA), international donors, international and domestic NGOs and government ministries have been rightly concerned at the risk of excluding smallholder farmers from markets and a source of livelihood. Thus, these organizations have directed GAP promotion efforts at smallholder farmers who may lose their opportunities to access markets due to their low capacity to adopt, implement and demonstrate specific standards.

As a result, organizations have invested a great deal of time, resources and effort to promote GAP amongst smallholders. Delivery of training and farming support to smallholders has been carried out through traditional agricultural extension practices such as relying on trained experts who travel into the field to interact and advise farmers directly in groups or individually. Other delivery channels have targeted producer grower associations and grower cooperatives as a mechanism to disseminate training and information. Multiple training methods and strategies are employed, including demonstration plots, informational posters, radio programming, interactive voice recording (IVR), and video to provide knowledge and 'know-how' to farmers. Digital Green identified successes in adoption rates amongst smallholder farmers in India using video training delivered by local facilitators working through local networks such as self-groups.[3]

Amongst these efforts, several questions of efficacy remain:

- How can industry actors best communicate why smallholders should adopt GAP?
- How can industry actors best appreciate the smallholders' value proposition and align promotion activities to improve smallholder adoption of GAP?
- What is the pathway for farmers to access GAP certified markets?
- Should farmers implement all the standards at one time, or should certain practices be adopted sequentially over time?

This paper advocates that in order to address these questions and promote adoption of GAP to smallholders, one needs to appreciate the fundamental business decisions faced by the smallholder farmer.

3 Digital Green reached 420,000 farming households through 296,000 video screenings [through which they] induced 167,000 farmers to adopt at least one new practice. Kerry Harwin and Rikin Gandhi, Digital Green: A Rural Video-Based Social Network for Farmer Training, Innovations Case Narrative, Volume 9, Number ¾, 2014.

2. Adaptive GAP: Appreciating the Business Case

Industry actors need to broaden and expand on the GAP's agronomic perspective (e.g. "how to grow") to include a business case perspective centered on markets. Fundamentally, adopting GAP is a business investment decision. Smallholder farmers are concerned about:

- Maximizing the return on their investment (e.g. time, resources and effort) from implementing GAP practices;
- Determining how much the promoted GAP standards will cost and whether they can earn enough revenue to cover the costs; and
- Optimizing net revenue and incorporate risk-based decision-making into their allocation of scare resources.

Industry actors promoting GAP need to empathize with the smallholder business case and demonstrate how the smallholder will be better off by implementing GAP.

In order to address these business investment questions, it is necessary to:

1. **Emphasize the market context**, not only the agronomic and growing practices;
2. Adopt a **customer centric perspective** that treats smallholder farmer segments differently; and
3. Adopt a business orientation to promote the **business case** and the **value proposition**.

2.1. MARKET CONTEXT: MARKETS MATTER

Markets have different specifications – and it is those market specifications that determine which GAP standards should be implemented. Thus, farmers must align their production practices and their cost of production with the specifications of the markets to which they sell.

The driving question amongst those promoting GAP is whether smallholder farmers will be permanently cut off and fundamentally excluded from markets if they do not adopt GAP.[4] The extent of this risk depends on the size of the market to which they currently sell and the growth of markets that are aspirational. In most markets around the world, local, open markets still represent viable selling opportunities for smallholders. Such markets operate according to opportunistic, spot transactions and are vastly different than niche or export markets, which represent the target for GAP standards. This critical orientation is frequently an unidentified assumption when discussing GAP promotion, especially when agronomists and agricultural extension agents discuss best practices with smallholder farmers. It is important that production practices with targeted farmers are clearly aligned with markets and their market specifications. Constraints for rural smallholders to access local, open markets do exist, but those constraints are fundamentally different than the challenges posed by GAP adoption.

Discussions with smallholder farmers concerning incorporating GAP and best agronomic practices should account for markets and their specifications – as stated assumptions. GAP promotion should be expressly relevant to specific markets and their expected product specifications. Farmers and GAP practitioners can then more readily assess performance gaps facing farmers and determine which GAP techniques could be targeted for promotion and adoption.

2.2. CUSTOMER CENTRICITY: NOT ALL SMALLHOLDER FARMERS ARE THE SAME!

The industry literature on promoting GAP to smallholders addresses multiple growing conditions (e.g.: types of soils, soil health, water, crop species, etc.), but tends to approach smallholder farmers monolithically. Smallholder farmers are not the same! Not all sell to the same market. Not all share the same production and growing challenges. From a generalized gender equality and social inclusion (GESI) perspective, men and women face entirely different barriers, opportunities and aspirations as farmers. Men and women smallholders usually represent different education levels, experience different access to farming inputs and experience ownership of assets differently. This represents a demographic segmentation, disaggregating by gender. But one can further disaggregate a gendered segment (e.g. women) based on demographics (education, age, etc.) and behavior (income sources and spending behavior). In fact, segmentation can be performed on a variety of factors: demographic, behavioral, geographic and psychographic (lifestyles of people). Since smallholder households are quite complex, addressing smallholder propensity to adopt GAP requires understanding and nuance – it requires a customer centric approach.

Once targeted market specifications are known, then one can identify GAP techniques most critical to meeting the specifications.

4 FAO GAP Working Paper Series #3, #5, #14

A customer centric approach to smallholder farmers suggests that those delivering GAP know-how should empathize with farmers and approach them as 'customers' rather than 'beneficiaries' of knowledge that is provided to them. This represents a fundamentally different relationship and perspective. The INNOVATE Learning Series paper on "Starting Small: Pathways to Customer Centricity " described customer centricity as "a perspective and mindset that puts the customer at the center of all business decisions, business processes and actions." A customer centric GAP delivery approach emphasizes identifying, testing and validating initial assumptions about smallholders' preferences and needs. In doing so, agents delivering GAP know-how can learn from smallholders and better understand the drivers of influence that lead to adoption of practices. They might also learn the best communication methods to employ to promote uptake and reach. In doing so, they might empathize with smallholders' needs and align delivery to aspects that smallholders value. Without this orientation, GAP delivery agents risk misaligning their GAP recommendations to smallholders' value, not getting their desired results - and worse, being perceived as irrelevant. Kerry O-Shea Gorgone, a marketing professor, encourages companies to align communication with their customers' perceived value, otherwise, "if your message is irrelevant to them, people not only tune it out, but think less of your brand for not understanding their needs."[5] Smallholder farmers are no different. A customer centric approach reminds one to align to them and empathize with their perceived value.

Table 1 offers a number of data types and clustering methods to segment smallholders and to develop relevant profiles for GAP promotion.

"If your message is irrelevant to them, people not only tune it out, but think less of your [advice] for not understanding their needs"

— Kerry O-Shea Gorgone

5 Katie Cowling, Method+Marketing, 6 sure-fire tactics to boost your customer retention, https://blog.methodmarketing.com.au/6-sure-fire-tactics-to-boost-your-customer-retention.

TABLE 1. Data Types and Clustering Methods for Smallholder Segmentation

Data Types	1. **Demographic characteristics of people, households and farms**: Capturing data at the Person level allows for more discrete analysis as people in the same household have different characteristics and behavior. **For people**, gender, geographic location (enables distance to markets, suppliers, etc.), years farming, education level, experienced farmer, etc. **For farms**, this data can include land ownership, plot size, crop type, soil quality, etc. 2. **Farming behavior**: How the farmer grows their crop(s). This data can resemble agronomic practices, but more importantly are the costs of production for each growing stage (e.g.: preparation, planting, growing/maintaining, harvesting, post-harvest storage and/or transport to market).[6] 3. **Market and transaction data**: Reveal the targeted market and the estimated revenue. Data can include market, market type, buyer, price, quantity sold, product grading. 4. Finally, indicators that demonstrate social factors such as **gender equity and social inclusion (GESI)** can also be incorporated. MEDA has found leveraging "locus of control" questions with a Likert scale yields good results. For example, scaled responses (e.g.: 1 to 5, where 1 is low) to the statements below could be disaggregated and segmented along men and women to discern perceived gendered influences: (1) "I have access to training and information on how to grow" (2) "I have access to training and information on how to sell" (3) "I determine what crops to grow in the next season" (4) "I determine what amount of money to invest into production"
Clustering Methods	1. **Segment by demographics** (e.g. location, gender, farm attributes): This can be facilitated through simple graphs and charts that disaggregate along certain factors. 2. **Segment by statistics**: For example, determine summary statistics for yield, revenue or cost of production. One can use visuals to identify groups of people and farms. For example, use histograms to identify groupings and use scatterplots to identify clusters and outliers 3. **Compare actual production costs against an expected model of production costs**: Which farmers exhibit costs above expected costs and which display cost below. How is yield associated with each group? 4. **Use data science techniques**: Data science techniques enable one to identify segments based on implicit behaviors. For example, cost of production data can reveal choices and farmer behaviors. Use k-means clustering or hierarchical cluster analysis to generate dendrograms and heatmap clusters to identify specific farmers similar in behavior. Focus cluster analysis initially on farm, production costs and revenue data. Successively add locus of control factors to address cultural and social norm factors (e.g.: GESI). Explore the data to determine how the clusters are different from each other. Identify the compelling data differences.

6 The value of cost of production will become clearer in the next section.

TABLE 2. GAP Promotion for Commercial Firms and Non-Commercial Promoters

GAP promoters might have varying interests and mandates for seeing smallholder farmers adopt GAP. The table below highlights how commercial and non-commercial market actors can leverage these techniques to achieve their interests.

Commercial Firms	**1.** Buying firms may take a position that they will only deal with supplying farmers that adhere to their market specifications (GAP and commodity quality). When firms seek to increase their sales, they may actively seek additional buying sources, making them more willing to intentionally promote GAP. Their concern is: am I targeting the right farmers with my 'supply produce for me' pitch? **2.** To segment suppliers, a commercial buyer may source data easily from their sales transaction and accounting system using data such as purchase volume, grading, frequency of purchases and recency of purchases. This data can enable them to categorize suppliers, identifying 'second tier' suppliers who can be targeted to increase volume and/or improve quality. **3.** Buying firms can also target yield per hectare, providing resources and techniques to grow suppliers' volume. Through crop modeling, firms can determine the expected yield per hectare for certain growing practices and inputs. Identify supplying farmers growing below that yield, determine practices to improve yield and determine how to motivate supplying farmers to adopt those practices.
Non-Commercial Promoters	**1.** Government extension, INGOs and international entities (e.g. FAO) concerned with promoting market linkages and market access for smallholders might take a minimum viable product (MVP) approach: what is the minimally acceptable business case required to persuade farmers to become GAP-certified suppliers. **2.** Segmenting smallholder farmers and clustering them around certain attributes, characteristics and behaviors helps GAP promoters identify which GAP techniques might offer that segment the most value, thereby improving GAP adoption. 1) Identify the current position for each segment. 2) Identify what each segment could do to improve from its position. 3) Create the path from current state to the future position. 4) Note that these action steps are assumptions that need to be tested and validated. **3.** By segmenting farmers, INGOs can more effectively communicate the benefits of GAP to that group's specific value proposition. **4.** Segmenting enables extension agents deliver GAP to discover a specific clusters' unmet needs and better deliver products and services to them.

Leveraging a customer centric perspective is critical to understanding and empathizing with smallholder farmers and their perceptions on adopting GAP. Several INGOs and international entities (e.g. World Bank Group) are experimenting with these techniques and seeing its benefits. Amongst them, an excellent example of customer centric oriented data collection and data analysis has been performed by the Consultative Group to Assist the Poorest (CGAP) with their "Digitizing Agricultural Value Chains" blog series[7] and their "Customer Insights on Smallholder Families".[8]

2.3. ADOPT A BUSINESS ORIENTATION

A final component to adopt is a smallholder business orientation that draws from both the agronomic production practices as well as the market opportunities. Farmers need to determine which markets to supply at what cost. If they aspire to sell to a GAP certified market (e.g. secure a new market), they will need to assess the costs to upgrade. If they are selling to a GAP certified market and desire to increase yield or improve quality (e.g. realize better product grading), they need to assess their upgrade cost in light of the anticipated additional revenue. This includes consideration of whether they can sell the additional yield.

A variety of complex investment methods can be utilized for this purpose, but a simplified net revenue approach can provide a minimally viable business case to evaluate the decision. This approach also enables one to utilize simplified net revenue data components in clustering and segmenting analysis.

The simplified net revenue perspective is the preferred business model orientation when promoting Good Agricultural Practices amongst smallholder farmers as it encapsulates both the market and the production functions. It is a simple equation where data element can be relatively easily obtained from the market transaction and from the smallholder's estimation of production costs.

Net Revenue = Revenue [Price × Quantity Sold] – Cost of Production – Other Costs

Where "Cost of Production" is the total of all the stages of production (e.g. preparation, planting, growing/maintaining, harvesting, post-harvest storage and/or transport to market, etc.) and "Other Costs" reflects other relevant costs.

A simplified net revenue approach provides a minimally viable farmer business case for GAP that encapsulates market and production functions

7 Consultative Group to Assist the Poorest (CGAP) web site: https://www.cgap.org/blog/series/digitizing-agricultural-value-chains.

8 CGAP web site: https://www.cgap.org/topics/collections/smallholder-families.

9 The objective is to keep the data collection simple such that one can analyze the data. This is a balance: how much detailed data is necessary in order to derive a direction in promoting GAP to smallholders.

Revenue incorporates the market perspective through the "Price" and the "Quantity Sold." The market sets the price such that an open market price will be different than a niche or export price. Quality and grading of product are reflected in the price. Additionally, Quantity Sold reflects the nature of the market and the market channel. If a smallholder sells by the roadside, they may experience increased waste (e.g. spoiled produce), resulting in lower quantity sold than if they aggregated through a buyer that purchases all the harvest. In a situation where a farmer sells to multiple markets (e.g. different prices and different quantities sold), one could simply take a weighted average to determine the revenue.[9]

Cost of production reflects the growing practices and behaviors through the production lifecycle. What stages of production (e.g. preparation, planting and growing/maintaining, harvesting, etc.) did the smallholder place most of their effort on? Where did they invest most of their resources and time? This can be estimated by asking how much time and expenses were spent on specific stages. For each stage of production, one could ask: How much labor was paid to non-household members? Were any input products used and what were their costs? What other costs were associated with the specific production stages? It is most helpful to have estimated a crop model for the commodities prior to interviewing smallholders as it will inform what questions to ask for each production stage. Possessing cost data for each stage in the production cycle will help to better understand farmer behaviors, smallholder perceived value (e.g. importance) of stages in the production cycle and will facilitate segmentation as not all farmers will invest in the same activities.

The **Net Revenue** perspective is important because people are motivated by whether they believe they will make money if they adopt a new practice, technique or product. Their belief is influenced by their perceived risk, particularly in (1) obtaining the desired yield from the upgrade cost and (2) being able to sell the additional yield. Smallholder farmers spread limited resources from multiple household income sources across a variety of potential opportunities they hope will generate additional household income. Household cashflow follows the agricultural seasons and may be supplemented with non-farm revenue. As a result, farmers typically display a risk-averse orientation and are less willing to try unproven experiments. Their willingness to invest additional effort in a technique or pay for a particular product will be influenced by the perceived value it will bring. These considerations are directly related to the net revenue calculation and captured in the equation's data.

Thus, if industry actors promoting GAP to farmers do not address the farmer business case, they can misalign their communication to the fundamental business drivers and perceived risks facing farmers.

WHY ARE DEMONSTRATION PLOTS AND VIDEOS SO EFFECTIVE IN PROMOTING GAP?

Such techniques practically communicate and demonstrate the cost of production and the associated potential yield.[10] Smallholders can rationalize the activities in their own fields and estimate how much the practices might cost. They can project what the yield might be and align yield with prices to identify revenue. As a result, farmers can assess perceived risk. These techniques are meaningful because they not only inform how to grow, but also practically communicate the business case to farmers.

10 Digital Green empowers smallholder farmers to lift themselves out of poverty by harnessing the collective power of technology and grassroots-level partnerships. https://www.digitalgreen.org/about-us.

3. How: Process and Steps to Implement

This section provides practical steps to identify which Good Agricultural Practices to promote in order to maximize net revenue.

The process advocates data-driven segmentation techniques to group similar farmers into clusters so that one can target GAP activities at specific clusters rather than assuming all farmers equally need the same GAP activities and subsequently treat them all the same.

Finally, the roadmap advocates an agile/lean approach using experiments and hypothesis testing to identify potential pathways leading to GAP acceptance by smallholders.

Data-driven segmentation enables targeted promotion of GAP activities at clusters of farmers with similar contexts and needs

3.1. TIPS AND SUGGESTIONS

- **Do not get stuck with the detailed segmentation analysis**. If one does not have a data science background, then focus on segmenting analysis that can be performed. "Start with where you are; Use what you have; Do what you can!" Find what works to group similar farmer practices and create clusters of similar farmers. Then push forward iteratively to identify new segmentation methods that provide additional insight.

- **Focus on GAP activities that maximize net revenue**. What GAP techniques can be introduced that – while increasing cost of production – result in increased Revenue? What GAP improvements make sense given the necessity to align with market standards? Be careful about assuming farmers can obtain better prices. The objective is to increase net revenue: what factors in the equation (Revenue – Cost of Production) contribute to that goal?

TABLE 3. Roadmap for Identifying Pathways to GAP Acceptance by Smallholders

Step to Implement		Tips
1. Collect Data	Collect data on the following main areas:[11] • Collect data at the **Household** and the **Person** level. This allows for more discrete analysis as people in the same household are not the same • **Farm** and **crop** attributes • **Crop production costs** • **Market and transaction data**	• Collect at the point of an activity (e.g. agronomist's visit; Point of sale) • Capture timing of activities to better appreciate cashflow • Add further nuanced perspectives by introducing social factors such as gender norms and perceived social constraints
2. Analyze and Segment	• Use the data to segment farmers. Group farmers based on similar characteristics and practices • Identify how segments are different	• Be intentional about data collection activities. Do not over-collect beyond one's current capacity to analyze or implement
3. Determine Potential Direction	1. Determine potential pathways 2. Turn the pathways into small projects (e.g.: pilots) that are testable experiments	• Consider ways in which smallholder farmers actively co-participate and drive the experiment projects. How to promote a shared-risk opportunity? How to encourage learning with the community and from the community? • What increase can farmers expect to achieve by traveling the suggested path and adopting the specific GAP practices?
4. Pivot and Adapt	1. Run the experiments: collect data, analyze and make observations. Validate and learn about the underlying drivers of adoption 2. Pivot, adapt based on learnings	• Replicate and scale with activities that influence smallholder decision-making • Continue to learn/adapt over time. Assume that models will need to change

11 See the Appendix for a data model showing data elements for these areas.

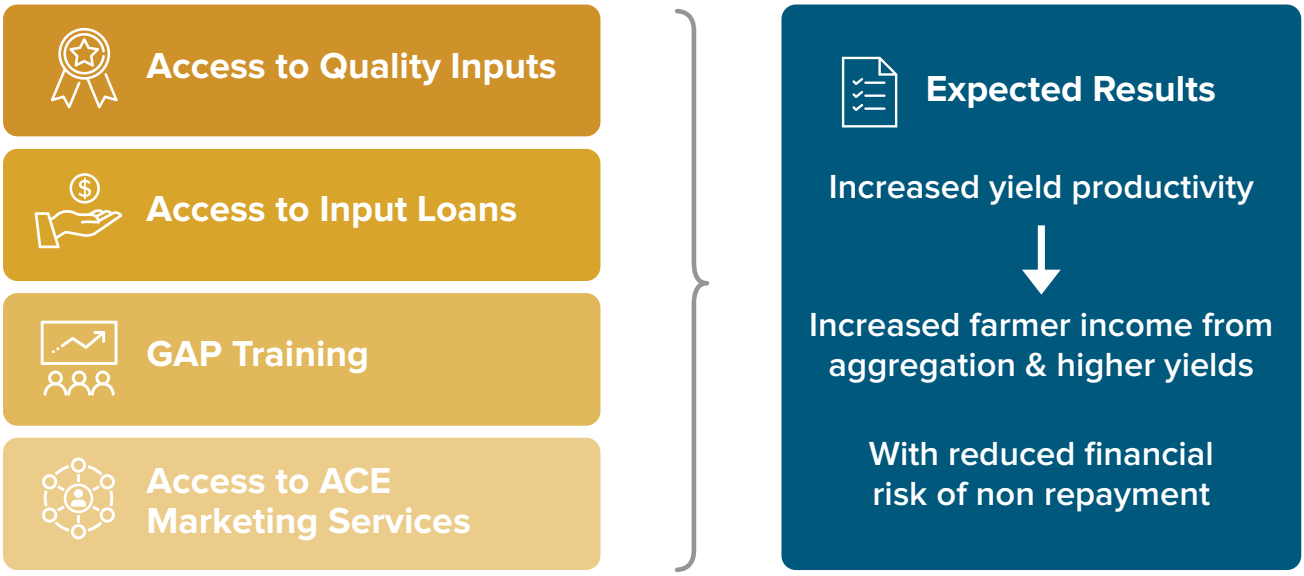
4. Case Study Scenarios Using Adaptive GAP

The following examples describe data-driven segmentation scenarios from attempts to promote GAP to farmers. These short case studies provide a variety of scenarios where business-oriented data (e.g. farming business model) was collected, segmentation was performed, and experimentation was utilized as a method to validate assumptions and discover the pathways by which smallholder farmers might adopt GAP.

4.1. INNOVATE EXAMPLE: CHITHUMBA MODEL (MALAWI)[12]

The Agricultural Commodity Exchange for Africa (ACE) designed the Chithumba model as an alternative finance mechanism and launched the model in Malawi in 2015 to mitigate challenges faced by smallholder farmers: low productivity and yields, lack of access to credit and limited linkages to formal markets. The Chithumba model bundles pre-harvest finance for farm inputs, agricultural extension services and marketing assistance to promote sales to aggregating commercial buyers. Agronomy Technology Limited (ATL), conducted case study research as part of the INNOVATE portfolio to assess and document the demand and adoption rates for all three services offered to Chithumba clients. ATL hypothesized that the bundle of services coupled with increased support of producers throughout the entire growing season would increase relational trust, create adoption of services, and grow sales transactions and use of ACE's marketing services.

FIGURE 1. The Chithumba Model



12 Anne-Cécile Delwaide and Luke Coulso, A Case Study of the Chithumba Model, INNOVATE portfolio case study, 2019, https://www.meda.org/innovate-resources/821-partner-publication-a-case-study-of-the-chithumba-model-a-non-traditional-finance-mechanism-to-improve-access-to-farm-inputs-in-malawi/file.

Despite solid loan repayment practices, the case study revealed low adoption rates of the recommended agricultural practices (e.g. GAP promotion) and low adoption of the marketing services. The study claimed "substantial differences" between the farmers' expressed desires and their actual behavior. "In particular, although respondents highly valued the knowledge on Good Agricultural Practices (GAP), their ability and willingness to move away from their traditional cultivation practices remain partial."[13] The table below provides reasons for not implementing the GAP recommendations.[14]

The findings of the case study indicate there are complex drivers contributing to decision making (e.g.: actual behavior differing from expressed desires or "felt needs") that may not have been fully known or understood during implementation. The smallholder behavior and preferences became better known through the case study activities. Farmers may express appreciation of extension services and training but are not likely to adhere to training or adopt practices if they increase production costs (e.g. labor costs) and do not directly translate to opportunities to increase post-harvest sales

TABLE 4. Reasons Cited for Not Implementing the Recommended Agricultural Practices (s =167)

Reasons Cited for Not Implementing the Recommended Agricultural Practices	
The recommended agricultural practices are too labor intensive	64%
The client does not believe the recommended practices will result in a yield increase	6%
The client does not understand the recommended practices	3%
Clients land size is larger than the input package obtained, but they want to utilize all available land with the inputs received.	8%
The training was conducted too late in the season when the land was already prepared	2%
Manual weeding is too difficult if the recommended practices are adopted	4%
The work was performed by someone else / casual labor who did not follow the instructions	2%
Other	5%
The client followed recommendations provided by another partner and different from Chithumba recommendations	6%

13 Anne-Cécile Delwaide and Luke Coulso, A Case Study of the Chithumba Model, INNOVATE portfolio case study, 2019, p1, https://www.meda.org/innovate-resources/821-partner-publication-a-case-study-of-the-chithumba-model-a-non-traditional-finance-mechanism-to-improve-access-to-farm-inputs-in-malawi/file.

14 Ibid, page 17.

according to cashflow needs. Farmers are likely to off-sell if they are running negative cashflow and cannot wait several weeks to obtain payment for their sales. These pressures may even impact compelling trading relationships built on past trust. The case study provides further evidence that one must deeply empathize and understand the underlying influences driving smallholder decision making. Adopting customer centric approaches, segmentation and modeling the business drivers could reveal additional drivers suggesting a new set of suppliers and purchasing strategies.

4.2. MEDA AND MOUNTAIN LION AGRICULTURE (SIERRA LEONE)

MEDA experienced an example of applying customer centric principles with smallholder rice farmers in Sierra Leone. Through focus groups and farm interviews, MEDA staff learned from smallholder rice farmers about the markets they sold to and the growing activities they engaged in from preparation to planting to growing/maintaining to harvesting. In this case, the cost of labor for smallholders was quite high relative to other production costs. As a result, smallholders resorted to growing activities that minimized labor costs, but had deleterious impact on yields: they cleared land by burning elephant grass, broadcasted seeds and allowed weeds to grow up alongside the rice, not weeding before harvest. Many opportunities existed to leverage GAP to increase their yield. But they also sold rice along the roadside via ad-hoc purchases to traders and travelers. In fact, smallholders could not sell all of the rice they produced through the current methods. It made no business sense for them to adopt better growing practices as any additional yield could not be sold through markets they accessed. They were optimizing for labor costs and maximizing net revenue.

Now, introduce Mountain Lion Agriculture, a domestically owned rice processing firm that desired to source rice from smallholder farmers. They had their own land on which they grew rice and could experiment with GAP methods. They constructed their processing facility to exceed their growing capacity and planned to procure rice from smallholder farmers to make up the gap. Their offer to smallholders included seed loans, technical assistance, input resources for growing and a guarantee to purchase rice at harvest market prices. Their challenge was to manage their margin and reduce waste at the farm gate.

This opportunity changed the market options for smallholders and thus had an impact on their business model – they were willing to invest in GAP in order to increase yield and increase quantity sold.[15] The question remained: which good agricultural practices were most useful in increasing yield without costing the farmer more – how to maximize net revenue? What was the pathway to increasing net revenue? Were some or all the practices necessary? Which GAP practices should be invested in first and what was the sequence for others to be adopted in future seasons?

To address these questions, MEDA and Mountain Lion Agriculture designed several growing experiments for farming communities to implement. Certain rice communities focused on preparation techniques, others on planting techniques and others on weeding techniques. MEDA and MLA provided assistance, captured production cost data and compared results

15 Farmer would increase Revenue by increasing their quantity sold, not through offering better prices. Too many INGOs focus efforts on the price factor when many times farmers are price-takers. The objective should be placed on increasing net revenue, which in this case focused on increasing yield and quantity of rice sold by investing in improving production practices.

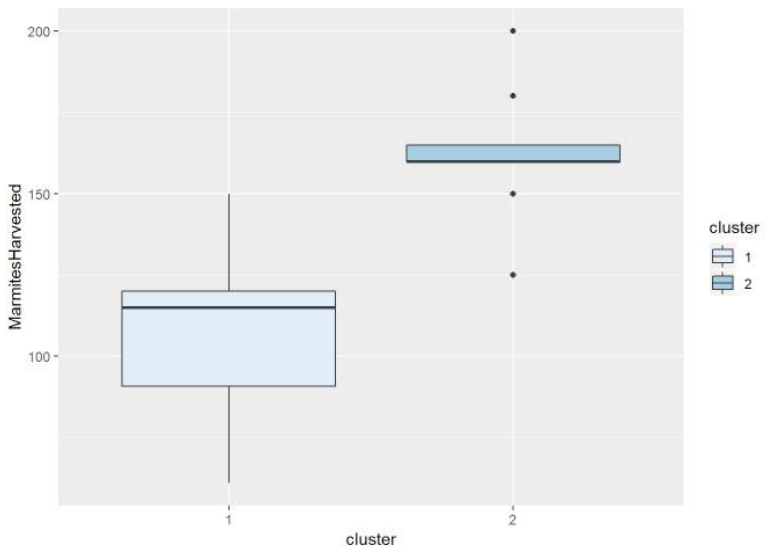
to recommend the first steps. Future GAP improvements will be introduced through iterative testing techniques with the farming communities in order to learn from each other, building supply chain relationships and reducing the risk of offselling to traders.

4.3. MEDA AND FONKOZE FOUNDATION (HAITI)

MEDA and Fonkoze Foundation worked together to promote peanut farmers amongst rural smallholder households in Haiti's central plateau. In this case, the motivation amongst the INGOs was to identify the feasible GAP options that would most likely increase net revenue amongst a pilot group of 24 peanut farmers.

Promotional and training efforts included GAP growing techniques, sourcing inputs (e.g. seeds and fertilizer) and linkages to markets such that rural household would have another viable income source. While conducting on-site training and advising farmers, Fonkoze Foundation's agronomist collected data on the farm and the cost of production for growing stages. After harvest and after sales, MEDA and Fonkoze Foundation analyzed the data, identifying two major farmer groups: one experiencing lower yield and another that obtained higher yields. These groups were confirmed to be statistically different from each other.[16] Initial analysis attempting to explain the different yield groups with demographic data generated little insight. The team then used agglomerative clustering analysis[17] on the simplified net revenue data (both market revenue and production costs) to identify two main clusters. The following boxplot graphic compares the different yields[18] of the two clusters: **Cluster 1**: 108.17 average yield and **Cluster 2**: 162.1 average yield.

FIGURE 2. Comparative Yields of Smallholder Farmer Clusters



16 The team used histograms to identify the two groups and then followed with analysis of variance to confirm the mean yields of the groups were significantly different.

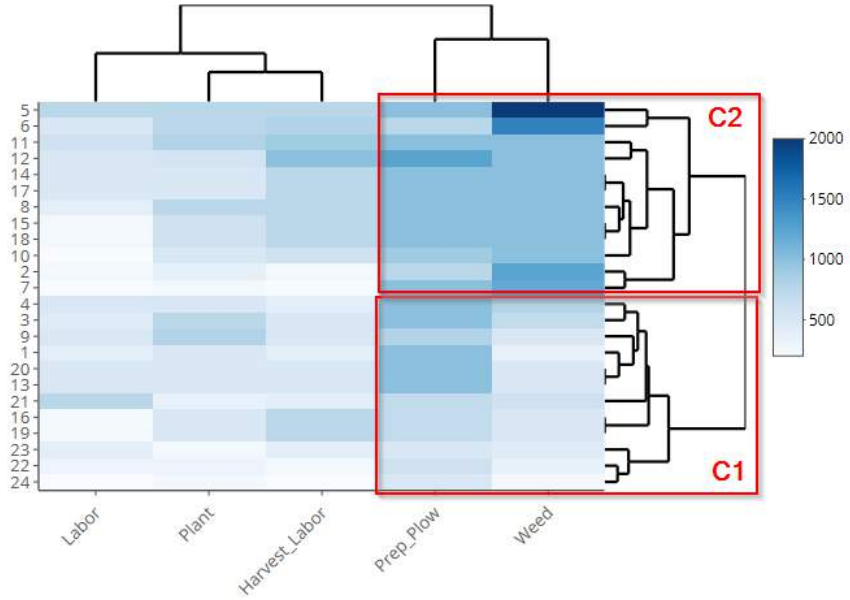
17 The team used Python, leveraging Pandas, Scikit-Learn (k-means and agglomerative clustering) and Seaborn (heatmap).

18 Analysis of Variance between the cluster yields results in: t = -6.4581, df = 20.425, p-value = 2.426e-06.

A heatmap diagram showing stages of production on the horizontal axis displays the lower effort Cluster 1 (low yield cluster) farmers placed on preparing land and weeding (lighter blue color) as compared with Cluster 2 farmers.

The clustering techniques suggested that farmers in the low yield cluster did not invest as much time and effort in preparation and weeding activities as farmers in the high yield cluster.

FIGURE 3. Comparative Yields of Smallholder Farmer Clusters Across Stages of Production



The team was now equipped with an understanding of two distinctly separate farmer profiles. The team could now apply customer centric principles and plan GAP activities tailored for the two different farmer groups.

Cluster	Cluster Centric Actions
Low yield (C1)	• Explore why this group of farmers were not weeding • Identify barriers to good practices: Explore influence of social norms that might influence production practices
High yield (C2)	• Confirm basic agronomic skills and farmers' perceived impact on yield • Explore "next step" production factors to further increase yield (e.g. soil health, animal traction)

Conclusions

1. **One cannot effectively encourage and promote GAP techniques without considering both agronomic and market influences.** The market context should be a primary consideration alongside production techniques and should be understood prior to articulating which Good Agricultural Practices should be implemented.

2. **A net revenue perspective captures both market and agronomy influences through revenue and cost of production functions.** Additionally, the revenue and cost of production data can be useful to segment farmers whether by new machine learning clustering techniques or standard statistical analysis.

3. **Delivering services to smallholder farmers can be expensive and time-consuming.** By segmenting smallholder farmers and adopting a customer centric approach, leads to more effective, more efficient methods to align GAP techniques with smallholder value. Segmenting smallholders into discrete clusters based on similar characteristics leads to targeted GAP approaches. Data-driven segmentation and a customer centric orientation go hand in hand.

4. **Many starting points exist to incorporate these perspectives and practices.** Don't be intimidated by the more advanced data science techniques. "Start with where you are; Use what you have; Do what you can!" Find what works, then push forward iteratively to identify new methods that add additional value.

5. **Finally, understanding farmer perceptions and empathizing with smallholder business models requires time and effort.** It is beneficial but costly. Who is positioned in the market context to perform these activities on a regular basis? Who in the market context might gain financially from the investment of cultivating supply relationships with smallholder farmers?

Bibliography

Anne-Sophie Poisot, Good Agricultural Practices – a working concept, FAO GAP Working Paper Series #5, Food and Agricultural Organization of the United Nations, Rome, October 2004.

Dalberg Global Development Advisors, Catalyzing Smallholder Agricultural Finance, September 2012.

David J.Pannell, Roger Wilkinsonc, Perry Dollingd, Jackie Ouzmana, Mike Ewinge, Predicting farmer uptake of new agricultural practices: A tool for research, extension and policy, Agricultural Systems, Volume 156, September 2017, Pages 115-125.

FAO, 2003. Development of a Framework for Good Agricultural Practices, Committee on Agriculture, 17th Session, Food and Agriculture Organization of the United Nations, Rome, COAG/2003/6.

FAO, 2016 "A scheme and training manual on Good Agricultural Practices (GAP) for Fruits and Vegetables: Volume 1", Food and Agriculture Organization of the United Nations, Bangkok, 2016. Web link: http://www.fao.org/3/a-i6677e.pdf.

Jill Hobbs, Incentives for the adoption of Good Agricultural Practices, FAO Working Paper Series #3, Food and Agricultural Organization of the United Nations, Rome, November 2003.

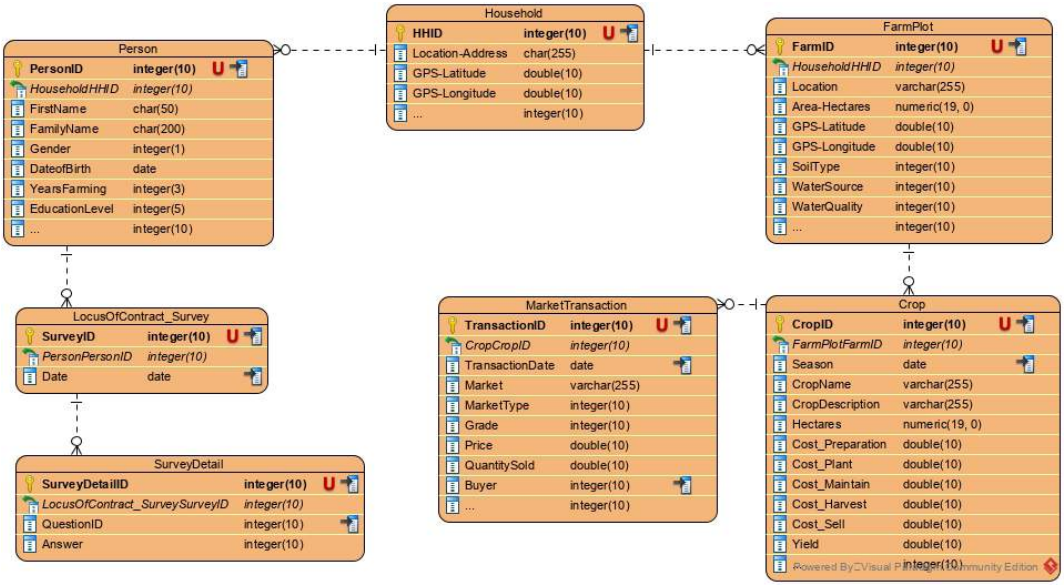
Wilfred Mushobozi, Good Agricultural Practices on horticultural production for extension staff in Tanzania: Training Manual, FAO GAP Working Paper Series #13, Food and Agricultural Organization of the United Nations, Rome, 2010.

Appendix: Data Model

A notional data model is provided below as a practical example to facilitate farm business data collection and analysis, including segmentation and clustering. The tables and associated fields can be expanded or reduced depending on the desired data points and the desired level of normalization. Lookup tables are intentionally not displayed but are inferred through field integer types (e.g. market type field in market transaction). Key points include:

- A similar structure was utilized to collect data in the Case Study Scenarios. The structure supports data at the individual level, promoting customer centricity and it stores farm business data, enabling analysis of the business case with the simplified net revenue approach.
- Farm business data is captured at several levels: at the *FarmPlot* and at the individual *Crop* level. The one-to-many relationship between *FarmPlot* and *Crop* allows for many crops to be identified. The one-to-many relationship between *MarketTransaction* and *Crop* allows for multiple sales of a crop within the same season.
- The individual *Crop* table captures production cost data, supporting the simplified net revenue data and enabling clustering based on farm behavior. Additional fields can be added to highlight agronomic growing data and practices.
- The *MarketTransactions* table enables capturing revenue data by recording discrete selling transactions. Market type, grading and buyer attributes are included to further differentiate the market context.
- The *Person* table enables capturing specific characteristics of individuals in the *Household* (e.g. one-to-many relationship). The associated *LocusofControl_Survey* table supports capturing social perspectives from each individual, enabling data-driven segmentation of the individual and supporting customer centric practices.

FIGURE 4. Model for Farm Business Data Collection and Storage



A Customer Centric Lens for Good Agricultural Practices

About MEDA

Since 1953, Mennonite Economic Development Associates (MEDA) has been implementing effective marketdriven programs which have enabled millions of people around the world to realize their economic and social aspirations. MEDA combines innovative private sector solutions with a commitment to the advancement of excluded, low-income and disadvantaged communities. As a dynamic technical innovator, MEDA has expertise in market systems and value chains, climate-smart agriculture, inclusive and green finance, impact investing, women's empowerment, and youth workforce development. MEDA partners with local private, public and civil society actors, strengthening individuals, institutions, communities and ecosystems, and thereby contributing to sustainable and inclusive systemic change.

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