# THE BUSINESS CASE FOR REGENERATIVE AGRICULTURE

## A Case Study of Central and Eastern Kenya

AGRA Growing Africa's Agriculture

CGA CEREAL GROWERS ASSOCIATION

FARM AFRICA

IIRR

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## A Case Study of Central and Eastern Kenya

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This business case is a result of a consultative process that International Institute of Rural Reconstruction (IIRR) and partners started at the onset of the regenerative agriculture project - "*Deepening Knowledge Management in Regenerative Agriculture through the Development of the Pulses Value Chain in Eastern and Central Kenya.*" The process culminated in a writeshop convened in August / September 2021 where the document was peer reviewed and validated by the project partners.

We are grateful to the representatives from Farm Africa (FA), Cereal Growers Association (CGA), Smart Regional Consultants (SRC), County Village Based Advisors (VBAs), County Governments and the National Government who contributed their time in the Writeshop to review and adopt this final document. See Appendix 8.2 for the full list of contributors.

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# GLOSSARY OF TERMS

| Term | Definition |
|---|---|
| **Biosequestration or biological sequestration** | The capture and storage of the atmospheric greenhouse gas carbon dioxide by continual or enhanced biological processes. |
| **Business Case** | A document that provides justification for undertaking a project, programme or portfolio. It evaluates the benefit, cost and risk of alternative options and provides a rationale for the preferred solution. |
| **Business Model Canvas** | A tool that describes a business model in a straightforward and structured way. Using this canvas will lead to insights about the customers served, what value propositions are offered through what channels, and how the enterprise makes money. You can also use the business model canvas to understand your own business model or that of a competitor. |
| **Climate Change** | A long-term shift in global or regional climate patterns. Often climate change refers specifically to the rise in global temperatures from the mid-20th century to present. |
| **Climate Smart Agriculture** | An integrated approach to managing landscapes—cropland, livestock, forests and fisheries--that address the interlinked challenges of food security and climate change. |
| **Regenerative Agriculture** | Farming and grazing practices that focus on regenerating top soil, allowing farmers to maintain crop yields, improve water retention and plant uptake, increase farm profitability, and support bio sequestration, among other benefits. |
| **Village Based Advisor** | Young men and women in target villages who support paid extension officers – whether public, private or NGO – in reaching more farmers within an area. Village based advisors (VBAs) are chosen by their communities, rather than by an outside entity. |

# ACRONYMS

| | |
|---|---|
| **AGRA** | Alliance for a Green Revolution in Africa |
| **ASDSP** | Agricultural Sector Development Support Program |
| **BMC** | Business Model Canvas |
| **CA** | Conservation Agriculture |
| **CBE** | Community Based Extension |
| **CECM** | County Executive Committee Member |
| **CEV** | Community Extension Volunteers |
| **CGA** | Cereal Growers Association |
| **CIDP** | County Integrated Development Plans |
| **CIMMYT** | International Centre for Maize and Wheat Improvement |
| **$CO_2$** | Carbon Dioxide |
| **CSA** | Climate Smart Agriculture |
| **FA** | Farm Africa |
| **FAO** | Food and Agriculture Organization |
| **FEO** | Field Extension Officer |
| **GHG** | Green House Gases |
| **GoK** | Government of Kenya |
| **ICRISAT** | International Crops Research Institute for the Semi-Arid Tropics |
| **IIRR** | International Institute of Rural Reconstruction |
| **IPES Food** | The International Panel of Experts on Sustainable Food Systems |
| **KARLRO** | Kenya Agriculture and Livestock Research Organization |
| **KCEP-CRAL** | Kenya Cereals Enhancement Program Climate Resilience Agricultural Livelihood |
| **KEPHIS** | Kenya Plant Health Inspectorate Service |
| **KNBS** | Kenya National Bureau of Statistics |
| **MAM** | March-April-May |
| **MEEP** | Makueni Enhanced Extension Program |
| **MoU** | Memorandum of Understanding |
| **NARIGP** | National Agricultural Rural Inclusive Growth Programme |
| **NASEP** | National Agriculture Sector Extension Policy |
| **PCPB** | Pest Control Products Board |
| **PPP** | Private Public Partnerships |
| **RA** | Regenerative Agriculture |
| **SHF** | Small Holder Farmers |
| **SOM** | Soil Organic Matter |
| **SRC** | Smart Regional Consultants |
| **VBA** | Village Based Advisor |
| **WAO** | Ward Agriculture Officer |

# I. EXECUTIVE SUMMARY

This business case has been developed after the implementation of the *'Regenerative Agriculture (RA) Project through the development of the pulses value chain in Eastern and Central Kenya'* project funded by Alliance for Green Revolution in Africa (AGRA). The project was implemented in Embu County by Farm Africa and in Makueni County by Cereal Growers Association (CGA) from July 2020 to October 2021. The goal of the project was to improve food security and community resilience through adoption of regenerative agriculture practices and technologies among smallholder farmers. To establish the project, the implementation partners working in the two counties identified lead farmers who were willing to 'try' RA practices by establishing 'mother' demos – plots of land of up to half an acre where they could demonstrate RA practices to other farmers. These lead farmers were known as Village-Based Advisors (VBAs). VBAs once trained, then cascaded training to 100 farmers through the mother demos established. The business case evaluates the benefits, challenges, opportunities and lessons learnt from the project. It highlights the implementation processes of RA practices and evaluates the case for widescale adoption of the practices.

The RA practices uptake varied between the two counties depending on what was most appropriate. Farmers combined different RA practices within the same plot depending on the perceived benefits. In Embu county, crop rotation, intercropping, and use of organic fertilizers was adopted by 85%, 76% and 76% respectively, of the 10,239 farmers who were included in the program. In Makueni county, cover cropping, manuring and crop rotation uptake was at 79%, 75% and 68% respectively of the 14,917 farmers who were reached by the project. This business case confirms the effectiveness of RA practices in building farmers to adapt to the effects of climate change. This success in uptake of the RA practices was attributed to:

- The benefits the farmers have realized from the application of RA practices including increased yields, soil health benefits and labour saving.
- The use of mother-baby demo approach which offered on-farm practical training or learning by doing.
- The effectiveness of VBAs in disseminating and demonstrating RA practices through mother and baby demos. Farmers were also provided with sample inputs to test out the effectiveness of RA practice on smaller plots within their farms.
- The VBAs in liaison with private input providers made it possible for farmers to access inputs on time. VBAs were anchors for input providers who found that they could access more farmers and offer better prices to farmers through their VBAs.
- Availability of profitable output markets for the produce, significantly increasing returns to farmers and further encouraging uptake of RA practices.
- Collaboration between the project and the county government.

The uptake of RA practices had good outcomes that have been showcased in this business case. Improved crop vigour and resilience, even as rains failed in some of the project sites, provided evidence that the anticipated positive effect from RA practices are possible in the long-term.

The implementation of RA also yielded innovative institutional arrangements between farmers and input providers. It stimulated dialogue that is important in entrenching appropriate extension models within counties. County governments were drawn into critical climate change discussions which led to more robust support of the RA practices. Importantly, the introduction of RA practices which combine both conservation agriculture and organic farming were shown to yield better outcomes compared to conventional farming practices. This being a learning project, the following were the key lessons learnt:

- Farmers adopted different RA practices based on the benefits associated with the practices and their appropriateness to the agro-ecological zones. This showed that the farmers had gained knowledge from the project interventions and were applying in their farms.
- The is no one size fits it all – different RA practices were combined within the same plot to have effect and this varied from farm to farm and from location to location. This showed that we cannot recommend one practice to be the best but instead we should recommend the farmer to practice what is applicable in their farms for regeneration.
- RA practices like minimum tillage, mulching, soil and water conservation, use of cover crops, have proved to build farmers resilience in areas which received low rainfall as farmers who had practiced such, harvested with little rainfall as opposed to those who did not use the practices.
- The VBA model was effective in disseminating principles and practices of RA to communities due to the underlying trust between VBAs and farmer groups.
- For the community-based extension system like the VBA model to be sustainable, there is need to house it within the mainstream government extension system.
- Access to markets is a strong driver for farmers to adopt RA practices as they become more confident on the off-taking of their produce.
- Involvement of research institutes in providing the appropriate inputs for and knowledge to farmers in different ecological zones improved outputs.
- Use of digital platforms reduced the costs to serve farmers through extension and market linkages.
- Support from the county governments was critical to convening farmers and gaining their trust and commitment to adopt RA practices.
- Women and elderly farmers were more enthusiastic in adopting RA practices. Men and youth participated to a lesser extent. The former being traditionally less involved in farming activity and the latter being impatient, often migrate from rural areas looking for quick and better remunerating jobs. This posed a threat to the adoption and sustainability of RA practices.

The business case confirms that though the evidence may not be conclusive given the short implementation window, there are interventions that may accelerate further adoption of RA. These include:

- Knowledge management and community-based learning will be central in developing more appropriate and effective interventions in RA given the varying ecological characteristics. This may mean further collaboration with tertiary and research institutions.

- Harmonization of efforts by implementing partners within and without the program accelerate the uptake of RA practices.
- VBAs will need to be supplemented with both business and financial management training and support to help them establish viable businesses within the value chains and therefore continue offering extension services. VBAs should also be supported to access low interest working capital financing.
- The involvement of the private sector is critical to sustainability especially where inputs may be inaccessible or costly. More formalized agreements and memoranda of understanding as well as clear terms and conditions between these input providers, government and farmers will further strengthen RA uptake.

This pilot project has highlighted the effectiveness of the RA practices and how they can support farmers in different ecological zones to deal with adverse climate change and degraded soil quality. The continued dissemination of these practices is likely to improve productivity, sequester more carbon emissions and improve soil health for better returns. The VBA model has also proven its potency in embedding good agricultural practices within communities and should be formalized and legalized in government policy for its sustainability.

# 1. INTRODUCTION

## 1.1 Background

Africa largely remains food insecure, and the effects of climate change threaten Africa's ability to feed its fast-growing population. In Africa, agriculture faces several challenges including low crop productivity, which affects food security and household incomes, poor soil nutrient availability due to over cultivated soils, poor fertilization due to cost, depleted soil organic matter due to low use of manure and compostable organic matter (Rufino et al., 2011). Agricultural practices affect many of the key functional and structural attributes of ecosystems in several ways (Frink, 2011). Reduced rainfall, rising temperatures, loss of vegetative cover, deforestation, desertification, soil erosion, loss of soil fertility, low input use, limited skills, and extension support, are some of the challenges that face Africa's food production systems (Bryan et al., 2011, Sitko and Jayne 2018, Birch, 2018, Mulinge et al., 2016).

Regenerative agriculture (RA) has been pointed out to have several solutions to these issues and opportunities to provide food safety and security to the growing population in Africa. According to IKEA Foundation, regeneration of the soils, land and ecosystems in general are critical success factors to food security especially in Africa. From its ability to cushion the smallholder farmers to effects of climate change, RA practices such as zero tillage systems contribute up to 30% net global warming potential. The benefits reported result from reduced carbon dioxide fluxes, with the greatest impacts after longer periods of zero-tillage management.

## I.2 Regenerative Agriculture, Rationale and Argument

Regenerative agriculture describes farming and grazing practices that focus on regenerating top soil, allowing farmers to maintain crop yields, improve water retention and plant uptake, increase farm profitability, and support biosequestration, among other benefits. Various definitions offered on RA, articulate the benefits that accrue from the practice. One such definition describes RA as practices that:

*"i) Contributes to generating/building soils and soil fertility and health; (ii) increases water percolation, water retention, and clean and safe water runoff; (iii) increases biodiversity and ecosystem health and resiliency; and (iv) inverts the carbon emissions of the current agriculture to one of remarkably significant carbon sequestration thereby cleansing the atmosphere of legacy levels of $CO_2$."*

Regenerative agriculture can be best understood through five broad principles upon which it is founded on. These are:

- Reduced soil disturbance through no-till or minimum tillage agricultural practices
- Maintaining soil cover through cover crops
- Keeping living roots in the soil as much as possible
- Creating as much diversity as possible
- Integrating animals into the farming system

These principles are important guides for full realization of the benefits of RA and to sustain agricultural production. Regenerative agriculture practices that have been found to reinforce these principles include minimum or no tillage, mulching, intercropping, use of organic manure, agroforestry, micro-dosing, and crop rotation (Giller et al. 2021). These RA practices are interrelated and are aimed at increasing the soils' organic carbon content which, supports microbes and fungi that in turn provide nutrients to plants. This carbon can be easily released from the soil through soil disturbance practices such as excessive tillage and overturning of the top soil. Apart from carbon, healthy soil has an optimal level of moisture which not only supports the growth of the crops but also the microbiome. Mulching and application of organic manure has the effect of improving the soil carbon content. The two practices as well provide soil cover, hence improving water retention while at the same time improving soil fertility and water percolation. Agroforestry, soil and water conservation measures improve the moisture content which, is further protected by mulching and cover-cropping. Crop rotation on the other hand improves the absorption and replenishment of different soil nutrients such as nitrogen and potassium, while organic manure is a natural remedy for nitrogen fixation into the soil apart from providing a wide variety of nutrients for crops.

Some of the key RA practices are highlighted in figure 1 below:


*Figure 1: A representation of Key Regenerative Agriculture Practices*

There are significant advantages for RA compared to conventional agricultural methods or systems. The argument for a shift to RA is hedged on the sustainability of the practices against other systems such as conventional agriculture, which even though has more probability of producing more food for a growing world population, is characterized by overuse of resources, depletion of land resources and irreparable damage to the environment. Existing body of scientific research on RA has found that it has several benefits including:

a) Better crop yields: RA case is hedged on the principles and practices aimed at regenerating soils and ecosystems multiple and concurrently implemented agricultural activities (Moore 2021). Therefore, shifts to RA regenerates the soil and the accumulation of organic matter and conservation of soil moisture through practices such as mulching, use of organic manure among other practices. The soil structure and microbial activity is improved. RA is premised on restoring the soil 'health' and structure and improve the soil water retention capacity. This then contributes to increased productivity in farm under RA system. While some past studies may have found that yields from regenerative agricultural systems have had mixed results, compared to previous or conventional management systems (De Ponti et al. 2012; Ponisio et al. 2015; IPES Food 2016, 2017a; Burgess et al. 2019, 3), it is noted that the use of multiple practices have a great potential to increase crop yields.

b) Restoration of soil quality: several studies have made a strong case that RA practices have high potential to restore the physical, chemical and biological quality of soils (Soto, 2021). These RA practices have the potential to restore degraded landscapes with benefits to the farmer through increased farm productivity and long-term nutritional, climate resilience and sustainability of farm enterprises.

c) Lower operating costs: RA practices such as mulching suppresses weed growth thereby reducing the cost of weeding. Minimum tillage reduces the number of operations for tilling the soil that come at a machinery and fuel cost. What would have been used to plough and re-plough a parcel of land is saved when direct sowing is done. Mixed cropping with leguminous nitrogen fixing plants, integrated pest management reduce the use of inputs such as fertilizers, herbicides, and reduce the costs of irrigation for those practicing irrigated production (Garibaldi *et al* 2017). Studies done by Food and Agriculture Organization (FAO) have shown that conservation agriculture systems save an average of 30-50 percent on fertilizer and herbicide inputs over a period of ten years (FAO, 2001).

d) Plant diversity: mixed cropping, intercropping, and crop rotation among others all contribute various benefits that improve the soil microbial nutrients and physical structure that improves plant growth and organisms in the soil (Soto, 2021). Different plants will release different chemicals and take different nutrients which affects the growth and yield of crops. Therefore, a build-up of soil organic carbon is achieved under RA. Microbial activity is also enhanced. By planting various species of trees and shrubs, biodiversity conservation is achieved under RA therefore contributing immediate benefits to the farmer and to the ecosystem.

e) Diversified incomes: intercropping, mixed cropping and crop rotation have the potential to reduce overreliance on a few crops. Climate variability and evidence from research

shows that climate impact is crop specific, mixed cropping safeguards crop failure among farmers (Birch, 2018). Additionally, most farmers are affected by asymmetrical market systems where especially smallholder farmers have depressed influence on market prices (Mršić, 2017), diversified crops provide escape pathways to dependence on limited crop enterprises. The multiple crops provide an advantage for farmers' nutrition needs where for instance legumes and vegetables provide dietary benefits to farming households. Studies including those by Wright, (2015), Zhang *et al* (2015) found that intercropping systems increase yields, contribute to higher income, and future crops on the same plot benefit from accumulated nitrogen in the soil. These present benefits of better incomes for the farmers but at the same time reduce costs of production associated with purchase of inputs, more specifically inorganic fertilizers and herbicides.

f) Promotion of climatic resilience: RA practices such as agroforestry enhances the proportion of the perennial vegetation (trees and shrubs) on the land. These provide soil cover, enhance both biological and bio-geochemical nutrient cycling, and at an ecosystem level enhances precipitation (rain). All these lead to enhancing climatic resilience. Agroforestry does reduce soil erosion and contributes to biodiversity and a healthy agroecosystem (Elevitch 2018).

g) Reduced global warming: from reduction in Greenhouse Gases (GHG) through minimum or no tillage, to reduced use of pesticides and synthetic fertilizers that are known to contribute to global warming through emissions of nitrous oxide (de Urzedo, 2013).

## 1.3 Developments in Regenerative Agriculture in Africa

Regenerative Agriculture offers the potential to create a new farming future for Africa. The radical transformation of Africa's agricultural systems presents the opportunity to revive ecosystems, amplify biodiversity and improve dietary diversity, positive impacts that will cascade across sectors and create new pathways to more prosperous, resilient and sustainable futures (Moore 2021).

Six main factors that help or hinder the use of RA within Africa include: political, economic, social, technological, legal and international factors. These include the general poor economic conditions for investment in the transition, lack of knowledge among policy makers and farmers of the benefits of RA, fragmentation of RA actors across the continent. The large differences in climate across the continent means it is more difficult to apply a one-size-fits-all model. Therefore, solutions in Africa should combine the best of RA and the potential to scale into mainstream farming.

Scientific research and climatic, ecological, social, and economic case for RA in Africa have already shown there are significant benefits from RA practices and some of the practices have widely been used with varied results. The available literature confirms that RA is an emerging practice but not entirely new to Africa as it is eclipsed by a series of more established concepts, such as 'sustainable agriculture', 'climate smart agriculture', 'conservation agriculture' and 'ecological agriculture'. Conservation Agriculture (CA) as defined by FAO and other organizations such as International Centre for Maize and Wheat Improvement (CIMMYT) is a production system that is based on three main principles of minimum mechanical soil disturbance, permanent soil organic cover and plant diversification

form part of the RA practices. Similarly, other practices such as organic agriculture which is defined by FAO as "a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity", has the main elements of RA. Regenerative agriculture however, is a broader and more encompassing farming method as it advocates for all the practices in both CA and organic agriculture. It is reported to be more comprehensive in addressing productivity and climate adaptation. Ecosystem health, biodiversity and soil biological activity still get addressed through adoption of RA practices.

Considering that RA is an add-on, and it would seem as a progression from other farming systems, it is currently at the centre of sustainable agriculture debate and in recent times is part of the Climate Smart Agriculture (CSA) agenda in Africa and more specifically in Kenya. Climate change as a constraint that threatens agricultural productivity is a critical element in the relevance and applicability of the RA farming systems. Considering that practices such as CA are already confirmed as systems[1] that strengthen smallholder resilience, RA by extension has been embraced in Africa as a solution to the threats of climate change. There is emerging body of knowledge from studies done in several African countries that put RA at the centre of sustainable agricultural practices. According to Wezel. A *et al* (2014), many sustainable practices that are part of RA practices are already adopted although in different scales and results. Therefore, from addressing climate change to improvement of soil structure, RA practices are relevant and important to sustainable agriculture and natural resource management in Africa.

## 1.4 Regenerative Agriculture in Embu and Makueni Counties of Kenya

Kenya, and specifically, Makueni and Embu Counties are experiencing climate change effects, increasing demand for food and constrained productivity of land. Soil infertility has been documented to be a significant problem among smallholder farmers in these counties. This is exacerbated by the fact that most of the populations in these two counties depend on agriculture for subsistence and economic sustenance. According to the Kenya National Bureau of Statistics (KNBS 2019) - Kenya Population and Housing Census indicate that there were at least 82% and 75% of households with livestock in Makueni and Embu Counties respectively. The negative effects of farming have therefore escalated and led to degraded top soils which in turn has led to lower productivity. Specific challenges include:

1. **Declining soil fertility** – Like many other counties in Kenya, most farmers in Makueni and Embu Counties are faced with depreciated soil resources. Overgrazing, over-cultivation, minimal soil regeneration and fertilization, and soil erosion by wind and/or water has led to low agricultural productivity in Makueni[2] (MoALF. 2016). In its CIDP 2018-2022, the County Government of Makueni identifies soil and water conservation as the first strategy towards food security, informed by the clear understanding that farmers in the county

1 https://www.frontiersin.org/articles/10.3389/fagro.2021.671690/full

2 https://cgspace.cgiar.org/handle/10568/80457

are faced with low productivity that points to the quality of soils and soil management practices. According to AGRA *Follow-up Study on RA practices (AGRA July 2021)* soil infertility is mentioned as a challenge by 51% and 49% of farmers in Makueni and Embu County respectively.

2. **Climate Change** – Increased incidences of drought, increased temperatures and erratic rainfall contribute to severe crop losses which in turn leads to famine and is a threat to the well-being of human beings and livestock. In Embu and Makueni Counties, risks and disasters associated with climate change and variability are already manifested in the drying up of rivers and crop failure. The county government of Makueni in realization of this threat to development has enacted regulations to mainstream climate change in development and established the County Climate Change Fund. Human practices like deforestation leave the ground bare. Loose soil is easily swept away by either wind or rain water run-off, reducing its fertility and therefore productivity. Poor soil and low rainfall disproportionately affect poorer smallholder farmers who cannot afford the significant investments for irrigation. According to AGRA (AGRA 2021), adverse effects due to climate change have the real effects on farmers' ability to be food secure and participate in markets and are a threat to farmers' livelihoods.

3. **Land pressure** – Increasing populations that are steeped in traditional farming methods has led to over-tillage. In the last 50 years, Kenyans have subdivided land and encouraged personal land ownership by issuing land titles. While this development unlocked an important collateral for many Kenyans, it also paved way for smaller plots against an increasing population and led to the proliferation of small holder farmers. The smaller plots tilled for subsistence increasingly became the only source of livelihood for larger family units. Practices such as crop rotation, leaving farm plots fallow for a season, intercropping and cover-cropping were abandoned for commercial mono-cropping, excessive use of fertilizer and clearing trees for firewood. This has significantly reduced the carbon and nitrogen content in the soil, while use of inorganic fertilizer has acidified the soil making it less viable. The most adverse outcome has been the reduction of tree cover that has in effect destroyed the water towers and the ability to create adequate precipitation.

4. **Poor agronomic practices** – Advances in technology driven by innovation have been shown to improve productivity of all the other resources making technology the fifth resource aside from the four traditional resources – land, labour, capital and entrepreneurship. While agronomic practices, use of information technology and mechanization have improved agricultural production globally, most of the rural SHFs have had limited access to these practices leading to increasingly low yields. With limited extension support in both counties, there is poor farming practices, poor management of water resources and soil fertility at the farm level.

5. **Gender based disenfranchisement** – Patriarchal land ownership systems have deprived women and youth access to land they can use to access financing or even experiment on with better agricultural technology. This leads to land either being misallocated to other uses or lying idle. In Kenya, women account for 50% of the national population but face substantial challenges in accessing and controlling land resources. Despite land reform efforts by the Government of Kenya and empowering women in society, there are various

factors that limit land ownership and management among women in the country. The legal issue regarding the uncertainty on land ownership and future of tenure is not conducive to making longer term decisions regarding transitioning to RA.

According to the report by the Kenya Land Alliance (2018), the representation of women on issuance of title deeds is at 10%, and 87% for men. This glaring disparity is manifested when viewed against the actual land sizes titled for women and men. The data sampled shows women own a paltry 1.62%, while men own 97.76%.

Of the specific counties implementing the project, Makueni County has only 30% of households with land titles with an average farm size of 3 acres which, hinders development and investments in the rural areas, major towns and urban centres. In Embu County, the average farm size is about 2.7 acres per household according to the *Household Baseline Survey Report* (GoK, 2014). The region is characterized by rural settlement pattern which is influenced by social economic activities, rain and soil fertility[3]. Most promoted RA technologies have been part of crop management practices among farmers. The emphasis on and addition of new approaches to RA have led to improved productivity. More women and youth can demonstrate to the landowners the potential for higher productivity and access more land for increased production.

6. **Limited support to agricultural extension –** Government backed extension services have remained a challenge in both Embu and Makueni Counties and this has deprived SHFs access to agronomic advances and good practices. Besides human capital, other challenges in delivering relevant and timely information to farmers throughout is limited by coordination, infrastructure, and resource constraints. In these counties, extension services support farmers by providing knowledge, coaching and mentoring. These services ensure that the latest and most beneficial agricultural practices are quickly disseminated to the farthest reaches of the county. Extension officers coach farmers through the production process, continually assessing progress and giving early warning should they notice that production is not going according to plan. The officers are also good community mobilisers making it easier to share good practices between farmers and demonstrate how agricultural production could be improved. The challenges facing this extension network have left farmers to their own devices leading to practices which have damaged soil health and compromised production.

All the above challenges have contributed to reduced agricultural productivity among rural SHFs, which has in turn reduced their resilience against climate change and induced food-poverty.

3 Ngeckenya.org

**Map and Profile of Makueni County**

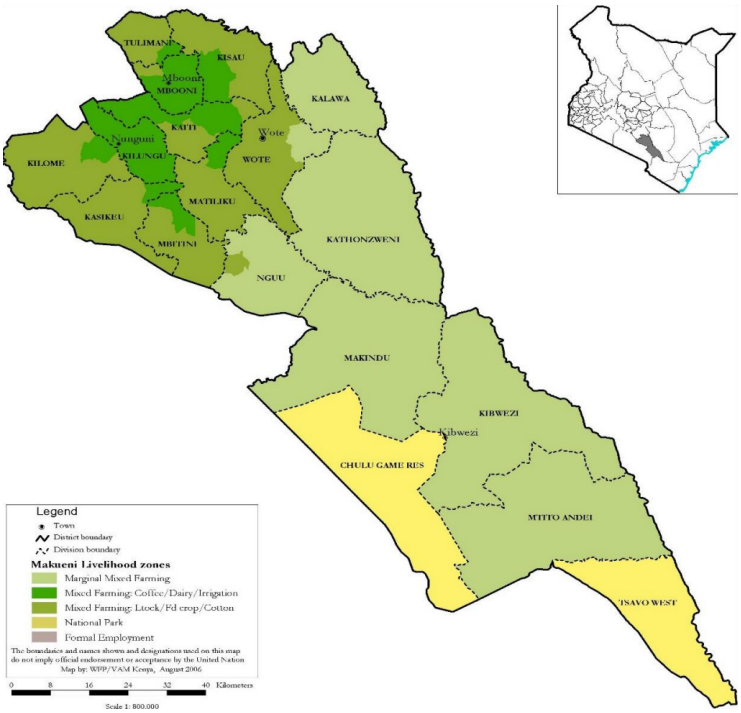


*Figure 2: Map of Makueni County*

*Source: Makueni County 2016 Short Rains Food Security Assessment Report*

## Box 1: Profile for Makueni County

### Location

The County of Makueni is located in the eastern part of Kenya. It borders Taita Taveta County to the South, Machakos County to the North, Kajiado County to the West and Kitui County to the East. It covers approximately 8,169.80, most of which is arid and semi-arid (KNBS 2021).

### Ecological Zones

The County receives long rains in March and April, and short rains in November and December. The rains are not evenly distributed across the County. The hilly regions of Kilungu and Mbooni receive about 800-1200 mm of rainfall (above normal) whereas the lower areas such as Kibwezi receive below normal rainfall of about 300 mm. The temperatures range between 20.2 and 35.80 degrees Celsius, with the hilly areas being relatively colder compared to the low-lying regions (GoK, 2013).

### Population

According to 2019 population census, the population of Makueni County is 987,653 (KNBS 2021).

**Map and Profile of Embu County**
**Embu County agro-ecological zones**

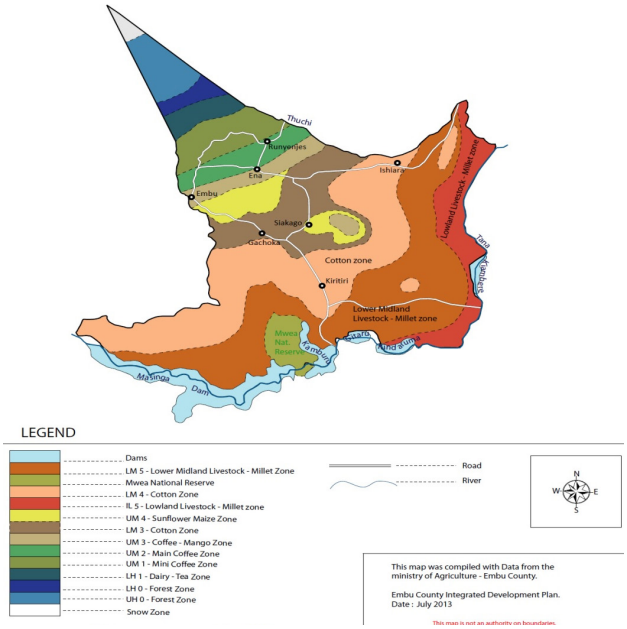


*Figure 3: Map of Embu County.*
*Source: Farm Management Handbook 2016*

## Box 2: Profile for Embu County

### Location

Embu County is a large and largely metropolitan area with a population of 608,599 persons. The county borders Kirinyaga to the west, Kitui to the east, Tharaka Nithi to the north, Machakos to the south. The county occupies an area of 2,821 km$^2$

### Ecological Zones

Embu County is characterized by highlands and lowlands. It rises from about 515m above sea level at the Tana river basin in the East to over 4,570m above sea in the North West which is part of Mt. Kenya. Embu County is served by six major rivers; four of them are, Thũci, Tana, Kiĩ and Rũvingasĩ which form part of the Embu County's boundaries. The other two rivers are Thiba and Ĩna. All these rivers are perennial. Between Embu town and Thũci river lies an area with an altitude ranging from 910m to 1,525m above sea level. The Southern part of the County is covered by Mwea plains. It then rises Northwards, culminating in hills and valleys to the Northern and Eastern parts

### Population

Embu County has a population of 516,212 (49% – male and 51% – female), according to the 2009 National census. (KNBS 2021).

**Rainfall patterns**

Rain received in the county is largely depended on the altitude ranging as 640mm to as high as 1,495 mm per annum. It has a mean temperature of 21°C. with July being the coldest with minimum of 12°C and March hitting highest temperatures of 31°C.

## 1.5 The Regenerative Agriculture Project

The *'Regenerative Agriculture Project through the development of the pulses value chain in Eastern and Central Kenya'* was implemented from July 2020 to October 2021in Embu and Makueni County by Farm Africa and CGA respectively. This was done in partnership with the IIRR and with funding from IKEA Foundation through AGRA. The implementation of RA aimed at improving food security and community resilience through adoption of conservation and rehabilitation approaches to food and farming systems among smallholder farmers.

### 1.5.1 Project objectives

- To develop and operationalize a robust village based advisory entrepreneurial business model that provides Regenerative agriculture extension service provision to farmers in Embu and Makueni County
- To enhance the adoption of regenerative agricultural technologies and practices by farmers in Embu and Makueni County
- To strengthen collaborative learning and dissemination processes of key Regenerative Agriculture technologies and practices to farmers, County Government and other stakeholders.

### 1.5.2 Project outcomes

- Enhanced extension services through a sustainable VBA business model
- Increased application of regenerative agricultural and climate smart agricultural technologies and practices by farmers
- Increased knowledge and awareness of regenerative agricultural practices among farmers and stakeholders.

### 1.5.3 Scope

- Embu County: Manyatta, Runyenjes, Mbeere South and Mbeere North
- Makueni County: Kaiti, Kibwezi West and Makueni Sub-Counties

### 1.5.4 Partners and their roles

**Farm Africa**

Farm Africa was working in Embu County with other key players in the implementation of the project for an estimated 10,000 smallholder farmers through community level extension

service provision by 100 Village Based Advisors (VBAs) over a period of 16 months. The selected pulses for this project were maize, climbing beans, bush beans and soybeans.

**Cereal Growers Association (CGA)**

CGA worked with other actors in the implementation of the project in Makueni County for an estimated 10,000 smallholder farmers through community level extension service provision by 100 Village Based Advisors (VBAs) over a period of 16 months. The selected pulses for this project were sorghum, green grams, beans, pigeon peas and cowpeas.

**International Institute of Rural Reconstruction (IIRR)**

IIRR came in as the learning partner to ensure that the key project activities, evidence, lessons, success factors and case studies were documented and disseminated to key stakeholders and the general public to facilitate replication and scale of RA practices as a sustainable pathway for resilience building in Africa's agricultural transformation.

### 1.5.5 Regenerative Agriculture Practices Promoted in Embu and Makueni Counties

At the onset of the project, farmer needs assessment was conducted in each county to identify current farmer practices and propose specific RA practices suitable for the different agro-ecological zones within the counties. The assessment was done in a participatory way with farmer representatives, VBAs, frontline extension staff, KALRO, input suppliers and other stakeholders promoting similar initiatives. The RA practices selected were validated for demonstration in the mother demos by the VBAs training and baby demos by the farmers for awareness creation. Different RA practices were combined within the farming system for optimum results. Box 3 below briefly describe the selected RA practices in Embu and Makueni Counties.

**Box 3: RA practices promoted in Makueni and Embu Counties**

1. Minimum Tillage
2. Agroforestry
3. Intercropping/crop rotation
4. Use of cover crops
5. Organic/compost manure
6. Micro-dosing
7. Soil and water conservation structures
8. Mulching
9. Inoculation

By July 2021, CGA reported that 14,917 (73% female, 27% male) farmers had been reached by RA practices in Makueni through the project with 114 VBAs having been trained to support them. In total, 120 Mother demos, 6,650 baby demos and 103 tree nurseries had been established. In Embu County, the project reached 10,239 (66% female, 34% male) farmers

and 134 VBAs have been trained. In total, 134 Mother demos and 5,600 baby demos were established. Figure 4 below shows the gender and age disaggregation of the farmers reached in the two counties.

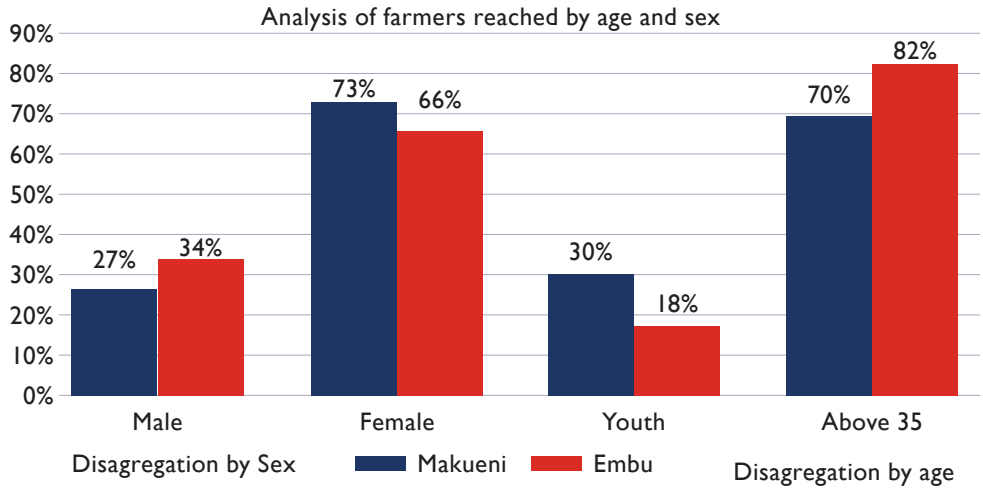


*Figure 4: Farmers reached by the Regenerative Agriculture Practices in Embu & Makueni Counties.*

*Source: Farm Africa & Cereal Growers Association Field Data, August 2021*

# 2. REGENERATIVE AGRICULTURE - THE CASE OF EMBU AND MAKUENI COUNTIES

There has been a rising interest in regenerative agriculture worldwide due to its potential as a sustainable pathway for resilience building in agricultural transformation, especially in Africa. However, this interest is contrasted with the lack of documented evidence proving or disapproving its effectiveness. Many of the knowledge gaps arise from basic lack of data at both the field and system scales, which undermines the modelling of the benefits of regenerative agriculture. The learning agenda for the RA project included documenting of the business case for RA using the evidence and lessons learned through implementation. The methodology for documenting the business case is outlined in box 4 below.

**Box 4: Methodology for documenting the Business case**

To develop the business case, the project worked with International Institute of Rural Reconstruction (IIRR) to implement an elaborate learning agenda and generate knowledge from the two agro-ecological zones (Embu County – humid; and Makueni County – semi arid). The RA project collected both qualitative and quantitative data to help in answering key learning questions (see Appendix 8.1) on the key success factors for adoption of regenerative agriculture anchored on VBA extension model. The data collection process used a combination of empirical approaches that included research-type information mining and participatory approaches to build both quantitative and qualitative information. This was done through Focused Group Discussions (FGDs) with farmers and VBAs, Key Informant Interviews (KIIs) with different stakeholders (County Governments) and Value chain actors, project partners and review of existing literature and documents. Quantitative data was drawn from the monitoring activities of CGA and Farm Africa. The qualitative learning questions for the project were framed around the project outcomes. To enhance participation and ownership of the knowledge management and dissemination process, the learning questions were validated by key stakeholders.

## 2.1 Uptake of Regenerative Agriculture practices in Embu and Makueni Counties

### 2.1.1 Embu County

The practices reported as having the highest uptake in Embu County included crop rotation, intercropping, use of organic manure and micro-dosing among others as shown in figure 5 below.

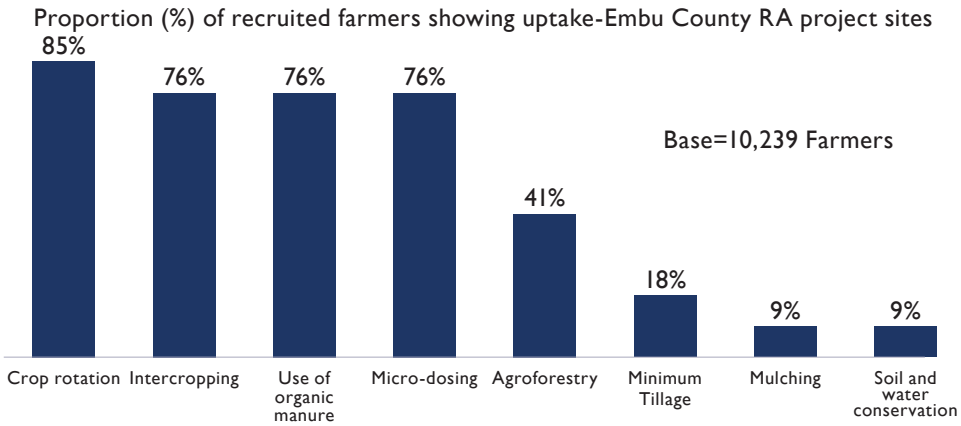


*Figure 5: Regenerative Agriculture Practices Uptake in Embu County*

*Source: Farm Africa Field Data, August 2021*

In addition, farmers were trained on inoculation which enhances nodulation for nitrogen fixation in legumes.

### Box 5: Demo plot whets Gichovi's appetite for improved yields

*Gichovi showcasing his demo plot with improved maize and beans inter-crop*

Over the years, Geoffrey Gichovi, 50, has been getting less than a 90kg bag of maize in a year from his quarter acre piece of land. This is due to declining soil fertility caused by continuously farming on his small farm without taking care of the soil. More so, the father of two from Kagumori village, Nginda ward of Manyatta sub-county has been planting a maize variety that takes 7 - 8 months to mature; a practice that is common with most farmers in the region.

In November 2020, Gichovi learnt about regenerative agriculture from his neighbour's baby demo plot. The neighbour had been trained, through the RA project, by his Village Based Advisor.

"I was quite impressed by how beautiful the demo plot looked, and I wanted my farm to also look like that," he says.

This made him look for the VBA, and enlist for the training. Just like the other farmers in the project, Gichovi learned about organic manure, use of fertilizers, mulching, inter-cropping, minimum tillage, agro-forestry, crop rotation and other good agricultural practices such as spacing, crop protection and post-harvest handling of maize.

After the training, he prepared his land and applied minimum tillage, and planted maize and climbing beans inter-crop. He planted certified maize seed, and used organic manure, micro-dosing fertilizer, and also followed keenly the VBA's advice on spacing and crop protection.

From his quarter acre plot, his yields increased from a quarter (100kg) bag to 2 (100kg) bags of maize and 2 (2kg) tins of beans. He is also happy that the maize has matured in 3 ½ months compared to the conventional one that took 8 months.

"Our parcels of land have reduced over the years due to fragmentation, and with low production we have been experiencing as farmers, we have been food insecure. However, with regenerative agriculture, we will be able to do commercial production from our small farms," he explains. From his last season's harvest, Gichovi now has enough maize and beans to feed his family and poultry. He says this has lowered his cost of living.

### 2.1.2 Makueni County

In Makueni County, some of the RA practices that farmers reported high uptake included cover cropping, manuring, crop rotation and minimum tillage among others as shown in figure 3 below.

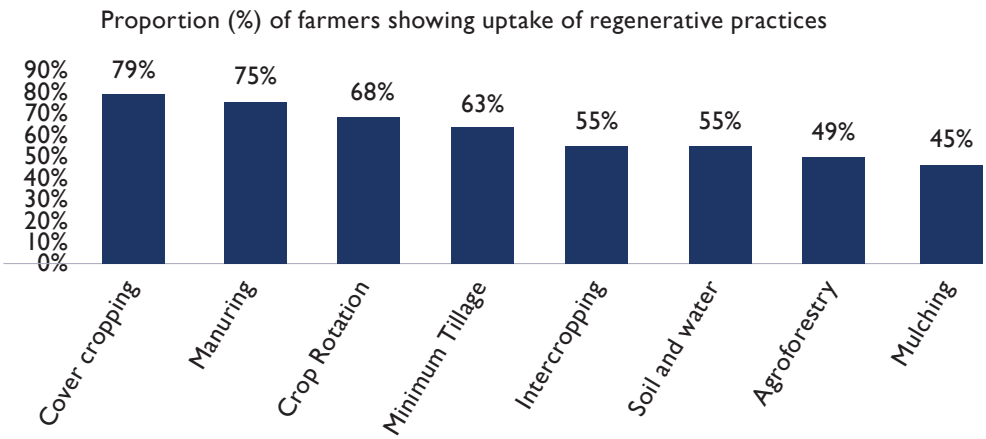


*Figure 6: Regenerative Agriculture Practices Uptake in Makueni County*

*Source: Cereal Growers Association Field Data, August 2021*

These RA practices are discussed below in detail:

1. ***Intercropping:*** This practice was reported by 55% of farmers in Makueni and 76% in Embu. Intercropping as an RA practice has been supported by literature that it improves soil fertility through nitrogen fixation by legumes. In the two counties where this practice was implemented, cereals were intercropped with pulses. The farmers, VBAs, government extension staff members and input suppliers reported there were significant ecological and economic interactions between cereals and legumes. Intercropping with legumes helps fix nitrogen and provides soil cover necessary to prevent loss of moisture, which is utilized during the crop cycle.

   These lessons are backed by empirical studies on conditions similar to the context of Embu and Makueni Counties. Intercropping practice, though it requires more care of crops during the growing period, has been proven to have several positive impacts including lower resource use, increased yields per unit of land with low-input use (Maitra, et al. 2021, Vanlauwe, 2019). Other projects have demonstrated farmers' capacity to embrace and draw benefits of intercropping cereals and legumes. For instance, CIMMYT past interventions to support the adoption of intercropping and other sustainable agriculture techniques in Makueni document successful adoption of intercropping with positive results.

2. ***Crop Rotation:*** This was reported by 85% of farmers in Embu and by 68% of farmers in Makueni. Some of the benefits reported from surveys conducted with farmers indicated the benefits as reduced pests and disease infestation and improved soil fertility. A great advantage of crop rotation comes from the interrelationship of nitrogen-fixing crops with nitrogen-demanding crops. Legumes, collect available nitrogen from the atmosphere and store it in nodules on their root structure. When the plant is harvested, the biomass of uncollected roots breaks down, making the stored nitrogen available to future crops. In addition, legumes have heavy tap roots that burrow deep into the ground, lifting soil for better tilth and absorption of water. The use of different species in rotation allows for increased soil organic matter (SOM), greater soil structure, and improvement of the chemical and biological soil environment for crops. With more SOM, water infiltration and retention improve, providing increased drought tolerance, and decreased erosion.

3. ***Mulching***: This was reported by 9% of farmers in Embu and 45% of farmers in Makueni. In Embu County, adoption was low as the area is humid and most of the biomass is used to feed livestock in comparison to Makueni County which is semi-arid and farmers use mulching to conserve soil moisture. Mulching reduces soil water loss and improves soil structure, improves soil microorganisms, protects bare soils, reduces erosion and soil compaction. All these favour soil microorganisms that enhance soil biological health and increase benefits of broad RA practices to farming. "It is well documented that mulching is beneficial to the soils and improves production" (Iqbal et al, 2020, Kader, 2017). Generally, farmers are presented with competing interests to find mulching material as the same plant materials are used as fodder or forage for animals.

4. ***Use of Organic Manure***: This was reported by 76% of farmers in Embu and by 75% of farmers in Makueni. While organic manure has previously been used by the farmers, the challenge has been the quality of the manure used and the application rate. The project trained farmers on proper use and application of the manure in the mother demos. Use of organic manure and specifically farmyard manure from livestock waste has taken root as an RA practice as most farmers in the two counties already practice mixed farming. The 2019 Kenya National Housing

and Population Census, reported that at least 82% of farmers in Makueni and 75% in Embu keep livestock. This therefore shows that organic manure (animal waste) is readily available in most households.

5. ***Minimum Tillage:*** The uptake of minimum tillage was at 63% in Makueni and 18% in Embu. In Makueni County there was higher uptake as being semi-arid, farmers are keen on moisture conservation in comparison to Embu County which is more humid. In Makueni farmers used ripping, zai pits and planting basins methods of minimum tillage, while in Embu, farmers used zai pits, hand weeding and slashing. Farmers who applied minimum tillage practices reported reduced labour and tilling related costs. Tillage practices that cause no or minimum disturbance to the soil structure have been proven to reduce loss of water from soils, improve the soil health, plant growth and the environment (Busari, 2015). When soils are left undisturbed, abundance and diversity of soil microbes increase, driving improved soil microbiome communities and soil structure. These improvements provide both ecological benefits as well as resiliency to crop stressors, crop quality, and ultimately yield. Ecologically, these practices improve soil structure, reducing both wind and water erosion of soils, reduce agricultural run-off into watersheds, and aid in soil carbon sequestration. On the farm, as some regenerative agriculture theories suggest, growers adopting reduced or no-till practices may see many changes that will benefit their bottom lines economically while rebuilding their soils for future generations. Additionally, there are cost reduction opportunities for growers, including reduced tilling soils, reduced requirements for fertilizers, and more efficient use of water resources. Altogether, reduced or no-till practices are key regenerative agriculture practices that will provide valuable benefits in both the near term as well as rebuilding soils for generations to come.

6. ***Micro-dosing:*** This was reported by 76% of farmers in Embu County but the practice was not tracked in Makueni County. The application of well decomposed organic manure reduces the use of inorganic fertilizer and enriches the soils. Majority of the farmers in the Embu RA project sites confirmed the use of micro-dosing as a method of supplementing mineral deficiency in their farms. Micro-dosing involves the application of small, affordable quantities of fertilizer with the seed at planting time or as top dressing 3 to 4 weeks after emergence. This enhances fertilizer use efficiency instead of spreading fertilizer over the field and improves productivity. Rather than asking how a farmer can maximize her/his yields or profits, micro-dosing asks how a farmer can maximize the returns to a small initial investment that might grow over time, turning deficits into surpluses.

7. ***Agroforestry***: The uptake of agroforestry was at 49% in Makueni and 41% in Embu. The trees planted included *Calliandra calothyrsus, Leucaena Spp.* and *Gliricidia sepium* in Embu and Citrus, Mango, *Moringa oleifera*, *Grevillea robusta* and *Gliricidia sepium* in Makueni. In Makueni County, 44% of the agroforestry trees planted are fruit trees, 34% timber, 31% nitrogen fixation trees and 19% medicinal (CGA August 2021 Survey). Farmers embrace agroforestry owing to the benefits of nitrogen fixing, fast growing and the vegetative leaves which provide the canopy and are fodder for livestock. Farmers appreciate that the deep-rooted trees increase soil pH, nutrient content, and crop yields. In some areas, agroforestry trees provide sticks for support for the climbing beans. Agroforestry employs a broader array of tools with the goal of altering large agriculture landscapes in ways that provide broad environmental, social, and economic impacts. It incorporates cropping between the rows of trees, forest farming, riparian forest buffers between crops fields, watersheds, and windbreaks. When combined in a deliberate planned and managed fashion, these practices increase plant diversity, soil health, reduce

agricultural run-off, guard against soil erosion, and provide habitat for native flora and fauna to thrive. Economically these practices provide additional revenue streams by employing practices such as forest farming, growing a second crop between rows of a tree crop, utilizing wildlife that thrives in riparian forest buffers, and allows for the integration of grazing with tree operations.

8. **Cover-cropping:** This was mainly promoted in Makueni County with 79% of the farmers reporting uptake. The main crops used included beans, cowpeas, pumpkins and *Dolichos lablab*. Farmers reported enhanced soil moisture, conservation suitable for the crops during the crop production cycle, reduced cases of weeds as well as reduced soil erosion on the uptake of the practice. Promoting more continual plant and root growth in soils is key to soil health. Cover crops can be excellent scavengers of excess nutrients left in the soil after crop harvest. They can incorporate the nutrients into their biomass, store, and then recycle excess nutrients until needed at the beginning of the next planting season. Cover cropping will also reduce potential fertilizer leaching into watersheds and groundwater and help to reduce agricultural run-off. Leguminous cover crops are used to fix nitrogen from the atmosphere into the soil, reducing the need for nitrogen fertilizers the next season. In some permanent crop systems, cover crops can be interspersed between rows. Keeping soils covered reduces the risk of possible soil erosion, suppresses weeds, and can even provide pollinator habitat. Cover cropping is a key tool that can help to sequester carbon from the atmosphere into soils, recycle nutrients, reduce the need for synthetic fertilizers, reduce agricultural run-off, and promote better soil biology and structure. This is a key tool that can add value to your bottom line while also regenerating your soils for optimal crop productivity and health.

9. **Soil and water conservation structures:** The uptake of this practice was at 9% in Embu County and 55% in Makueni County. In Embu, the use of soil and water conservation was not promoted as an RA practice, but in Makueni the uptake was higher because farmers had understood the benefits emanating from the use of the structures. Farmers who developed soil conservation structures had reduced soil erosion, improvement of soil structure, and better yields because of soil moisture conservation.

## 2.2 Drivers for Regenerative Agriculture uptake

The following were identified as the drivers for RA practices uptake:

1. **Improved and/or more predictable yields linked to healthier soils**

While this project was implemented for two growing seasons, early results on uptake of RA practices demonstrate double or in some cases triple outputs from the same plots of land that had previously performed poorly. In Embu, 55% of the farmers and 84% of the farmers in Makueni County who had adopted RA practices reported that their crops exhibited strong vigour and achieved improved yield. Regenerative Agriculture practices which included the application of fast-maturing crop in soil whose moisture had been conserved through mulching, manure application, micro-dosing and cover-cropping meant that farmers were able to reap the benefits of early produce that hits the market before the bulk of the produce becomes available commanding better prices.

**Box 6: Seeing, learning and doing: How Catherine and Mary from Makueni and Embu Counties are getting more food secure**

*Catherine Mbili shows freshly harvested sorghum from her demonstration plot after using RA practices. /Photo: CGA*

*Mary doing second weeding to her soy beans.*

Catherine Mbili from Makueni County and Mary Mukonyo from Embu are two smallholder farmers who have experienced low productivity over the years due to climate variability, poor soils and poor farming methods. Lack of access to extension services also compounded their problems, and they could not produce enough food for their families.

For Mary, every season she used an ox-drawn plough to till her farm where she would later plant maize and green grams as inter-crop. On average, she harvested one (100kg) bag of maize and 5 (100kg) bags of green grams from the 5-acre farm, on a good season.

In November 2020, she was chosen by Farm Africa, as one of the farmers in her Kathanyaga village to be trained by the village-based advisor on regenerative agriculture practices.

After the training, Mary applied minimum tillage, mulching, use of organic manure and inter-cropping on her farm just the same way she was trained.

"I saw this as a big opportunity for change, and through the project, I have also learnt about other crops like soybeans, business skills like record-keeping, crop spacing, use of certified seeds, post harvest handling and aggregation of produce.

For Catherine, she got involved in the project in October 2020. She is a lead farmer who was trained as a VBA, but has also applied the RA practices in her farm. She has established mother demo plots to showcase how to increase production through the use of RA practices such as minimum soil disturbance or zero tillage, cover cropping, inter-cropping, crop rotation, organic manuring, use of organic mulch, agroforestry, planting drought tolerant crops, use of certified seeds, and soil and water conservation structures such as terraces and basins.

As a result, both farmers have realized improved and more predictable yields. For example, Mary has since increased her yield to 3 (100kg) bags of maize and 5 (100) bags of green grams. She has also introduced soybean, as a variety crop, from which she got 80kgs. She sold the 80kgs of soybean at Ksh. 70 per kg, earning her Ksh. 5,600. From this harvest, she now has enough food for her family and poultry. For Catherine, the sorghum yields have increased more than threefold. "I have had about 40% increase in crop yields," says Catherine.

2. **Accessible community-based extension services through the VBAs**

As at August 2021, 10,239 and 14,005 farmers in Embu and Makueni respectively had accessed extension services through VBAs. The VBAs therefore stepped in to bridge knowledge and capacity gaps and encourage farmers to adopt agricultural practices and technologies. As a community-based resource that is known and trusted, VBAs have been found to easily work with farmers to transfer knowledge, reinforce lessons and demonstrate the best practices. The VBAs used on-farm training through use of demonstration sites which consistently supported the uptake of RA knowledge and practices. VBAs are trusted community leaders and this made it easier for farmers to implement what they recommended. Other aspects of the VBA model that made it easier for RA to be adopted included simplified RA manuals that were shared with the farmers. The VBA model was also supported by the county governments which further reinforced the farmers' confidence in their work. *Refer to Chapter 4 for details.*

3. **Increased access to inputs**

VBAs aggregated input demand and negotiated for lower bulk prices which benefited farmers in both Counties. Input providers also distributed sample inputs through the VBAs which the farmers could experiment on in their baby demo plots and confirm the viability of RA practices. Longer term linkages between the input providers and the farmers were also established. The VBAs provided last mile delivery of inputs reducing the cost of accessing inputs. VBAs also came with specific local knowledge which helped to modify RA practices to meet local needs.

**Box 7: Counting the gains: Makueni's Fridah Muendo benefits from increased access to inputs**

The village of Kinyongo in Kaiti Constituency of Makueni County was once known for its maize production. Not anymore. Today, it struggles with the impact of rainfall variability due to climate change and land degradation. Farmers like Fridah Munedo also lack access to supportive extension services and weak link to input supplies and markets.

However, in October 2020, Fridah, 33, was recruited and trained by the Regenerative Agriculture (RA) project. She established the Kinyongo Farmers Self Help Group and, in turn, trained 73 of its members on RA practices through mother and baby demos. He engagement with the project got her linked with private companies supplying farm inputs and services. This increased access to inputs enabled her to start using inputs such as certified seeds and fertilizer for micro-dosing on her farm. This enabled her to inter-crop pigeon peas, maize, and cowpeas. She also established a tree nursery to help with soil conservation, and built terraces to conserve water.

From only 3 (90kg) bags of maize per acre, her production doubled to 6 (90kg) bags per acre after applying the RA practices. In addition, Fridah developed business skills and has been linked to grain value chain actors. She set up a cereal store where she off-takes grains from farmers. She also sells post-harvest handling equipment such as hermetic bags, hand shellers and tarpaulins. That has increased her monthly net income from Ksh. 10,000 (about US$99) to Ksh. 30,000 (about US$272). Her living standards and that of her family has improved.

4. **Access to Remunerative Outputs markets**

At the end of each season, VBAs were instrumental in aggregation and market linkages for farmers. Farmers who were part of the project were connected to the market directly through the aggregation of their output and bargaining for better prices. In Embu County, 6,553 and 3,133 farmers in Makueni accessed markets. Trading platforms such as Agri-view in Embu and Farm Shine in Makueni and other more publicly available communication apps such as WhatsApp were used to aggregate demand for produce and connect to the farmers who had the produce in demand. This reduced the cost of middlemen. Market access is a critical motivation to farmers achieving economic benefits and sustaining practices. Price points of farmers' produce and costs to access markets are therefore intertwined in the decision to undertake a farming enterprise. Contractual arrangements between farmers and aggregators boosted the uptake of RA practices due to the ready market for surplus produce. For example, a contract with Bulto Foods resulted in 127 farmers aggregating 2.78 tonnes of Soyabean in Embu.

### Box 8: Getting farmers to earn more through off-taking and linkages: Margaret Muunde's story

*Margaret at her demo site.*

*Margaret with her bush beans harvest from her demo plot.*

For the 54-year-old Margaret Muunde, a VBA from Makima ward of Mbeere South Sub-county in Embu County, the cooperative has been her best bet for linking farmer produce to markets.

Besides being a VBA, Margaret is also the chairperson of Makima Cereals Cooperative, a position that puts her directly in charge of overseeing off-taking of cereals in the area.

In her work as a VBA, Margaret has, to date, trained 250 farmers on regenerative agriculture practices, and most of these farmers have recorded improved yields. "My aim is to ensure all farmers in this region are food secure, while those who have surplus have access to markets," she explains.

From her 5 acres of land Margaret harvested 2,000kgs of maize and 150kgs of green grams after applying the RA practices, compared to 1,000kgs she used to get before the project. She sold part of the produce, through off-taking, earning her Ksh. 40,000, money she used to pay college fees for her son.

"We had to form the cooperative to act as an aggregator and to increase our access to reliable and remunerative markets because improved yields would result in surplus," she says.

Currently, through the cooperative, she is selling green grams at Ksh. 100 per kilogramme, compared to Ksh. 60 offered by middle men, and this will assist farmers to earn more, she adds.

Farm Africa has, through the cooperative, linked farmers in the region to private farm input and service providers.

5. **Collaboration with the county governments of Embu and Makueni**

The project worked closely with the Ministry of Agriculture in both counties, key stakeholders and value chain actors. The county governments also have related programmes and the RA project partnered with them for leverage. During the project inception, the CECM and other Ministry of Agriculture staff welcomed Farm Africa to the region. The WAO and FEO assisted in the recruitment of VBAs. They also carried VBA and farmers needs assessment which assisted the project to in determining the value chain selected and validating the RA technologies promoted in the various wards in Embu County.

6. **Climate resilience**

There is a consensus that conventional agricultural systems are detrimental to environmental functioning and are not compatible with sustainable soil and biodiversity management. Regenerative agriculture leads to healthy soil, capable of producing high quality, nutrient dense food while simultaneously improving, rather than degrading land, and ultimately leading to productive, profitable farms and healthy communities and economies. Farmers who adopted RA found that their crops were more resilient especially during the depressed March-April-May (MAM) 2021 rains in Makima in Embu and similarly around Kibwezi in Makueni.

### Box 9: Makueni's Monthe gets skills to cope with erratic weather patterns

*After learning RA practices to better cope with the effects of climate change, Silvania Monthe, a VBA and farmer in Makueni County, shows off the green maize plants in her mother demo plot / Photo: CGA*

Silvania Monthe, a farmer and VBA in Wote/Nziu ward, Makueni County, experienced limited access to extension services for a very long time, and continued getting low yields, sometimes even nothing, after tilling her farm.

However, after being trained by the project, she applied the practices on her own land. She established a demonstration plot (mother demo) in her farm, which she used to learn and train other farmers as well.

The farmers who learnt at her demo plot noticed that plots with improved farming practices showed resilience despite poor rains in the season, and yielded more than double the amount of maize in the control plot. The section planted with conventional methods had dry soil and maize stalks with yellow leaves; a sign of nitrogen deficiency. Where Monthe planted maize with legumes, the maize stalks were greener, taller and visibly stronger, showing resistance to the effects of climate change.

For Monthe, RA means more resilience, which leads to more food to feed her children, more produce to sell, and more income to support her family, and stocking her agrovet shop. She is currently sharing these practices and results with 150 other smallholder farmers in her community.

## 2.3 Limitations to the uptake of RA Practices

Whereas the implementation of RA has been largely successful there are a number of challenges identified that will inform the development of future programmes. Some of these challenges include:

1. **Limited VBA capacity** – Even with clear benefits of the VBA model, the capacity, facilitation and ability of the VBAs to reach farmers was not without its challenge. Some of the VBAs lacked performance rewards/incentives to motivate them to reach and support farmers. Poor state of the roads and lack of reliable transport to visit farmers regularly, poor market facilities to serve as aggregation centers, and high costs of operation against poor returns from sale of inputs all affected VBAs efficacy and effectiveness. Most VBAs were not tech-savvy and didn't have smart phones meaning they couldn't participate effectively through the available mobile platforms such as WhatsApp.

2. **Policies and regulatory environment** – Agriculture is a devolved function and the county governments were to cascade agriculture policies. However, this has not happened in the last 8 years, due to limited resources and capacity. The enactment of policies that support community level extension services and deliberately focus on managing the adverse effects of climate change are key to the institutionalization of RA practices.

3. **Access to inputs** – Whilst it is envisaged that the VBA model would address the gaps in input access, low-income levels among targeted farmers and the high cost of inputs limit their access to inputs.

4. **Access to specialized machinery** – Rippers in Makueni were difficult to obtain which slowed the uptake of some RA practices like minimum tillage and conservation agriculture. Mechanization and access to hardy tools to carry out some of the farm activities for example shallow weeders and spring jembes for planting basins that are being advocated for under RA in Makueni were not readily available to most farmers.

5. **Reliance on erratic rain-fed agriculture** – As witnessed in both counties the rains in some of the project sub-counties was very low and unpredictable leading to total crop failure. It is important that institutional arrangements are mobilized to provide alternative sources like irrigation water.

6. **Drop-out of farmers and VBAs** – The project experienced drop out in both the VBAs and farmers with some elderly farmers depending on non-participating workers to implement RA practices on their behalf. Some youth who generally are very mobile did abandon RA training and practices at the demo sites and migrated from the project sites. In Embu for example, there were 31 VBAs who dropped out, of these 16 were youths while in Makueni there were 9 dropouts of which 5 were youth. The youths were unwilling to commit to the project due to lack of quick direct monetary incentive.

# 3. DELIVERY MODEL FOR REGENERATIVE AGRICULTURE

Agricultural extension' describes the services that provide rural people with the access to knowledge and information they need to increase productivity and sustainability of their production systems and improve their quality of life and livelihoods. Recent developments in agricultural policies have re-emphasized the importance of extension services (extensionists are technically qualified individuals who provide outreach services to rural areas). However, models of extension based on government services or private agro-dealers and service providers are not sufficient to meet the needs of farmers in less favoured areas. This is due to a number of factors including the necessity to respond to the specific technological needs of farmer in different agroecological zones; high transaction costs of reaching remote areas; the need for localized crop and livestock management solutions suited to tough environmental conditions, which are often not well understood by extension agents trained for work in high potential areas; and, the challenges of finding professional extension specialists willing to live and work in remote, and sometimes insecure areas (Coupe, 2009; Rivera, Qamar, and Crowder, 2001).

Community-based rural agricultural extension model is based on the idea of providing specialized and intensive technical training to one or two people in a community who then promote a variety of appropriate technologies and provide technical services with occasional support and review from a supporting organization (FAO, 1997). This model is demand-based in that the providers of service are contracted directly by farmers' groups or communities to deliver information and related services that are specified by farmers (Feder et al, 2010; Rivera, 2001). These models have generally experienced a high degree of success in terms of discovering or identifying productivity enhancing technologies, which are then widely adopted. They have also been able to do so at relatively low cost (Scarborough, 1995).

A wide range of roles are assigned to community based extensionists (Lopez in Scarborough et al. 1997). These can be looked at under four main areas:

- **Liaison and mobilization** – The importance of Community Based Extension (CBE) as a link between communities and development organizations is recognized by most of the programmes studied. The two-way link supports articulation of demand for technologies and services by communities through CBEs to the service provider (though evidence of impact on service provision is limited).
- **Training farmers in new technologies** – Increasing smallholder agricultural production and livelihoods through the adoption of improved technologies.
- **Role model on farming and natural resource management** – The potential for positive influence of a CBE provider – who has achieved food security, income and status through farming.
- **Facilitating community development** – The development model of building capacity of communities to plan for their own development and effectively access government, civil society and private sector services has been adopted.

The National Agriculture Sector Extension Policy (NASEP 2012) recommends a pluralistic approach to extension service delivery. The policy provides guidance and a framework that brings on board the public and private sector extension service providers to strengthen and

develop a well-coordinated, decentralized, multi-sectoral and multidisciplinary extension system. This will in the long-term lead to a fully commercialized extension service delivery. The ratio of frontline extension worker to farmers is about 1:1000 compared to the desired level of 1:400.

The Agriculture Extension Strategy (GoK, 2017) that sets standards for the provision of a pluralistic extension system for all stakeholders sets minimum technical staff to farmer ratio based on the farming system in question. For intensive farming systems the ratio is 1:700, for agro-pastoral systems the ratio is 1:640 and for pastoral systems the ratio is 1:1,000. In Makueni County, the ratio of county extension officer to farmers is about 1:1,099 (176 county extension officers for 193,531 farming households). In Embu County, the ratio of county extension officers is about 1: 725 (200 County extension officers for 1,450,000 farming household). To bridge the gap between the existing ratio, the VBA Model was introduced in Embu and Makueni Counties to implement the RA project.

The VBA model solved several challenges that have been exacerbated by the limited support of the government managed extension services. These challenges include:

1. A very low extension officers to farmer ratio – a low ratio meant that the extension officers could not pay sufficient attention to different farmers and follow them through a production cycle. Farmers have therefore received inadequate support in accessing the latest farming technologies.

2. Inadequate technical training for the remaining extension officers which further impaired their ability to serve the farmers.This means that farmers' evolving needs are not adequately met further dissuading farmers from participating in agricultural production.

3. Declining productivity due to poor farming practices has further depressed economic returns from agriculture, significantly reducing the workforce available for agricultural production. Without reliable extension services that can support production, more young people have migrated to towns and cities searching for alternative employment.

4. The need to support farmers to deal with climate change which, means that farmers must adapt early maturing varieties and improved soil management practices.

5. Vastness of the two counties also meant that the few extension officers could not cover the counties, and this was aggravated by inadequate transport and facilitation.

The success of the VBA model is premised on the proximity to farmers and communities that the VBAs served. The farmers selected as VBAs were trusted community members. The VBAs were then trained on RA practices and business development skills. They established mother demos in their farms to demonstrate the different RA technologies which acted as training sites for farmers. The trained farmers established 'baby' demos to test and disseminate the technologies learnt from the 'mother' demos. The farmers then scaled production using the RA practices after confirming the benefits on their plots or at the 'mother' demo sites. This approach was instrumental in driving adoption of RA practices in both counties. In total, 134 VBAs were recruited in Embu, while Makueni recruited 114, significantly reducing the ratio of extension officers to farmers.

VBAs serve as community mobilisers, which encourages peer-to-peer learning and exchange of information. They work closely with input providers to improve the access to high quality inputs.

### Box 10: Makueni's Wanja excels in availing input to farmers

*Immaculate harvesting her improved sorghum crop*

Five years ago, Immaculate Wanza, a 40-year-old mother of three, had nothing to celebrate from her hard labour on her farm in Makueni County. The perennial droughts and poor soil fertility affect farming efforts, and results in low crop yields.

After she was recruited into the RA project in October 2020 by the Cereal Growers Association as a Village Based Advisor (VBA), Immaculate Wanza took up her role to train farmers as well as aggregating demand for input and post-harvest supplies with gusto.

She immediately became a change a agent in her Kwethelu village, as she trained farmers by showing and doing. Besides her healthy sorghum farm that won the hearts of many farmer 'trainees', and hence rising the number of those requiring farm inputs, Wanza also, through the project, was linked with value chain actors including input suppliers.

As a result, she organized linkage meetings and trainings between farmers and output buyers. Using the linkages, Wanza has established an input provision model where she recruits the farmers who adopt the RA practices, and thereby creating and aggregating demand for the input. On the other hand, with the linkages, she gets the inputs supplied to the farmers. Wanza aggregates seeds and other relevant inputs for farmers. This has increased her net income from about Ksh. 6,000 (about US$ 54) to Ksh. 20,000 (about US$ 181) a month. She has aggregated demands for Hermetic storage bags and other post-harvest handling technologies.

Wanza remains one of the 114 VBAs working with to complement extension workers capacity to reach farmers in Makueni County.

In Makueni, the county government has expedited the implementation of policies that support community-based extension system, (CIDP, 2018-2022) while in Embu the county government is exploring policies that need to be enacted to support the model. VBAs also support and invigorate value chains through produce aggregation which improves the bargaining power of farmers and gets them better prices from the market. By aggregating input demand, VBAs can negotiate lower prices for the inputs needed by the farmers. Additionally, the market linkages were enhanced by the adoption of digital platforms which included the Agri-view, Agri-Bot and WhatsApp that connected farmers to markets enabling a faster transfer of demand and supply information from the market to the farmer and vice versa. In Embu, aggregated farmers were supported to access index-based insurance which further strengthened the value chain. These disparate gains have greatly improved the uptake of RA in the two counties and the VBA model has proved to be a powerful vehicle for dissemination of the practices.

Sustaining the momentum of VBAs reaching farmers is critical to making agriculture have a lasting positive impact on farmers and the farming community. It is in this regard that a business case has been developed for the VBAs building on critical success factors.

## 3.1 VBA Business Model Canvas

The VBAs were selected based on their expertise in farming and their commitment to share that expertise with others. They have demonstrated their capacity to share improved farming technologies and to help other farmers get more from their farms. As they undertake their extension work, they are required to raise resources to travel and get to the farmers. They have been meeting these resource requirements by undertaking agribusinesses.

Since they are not business people by design, there is need for a simplified approach to equip them for business. To concretize a business case for the VBAs multiple ventures, a Business Model Canvas (BMC) has been used due to its simplicity and flexibility. Unlike the standard business plans that run into tens of pages, the canvas model enables an entrepreneur to visualize the business by looking at it on one page. The BMC is designed to help VBAs improve on the business they are engaged in as well as harness opportunities for scaling up and scaling out their business ventures.

## 3.2 Building the VBA Business Model Canvas

The Business Model Canvas describes the rationale of how a VBA creates, delivers, and captures value of their enterprise activities. Generally, the BMC describes the business model of the VBA using nine pillars as described in the figure below.

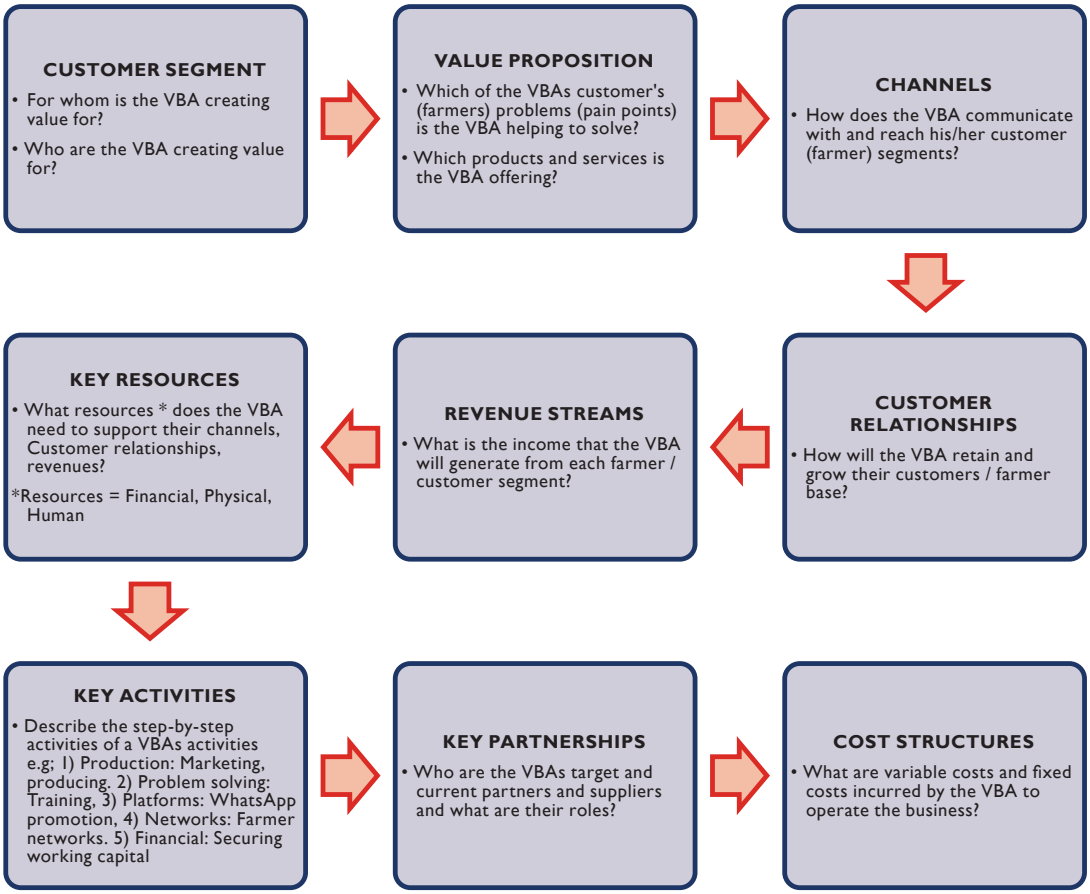


*Figure 7: Understanding the flow of a Business Model Canvas.*

The table below describes in a snapshot, the nine pillars of a Business Model Canvas for VBAs offering Regenerative Agriculture Extension Services.

***Table 1: Business Model Canvas for VBAs offering Regenerative Agriculture Extension Services***

| Key Partners | Key Activities | Value Proposition | Customer Relation-ships | Client Segment |
|---|---|---|---|---|
| Farmers<br>Project partners<br>Input dealers<br>Buyers & aggregators of farm produce.<br>County Governments | Profiling & dissemination of improved technologies<br>Profiling of farmers<br>Establish farmers' needs<br>Availing inputs to farmers<br>Getting feedback on performance<br>Aggregating produce to meet market needs. | Farmers: Quality Inputs at your Doorstep<br>Input Dealers: One Stop Hub for Aggregated Clients<br>Buyers of Farm Produce: Quality Product Aggregation Hub | Farmers – Quality, trust, and reliability<br>Input Suppliers – Large number of clients, demos<br>Buyers of farm produce – product quality, and traceability, | Farmers<br>Input Suppliers<br>Buyers of farm produce (End-Market). |
| | **Key Resources** | | **Channels** | |
| | A pool of farmers who trust the VBA<br>Evidence of improved performance<br>Inputs at the correct time<br>Money for buying produce<br>Money for buying other time and labour-saving farm implements | | VBAs<br>VBA Groups (CBOs that will transition to Sacco or linked to existing Saccos)<br>Farmer Field Schools | |

| Cost Structure | Revenue Streams |
|---|---|
| Capital to buy inputs in advance | Commissions from sale of seeds |
| Capital to aggregate farm produce | Commission from aggregating produce |
| Money for travel to meet farmers | Interest from selling aggregated produce |
| Funds for building trust with suppliers | Fees for mobilizing farmers under contract farming |
| | Fee from undertaking farm practices – vaccination, laying terrace, ripping, spraying, etc. |
| | Fees from leasing farm equipment – thresher, ripper, and others. |
| | Funds from proposals for different projects at County Level |

Each of the nine panels in the BMC above are discussed in detail below.

### 3.2.1 Client Segment

Client segments refer to the distinct groups of people that a business serves. The role that VBAs play has evolved as the need for creating connections across the value chain has become more apparent. VBAs act as the 'go-betweens' between the input providers and the farmers, the farmers and agricultural knowledge, specifically RA and the markets that demand farm produce. This has created three distinct market segments:

a) The over 100 farmers that each VBA serves – these farmers are seeking access to inputs, production technologies and innovations and a reliable market. The market reliability is based on how efficient information on market needs can be transmitted to farmers and vice versa.

b) The input dealers with whom VBAs offer the last-mile sales – the input providers are looking for a reliable market that is underlined by successful application of their inputs. This is important as it improves their market standing as well as allows for the testing of those inputs in different environments. In addition, the input providers want to either be paid upfront or be assured of timely payment, when the payments are due.

c) The produce buyers who need VBAs to reach farmers and aggregate produce – the market wants to have reliable quality and quantity of the desired farm output.

For each of these services the VBA earns a commission. First, a commission from the resale of inputs to the farmers. Second, a commission for the aggregation and provision of logistical support for the transportation of the produce to the market.

**Box 11: Farmer client demands puts more money in Embu's VBA pocket**

*Caroline Gakii at her farm in Ngurika village*

At the youthful age of 29, Caroline Gakii, a VBA from Ngurika village, Kagaari south ward in Embu County, has already cut herself a niche as a successful aggregator of farmer demands for inputs. This is due to her big farmer client base which she built through Ngurika self-help group, of which she is a member.

"So far I have trained 250 farmers through the mother demo plot and through group meetings," Caroline explains.

The trained farmers proceeded to apply the RA practices in their respective farms, and this has created a farmer client base for Caroline.

For instance, in the previous season Carol earned a commission of Ksh. 11,000 from the sale of seeds, Ksh. 3,000 commission from hermetic bags and Ksh. 1,000 from agrochemicals. Caroline also earns a commission of Ksh. 7,500, monthly, from ACRE Africa through the sale of crop insurance to farmers. Besides the commissions, Caroline's yield has increased from 2 (100kg) bags of maize to 20 (100kg) bags, and 30 (2kg) tins of beans. She also does value addition of bananas by making banana flour which she sells at her farmers meetings. On average, she earns Ksh. 30,000 (about US$272) monthly on commissions.

"I wish this project could be rolled out to all counties to create more employment for the youth," she says.

**Box 12: Makueni youth reaps big from big extension client base**

Necessity is the mother of inventions. This adage fits so well with Daniel Munene, 25, a VBA from Makueni county. Daniel graduated with a degree in procurement and logistics but could not find a job. "After being trained as a VBA, (in October 2020) I am happy to report that I have trained at least 300 farmers on the practices," he says.

Through the VBA model, Daniel has built a network with input suppliers, financial services providers and other VBAs. Through these networks, Daniel has delivered inputs to his client base of over 300 farmers. Last season alone, he delivered 8 bales of KATB1 (certified maize seed); 9 bales of DK8031 (certified maize seeds); 13 tarpaulins; 36 AgroZ grain storage bags; and 26 maize shellers. At the start of March - May season, Daniel offered input linkage of 131 bags. On average, Daniel earns a commission of Ksh 15,000 monthly and this has enabled him to sustain his livelihood. Additionally, he was identified by Farm Shine Ltd as a trainer of trainees, whereby he offers market linkage between farmers and the organization. Through this, he helped in aggregation and purchase of 300 bags of beans, earning him a commission of Ksh 30,000. "From all these commissions, I have been able to expand my farm, from 1 acre to 3 acres, drilled a borehole and acquired a solar pump to enable me carry out irrigated farming, "says Daniel.

### 3.2.2 Value proposition

The VBAs have created compelling value propositions for the three client segments above. These are outlined below.

a) Farmers – Access to high quality inputs at lower than market prices, innovations, and production technologies. Access to aggregation of farm produce services and appropriate markets. Farmers conveniently access inputs at their door-step.

b) Input dealers – VBAs aggregate farmer demand as well as support the demonstration of input effectiveness thus increasing the market share of the input providers and provide last mile input distribution.

c) Buyers of farm produce – aggregation of high-quality farm produce, in the right quantities that ensures reliability and market growth.

The formalization of VBA businesses could further enhance the value propositions outlined above. There is also a need to aggregate VBAs and offer increased training in business management and deepen technical production knowledge. Such an aggregation would also enhance cross-learning between VBAs.

### 3.2.3 Relation with clients

The relations with clients will largely be guided by the value proposition for the different categories of clients. Farmers form part of the society in which the VBAs live. The VBAs relationship with farmers is built from the informal linkages in place to more formalized linkages defined by the following:

a) Registration of the farmers under the VBAs

b) Placing of orders for the inputs needed

c) Building of trust for delivering inputs

d) Reliable aggregation of produce

e) Bargaining in markets and paying farmers

The diagram below outlines the relationship between VBAs, farmers, markets, government, project implementors and input suppliers. VBAs are key to initiating these relationships and maintaining them as trusted agents for all the parties involved.

VBAs will relate with input suppliers by meeting their desire for reaching many clients (farmers). The database of farmers, knowledge and trust they have in the VBAs is a compelling reason to strengthen the relationship between the input dealers and the VBAs. Most seed companies establish demos at the VBAs to elucidate phenotypic characteristics of the varieties they promote. Establishment of demos is among the approaches the RA project is using to reach farmers with technologies and create demand for inputs.

VBAs will relate with buyers of farm produce by providing a framework that guarantees quality, quantity, and traceability of the produce.

The diagram below shows how the village-based Advisor model works.

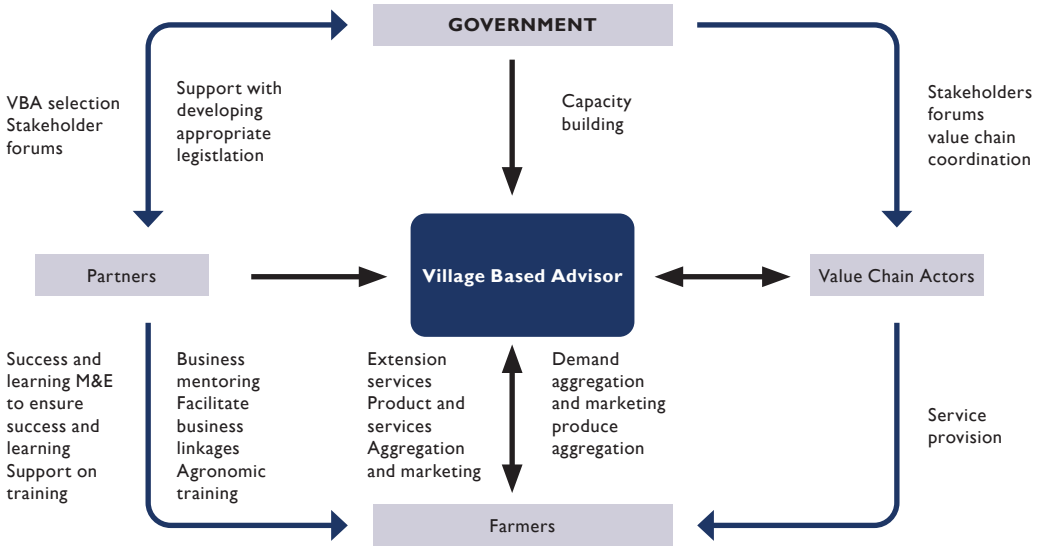


*Figure 8: The Village based advisor model*

### 3.2.4 Channels

The VBAs operated within their communities and therefore had a close relationship with the stakeholders. The following are the main channels used:

a) Face-to-face contacts and meeting such as with VBA groups, County Government personnel, and opinion leaders in operations. This proved to be effective in building trust and driving on-boarding of farmers as well as implementation through demonstrations in both 'mother' and 'baby' plots.

b) Electronic and print media was used to sensitize communities on the RA project which made it easier for the VBAs to drive adoption and participation.

c) Social media platforms are now the preferred channels due to the capability of the audience to interact with the broadcaster. Platforms were used within the project to disseminate information as well as well as create market linkages.

### 3.2.5 Key activities

The following activities were given preference in actualizing the VBA business model.

a) Recruitment and training of farmers – farmers were profiled based on access to land and willingness to implement the RA practices, trained on the concepts of RA and exposed to demonstrations.

b) Identification of RA practices – the appropriateness of the practices was evaluated based on the agro-ecological zones where the project was being implemented.

c) Establishment of farmers' demand for inputs and services through crop demonstration – crop demonstration on the mother plots was a key driver of the uptake of different technologies by farmers as they could easily relate with what was being demonstrated.

d) Availing inputs to farmers – the VBAs helped farmers aggregate their demand for inputs and obtain better prices from the input providers. Other service providers offered their services to an aggregated group of farmers reducing the cost to serve.

e) Aggregating produce – VBAs provided a critical service of aggregating the produce and connecting farmers to the market. This allowed the farmers to access better prices for their produce eliminating the costs they incurred by intermediation by middlemen.

Village based advisors have emerged as important value chain facilitators that have not only embedded RA practices, but also created demand for the increased produce from the farmers which has been shown to be a critical factor in ensuring sustainability even after the end of the project.

### 3.2.6 Key resources

Resources are vital for the success of the business model. The following are resources already with the VBAs:

a) Farmers under the VBAs – the aggregation of farmers has created collective demand for service providers. This has incentivized service provision due to the reduced cost to serve. The presence of a trusted VBA has allowed the service providers to offer inputs and services on credit.

b) Evidence of improved performance – crop vigor and the resilience of farmers who have adapted RA during the drought has given the farmers confidence that these practices were effective.

c) Knowledge resources on the improved varieties and farming practices – a focus on RA has provided a coherent regimen of knowledge that ensures use of end-to-end technologies, improved output, reduced labour costs, and catalyzed innovation.

d) Leveraging on social capital – VBAs generally came with significant social capital and were either community leaders or respected members of the community they were serving which drove the quick uptake of RA practices.

e) Timely quality inputs – the right inputs at the right time were a significant predictor of a successful season.

f) Working capital – Some VBAs accessed working capital through credit offered by service providers, which is a critical resource in revitalizing the value chain.

### 3.2.7 Key Partners

VBAs acted as a nexus for critical stakeholders by mobilizing farmers. They were able to present a unified 'voice' to the county governments, service providers and markets. In addition to the farmers, other key stakeholders included:

a) Input dealers

b) County Government extension staff

c) Project partners

d) Buyers and aggregators of farm produce

### 3.2.8 Cost structure

Due to the proximity of VBAs to farmers, they have developed a lean cost structure. However, some costs were unavoidable, and these led to the VBAs diversifying their services to input provision and output aggregation among other services. Some of the costs included:

a) Travel including farm visits, field days, exhibitions and other agricultural functions

b) Purchase of inputs from agrovets and seed companies

c) Setting up and managing mother demos

d) Buying produce for aggregation

e) Airtime to mobilize farmers

f) Storage cost for aggregation

### 3.2.9 Revenue Streams VBAs are Engaged In.

Revenue streams were embedded in extension services that VBAs offered to their fellow farmers. VBAs uncovered other unmet needs in agricultural production which included access to the appropriate inputs such as treated and certified seed that has a higher propensity for germination and growth. They also provided or organized for labour to be made available to farmers and to be applied appropriately for better results. Having become trusted service providers to farmers, the farmers relied on them to provide aggregation hubs for output. This intermediation created an additional income stream for VBAs. The extension services provided by the VBAs therefore served as the basis for the VBAs to set up businesses supported by the virtuous cycle of increased agricultural production. This effect is a powerful driver for the adoption and expected sustainability of the VBA model and therefore continued dissemination of improved agricultural practices. Table 2 below summarizes these incomes streams.

***Table 2: Revenue streams managed by VBAs in Embu and Makueni Counties.***

| Revenue Stream | Season | Mode of earning |
|---|---|---|
| Sale of seeds and other inputs | Planting | Commission on sales |
| Sale of tree seedlings | After crop planting | Cash from sale of seedlings |
| Laying of terraces | Before planting | Cost per unit length and depth |
| Sale of chicks | All through | Commission per chick |
| Vaccination of chicken | All through | Cost per bird |

| Revenue Stream | Season | Mode of earning |
|---|---|---|
| Aggregating produce on commission | During harvest | Commission on aggregating and profits from selling to better outside markets |
| Ripping service | Before planting | Cost per acre |
| Sale of harvesting bags | Before harvest | Profit per bag |
| Sale of tarpaulins | Harvest season | Commission per piece |
| Aggregation of output | Post-harvest | Commission on sale |

## 3.3 SWOT Analysis for the VBA Business Model Canvas

While the BMC presents the VBAs business model in a page. A SWOT analysis helps to identify areas where more investment is required to strengthen the VBA model. A SWOT analysis is a tool used to assess the critical success factors of a business activity, business organization or an industry. Such an analysis gives us a snapshot of how feasible or viable the business is currently and how it will be in the future. The four thematic areas of the VBA business model that were analyzed were its strengths, weaknesses, opportunities and threats as depicted by Table 4 below. The tool was used to identify each thematic area of the VBA business model, the issues raised under each theme and the key considerations suggested to mitigate each issue.

***Table 3: SWOT Analysis for the VBA Business Model Canvas.***

| Thematic Area | Issue(s) | Consideration(s) |
|---|---|---|
| Strengths | • Cumulated experience and knowledge in improved crop technologies and varieties.<br>• Sufficient knowledge of the target community.<br>• Trust and acceptance of the VBA by the target community.<br>• Ready market for farm inputs/ huge pool of farmers forming a market for farm inputs | • Readiness of each VBA to catch up with emerging technologies.<br>• Target community will maintain their trust and acceptance in the services of the VBA.<br>• Farmers will maintain their demand for farm inputs. |
| Weaknesses | • Inadequate knowledge, skills and experience may hinder registration/ licensing with professional bodies and state agencies such as the Veterinary Board, KEPHIS and PCPB.<br>• Poor attitude towards entrepreneurship or the lack of a will to engage in business. | • VBAs will acquire the necessary skills in-order to be licensed by the appropriate authorities.<br>• VBAs will embrace entrepreneurship instead of craving for white collar jobs. |

| Thematic Area | Issue(s) | Consideration(s) |
|---|---|---|
| Weaknesses | • Inadequate capital for acquiring the inputs and aggregating products.<br>• Inadequate means of transport to affect the service.<br>• Adoption of business organization models such as sole proprietorships that lack a succession plan for the VBAs. | • VBAs will engage suitable stakeholders within each value chain in order to get their support e.g. creditors and transporters<br>• VBAs will use business organization models that can withstand the test of time such as partnerships |
| Opportunities | • The existence of favorable weather conditions and viable agriculture value chains.<br>• The availability of an effective demand for the inputs and services offered by VBAs.<br>• Linkages with County Government projects and other stakeholder-led projects that support the VBA extension model.<br>• Inadequate government extension services. | • Favorable weather conditions will continue to prevail and agriculture value chains will remain viable.<br>• The demand for the inputs and services offered by VBAs will remain high.<br>• County Government projects and other stakeholder-led projects will continue to support the VBA extension model.<br>• Government will continue to embrace a pluralistic extension services model e.g., the VBA model. |
| Threats | • Crop failure due to bad weather and a change in the demand for a targeted commodity can lower the demand for inputs and threaten produce aggregation.<br>• Some youthful VBAs may abandon the business in search for greener pastures.<br>• Change in government policy in favour of the adoption of other conflicting extension approaches by different players.<br>• Some stakeholders may resist the VBA model if they are not properly consulted and engaged in the exercise particularly input dealers and government officers. | • Farmers will guard against potential crop failure due to bad weather by adopting drought tolerant crop varieties, crop insurance, irrigated farming and water harvesting technologies.<br>• The tastes and preferences of the targeted customers will not change as to lower the demand for the commodity.<br>• The terms of engagement for the VBAs will be favourable to them. |

| Thematic Area | Issue(s) | Consideration(s) |
|---|---|---|
| Threats | | • Government policy will remain in favour of the adoption of the VBA extension approach by different players.<br>• VBAs will adequately consult and engage with all stakeholders. |

From Table 4, the VBA business model must find ways to capitalize on its internal strengths and to take advantage of all available opportunities in-order to prosper. The model must also find appropriate ways to eliminate its weaknesses and to counter, mitigate or neutralize all its threats.

The County Government should be drawn in to support the community-based extension system by providing the requisite policies to embed the system in the County extension programs as well as to legitimize the system within the county legal framework. The demand for produce remains a critical factor for the continued development of value chains and the role of the VBAs in driving quality production cannot be ignored.

# 4. INSTITUTIONAL ARRANGEMENTS FOR REGENERATIVE AGRICULTURE

## 4.1 Overview

The success of any project is driven by strong partnerships and stakeholder involvement between individuals, organizations and their interactions. The RA project partnered with the County Governments of Embu and Makueni for leverage and scale out of the RA practices beyond the target locations. The project trained frontline extension officers from the Ministries of Agriculture who by extension were engaged to train the VBAs in a cascade model. Based on the baseline survey undertaken at the beginning of the project, the need for strong institutional arrangements took the form of:

- Integrating and institutionalizing the VBA model within the County extension system.
- Collaboration with development partners, research organizations and value chain actors operating in the region to showcase appropriate regenerative agricultural technologies.

## 4.2 Key Institutional Arrangements

### 4.2.1 Collaboration with County- Related Programs

The RA project partnered with the programs in Embu and Makueni counties such as the Agricultural Sector Development Support Program (ASDSP), Kenya Cereals Enhancement Program Climate Resilience Agricultural Livelihood (KCEP-CRAL) and the National Agricultural Rural Inclusive Growth Programme (NARIGP). These programs offered an opportunity to leverage resources for similar initiatives and raising awareness on the RA project. For example, in Makueni County CGA is a member of the Pulse Value-Chain Platform hosted by ASDSP, which has offered an opportunity to entrench the RA practices in the green-gram value chain. The NARIGP is using community-based extension system to train farmers on climate smart agriculture. This has offered an opportunity for learning on both the VBA and Climate Smart Agriculture (CSA) related models. KCEP CRAL promotes conservation agriculture that forms a bigger component of RA practices.

### 4.2.2 Formalization of Partnership with County Governments

Partners and stakeholders were required to sign agreements with County Governments to support implementation of project activities and to provide frameworks for ownership and sustainability of the initiatives after the project's tenure. For instance, in Embu County, this was actualized by developing an MoU with Farm Africa to entrench RA initiatives within the county programs. In Makueni County, CGA entered a partnership deed with the county government to support similar initiatives on building farmers' resilience.

### 4.2.3 Embedding the Community Based Extension into County Government Extension System

For any community-based extension system to be sustainable, it must be incubated within the existing government extension system. The County Government of Embu and Makueni

embraced the VBA model due to its effectiveness in reaching farmers across communities and enhancing the existing extension services. In Makueni County, the government has developed a community extension system, Makueni Enhanced Extension Program (MEEP), borrowing from the VBA model.

**Box 13: Makueni Enhanced Extension Program (MEEP)**

In its bid to enhance extension service delivery, Makueni County approved a cabinet paper "Makueni Enhanced Extension Program (MEEP)" that supports extension activities at the village level. The County Government of Makueni is implementing a project to enhance extension service delivery among small scale farmers in the County during the 2020/2021 financial year spilling over to FY 2021/2022.

MEEP seeks to achieve the following:

1. To facilitate the extension officers for enhanced service delivery.
2. To support resource persons and service providers referred to as Community Extension Volunteers (CEVs) to provide extension services to farmers.
3. To engage the youth who have completed their studies in various fields related to agriculture as interns in the extension service delivery system to mentor and improve their hands on skills.
4. To formally engage qualified persons to join the extension service as agricultural extension officers in all fields related to agriculture, livestock, veterinary medicine and aquaculture.

**Box 14: The Case of Community Extension Volunteers (CEVs)**

The project targeted all the 60 sub-wards in Makueni County. Each sub-ward received four CEVs, 240 CEVs in total. The CEVs are trusted lead farmers who are qualified to assist farmer in matters related to agriculture, livestock, veterinary medicine, and aquaculture. Of the 240 CEVs, 20 were engaged as VBAs. Each CEV reports to the sub-ward administrator and is responsible to the Ward Agriculture Officer (WAO). Successful CEVs were interviewed and issued with a formal engagement letter. Each CEV was allowed to draw a stipend per month for six months. The engagement period had the possibility of an extension for a similar duration subject to satisfactory performance under minimal supervision.

### 4.2.4 Supporting Legislation

Makueni County government in 2017 enacted the County Climate Adaptation Fund to support resilience work. This has been implemented through allocating 1% of the total county budget to the fund. This fund supports RA work in the County.

### 4.2.5 Structured Working Arrangements for Input Provision and Markets

The project linked the VBAs to different private companies that sell agricultural inputs as well as other services such as insurance. The project negotiated for a structured arrangement

where the input suppliers advanced some of the VBAs with inputs on credit to be paid back after sales. The companies provide inputs and services to demonstrate different farming technologies. The project further created structured linkages between farmers and the markets, which reduced the rent-seeking costs between the farmers and the market as VBAs aggregate and deliver the output.

The project stimulated contract farming arrangements which provide assured markets for produce and improved returns to farmers. In Embu County, Bulto Foods in collaboration with Acre Africa worked through the VBAs to provide 2,266 farmers with weather index-based insurance products further protecting the soya value-chain from losses occasioned by poor weather and other externalities.

# 5. LESSONS LEARNED

The discussions held with project implementers, the VBAs, farmers and other stakeholders, generated useful lessons that could inform future programming in Regenerative Agriculture:

1. Farmers adopted different RA practices based on the benefits associated with the practices and their appropriateness to the agro-ecological zone. This showed that the farmers had gained knowledge from the project interventions and were applying in their farms.

2. The is no one size fits it all. Different RA practices were combined within the same plot to have effect and this varied from farm to farm and from location to location. This showed that we cannot recommend one practice to be the best but instead we should recommend the farmer to practice what is applicable in their farms for regeneration.

3. The project in both Makueni and Embu counties enjoyed strong support from both the National and County Government. The County government through the respective department of Agriculture, assisted in the recruitment, training, and coordination of RA extension through the VBAs. Additionally, the support by both the national and county government improved the farmers trust of the implementors and the RA practices promoted.

4. Strong partnerships with research organizations (KALRO and ICRISAT) helped in identification of climate resilient varieties for use in RA and in soil analysis. The organizations also donated seeds for use in demonstration plots. Support from private sector partners in the form of seeds, input finance, insurance, market linkages and chemicals contributed to the uptake RA practices by farmers. Some of the actors, e.g., Bayer provided support for VBA training on general good agronomic practices.

5. The funding for agriculture departments in the project Counties is limited which makes it difficult for the already limited County Extension workforce to adequately serve the ground due to lack travel facilitation to meet farmers. Private Public Partnerships (PPPs) are one way to come out of this limitation. VBAs- Partnership with County Government is an entry point that helped to bridge this gap.

6. The design of the VBA model was appealing to the farmers as the VBAs themselves were well known members of the community. The receptiveness of the model by the farmers enhanced RA knowledge transfer and uptake. The use of localized RA demo farms (both mother and baby) for peer-to-peer learning was a crucial pillar in transfer of RA practices. This was effective because farmers would get a more personalized learning experience and would be more receptive of information from their peers. Practical exposure through the demos enabled farmers to better internalize the RA practices taught and to even reach their semi-literate peers.

7. Some of the RA practices (such as minimum soil disturbance, soil and water conservation structures, use of well decomposed farm yard manure and spot placement of the manure, intercropping, crop rotation, cover cropping, mulching and agroforestry) were not completely new technologies to farmers. Farmers used to practice them but at a smaller scale or the wrong way.

8. Regenerative Agriculture practices like minimum tillage, mulching, soil and water conservation, use of cover crops, have proved to build farmers resilience in areas which received low rainfall as farmers who had practiced such harvested with little rainfall as opposed to those who did not use the practices.

9. Crop diversification through crop rotation/intercropping with newly introduced drought resistant crops such as Soya beans motivated farmers especially from the more drought prone areas to adopt RA as it cushioned them from vagaries of weather.

10. The introduction of market linkages and aggregation centres for farm produce was a critical motivation for farmers to take up RA practices.

11. The elderly people were more receptive of the RA project more than the youths which poses a future challenge to the sustainability of the RA practices.

12. Digital platforms such as AgriBot (in Embu County), SMSs and WhatsApp groups were helpful in community outreach. They enabled the VBAs and project implementors to pass RA information more efficiently and enhanced the uptake of the practices.

13. Stakeholders embrace new ideas and innovations depending on what they stand to gain from them. The government invests in initiatives that support their development agenda while the private sector will invest in initiatives that will contribute towards increasing their returns on investment. In the RA project, the value proposition for the VBA model was clearly defined to farmers and stakeholders which contributed to its acceptability across the board.

14. Youth retention in the project was a challenge mainly because most of them prefer to relocate to urban areas where they believe there are better, fancier and more exciting and rewarding opportunities than farming. For example, some VBAs abandoned their role for other income generating activities. Some of the VBAs have however come up with innovative ways to sustain their income streams such as through livestock vaccination, selling inputs and aggregation of farm produce.

15. Women were reached with RA information more than men. This is because women are organized into formal self-help groups than men. This poses a challenge on reaching men with RA information and decision making at household level

The business case confirms the effectiveness of RA practices in managing the effects of climate change for rural smallholder farmers.

# 6. RECOMMENDATIONS

Policy makers, farmers, researchers and funding agencies and those in the supply chains all have a role in enabling regenerative agriculture. As detailed by FAO (2019), the good news is that many regenerative systems can be profitable, can sequester carbon, and can enhance biodiversity, and in many cases, such systems are being more widely adopted.

## 6.1 To Government departments and policy-makers

Successfully scaling up RA requires both appropriate practices, technologies or models within favourable enabling environments, such as supportive institutional arrangements, policies and financial investments at the local level.

1. The county governments should mainstream RA extension in their policy frameworks. This will ensure that all extension staff pass RA related information to farmers. The governments should incentivize RA adoption through favourable tax rates on RA equipment and climate resilient inputs. It is also important to reconfigure the economics of food production and value chains to reward regenerative practices to further enable Regenerative Agriculture. Such ideas have been trialled through Payment for Ecosystem Services (PES) schemes that contribute to household income if on-farm ecologies are protected/enhanced.

2. Support long term demonstrations for farmer capacity building on RA. The most important beneficiaries of RA evidence and information are farmers. Therefore, evidence must be presented in a way that farmers can objectively observe and learn from. At the core, is to increase the amount of evidence available as the basis for scaling RA to more farmers or locations. With an evidence base that is accumulating, multi-locational, replicable and current, it will be much easier to mainstream RA as an important part of sustainable agricultural intensification.

3. Some regenerative farm practices have low investment costs which means that resource-poor farmers can often initiate such practices "from within." However, some practices such as establishing tree crops and some agroforestry systems do require significant upfront investment and it can take substantial time before the tree crops provide a return on investment. In such situations, county governments or social investment support programmes can play a pivotal role.

4. Facilitate transition to Regenerative Agricultural by raising public awareness and shifting support to diversified agricultural systems. The adoption of Regenerative Agriculture can produce ecological and socio-economic outcomes that create new pathways to descent livelihoods, healthy households and well-functioning resilient ecosystems. Raising public awareness must thus also involve creating health campaigns oriented around the promotion of nutritiously diverse diets and clean environments.

5. The County Governments of Makueni and Embu through the Ministry of Agriculture currently coordinates the extension service system. For the community-based extension system like the VBA model to be sustainable, there is need to house it within the mainstream government extension system. With presence of a hybrid system that brings on board public and private extension service providers, there is need to establish a coordination

mechanism. This will create a framework for monitoring to deliver on quality assurance and standards.

6. Many service providers have developed ICT solutions for agriculture. These solutions come in form of applications that have specific information on an issue such as weather, markets, extension, inputs, finance among others. There is need to have an integrated system that bring all these solutions under one application offering multiple solutions.

7. Mainstream principles and practices of Regenerative Agriculture into education agenda and curriculum to support a new generation of regenerative farmers. This should be undertaken in schools as well as within specialist agricultural training courses/diplomas and extension programmes in order to equip aspiring farmers with the necessary knowledge and skills to transform our food systems from the ground up.

8. Partner with the public and private sector to scale-up the packages of blended concessional finance, investment and insurance and provide access to technical advisory services that support and mentor RA adoption.

9. On sustainability of the Village Based Advisors Model:

    a. Support the VBAs to structure their businesses in way that the extension service becomes an embedded service for creating demand for the different goods and services they offer at a cost. Training in managing the extension services as a demand creator is an important safeguard to ensure that the VBA businesses grow alongside the strengthening of the value chains in which they operate.

    b. Consider 'housing' the VBA extension services within the county government's extension system. This may require some changes to the county legislation, formally recognizing the community-based extension services, as Makueni County has done also helps to attract the youth who may be better trained and motivated to innovate. Incentivize community extension services by offering a stipend and supporting infrastructure.

    c. Incentivize the development of other income streams for VBAs that are embedded in the value chains for example provision of registration of community extension officers as input resellers.

## 6.2 To partners (NGOs, research institutions, and tertiary academic institutions)

1. Invest in long term research sites to create a "live" knowledge base on Regenerative Agriculture - Gathering information about adoption and spread of RA technologies still represents a significant challenge. In Africa, the evidence on yield, labour saving and soil impacts is yet to be sufficiently demonstrated. The basic principles underpinning RA and how to integrate it successfully in smallholder farming remains new. Thus, the existing evidence base needs to be beefed up further. This can be done by continued refinement and testing under more socioeconomic, agro-ecological and policy circumstances.

2. Develop more farmer-led research initiatives to demonstrate regenerative agriculture application.

## 6.3 To Farmers

1. Embrace rigorous science-based and farmer led experimental approaches towards RA adoption by tapping into existing local organizations, study groups, and neighbouring champion farmers.

2. Strengthen farmer to farmer learning and coordination structures based on interests and ecological zones.

## 6.4 To Village Based Advisors (VBAs)

1. Profits and commissions on inputs and output aggregation were among the main income streams for VBAs. The partnership with private sector is, however, based on loose association which is not sustainable. The VBAs need to formalize their engagement with the private sector by signing agreements and not relying on just the 'word of mouth'.

2. It is vital for VBAs to raise funds in advance for buying inputs and to be able to aggregate produce. The input dealers operate on a zero-credit principle, yet farmers are not willing to pay in advance for the orders that they give VBAs. They, however, pay when the VBAs deliver the inputs. This means VBAs need to raise funds in advance. The VBAs have credit and contract farming arrangements with service providers and markets respectively. However, it is critical that these arrangements are formalized, terms and conditions fleshed out and rules of engagement determined to ensure sustainability beyond the RA project.

3. VBAs are farmers who have not been in business by deliberate effort. It is important they pursue existing opportunities for training in Business Development Services. The VBA Business Canvas Model developed with project partners is a starting point to have them structure their operations in a business setting.

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# 8. APPENDIX

## 8.1 Learning Questions

**Outcome 1: Enhanced Extension Services through a Sustainable VBA business Model.**

1. What is the rationale for a private extension model in the project areas?
2. How does the VBA model operate?
3. Which services are being offered by the VBAs?
4. How are the VBA services improving agricultural practices and access to inputs and output markets for smallholder farmers?
5. Which commodities are being sold through the VBA aggregation centres (factors contributing to this?)
6. What is the value proposition of VBA model to farmers and value chain actors?
7. What are the push and pull factors for setting up and operating a sustainable VBA model for provision of extension services & their own commercial services/business for self-sustenance?
8. What are the challenges faced by VBAs in setting up and operating a sustainable model for provision of extension services?

**Outcome 2: Enhanced Adoption of RA technologies and Practices**

1. What is the level of farmer satisfaction with extension services on regenerative agriculture?
2. Which regenerative practices are being adopted the most?
3. What are the drivers (push and pull factors) for the adoption of RA Practices by farmers?
4. What demonstrated value/benefit is coming out of the application of regenerative practices [yields? economic value? environmental/ecosystem services benefits? soil health? Labour gains?]

**Outcome 3: Increased Knowledge and Awareness of RA Practices among Farmers and Stakeholders**

1. What initiatives, at the institutional level, have been introduced /strengthened by county governments to support regenerative practices in agriculture?
2. What are the factors that contribute to county government embracing regenerative agriculture practices?
3. Which regenerative practices are being adopted the most?
4. Who are the potential partners the project can seek collaboration with for awareness and implementation of RA technologies?
5. What are other new avenues of information sharing among key project stakeholders?

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