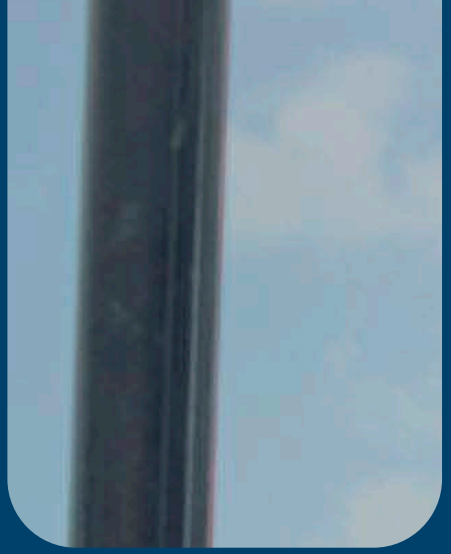
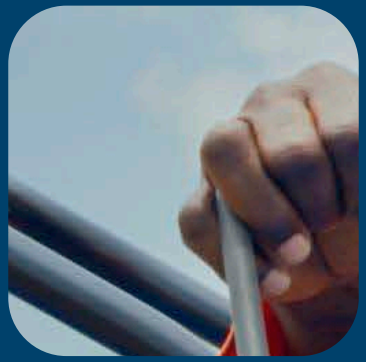
Mechanization for Africa

HEIFER® INTERNATIONAL

INNOVATIVE FINANCING FOR AGRICULTURAL TRANSFORMATION AND YOUTH JOB CREATION

2023





Content

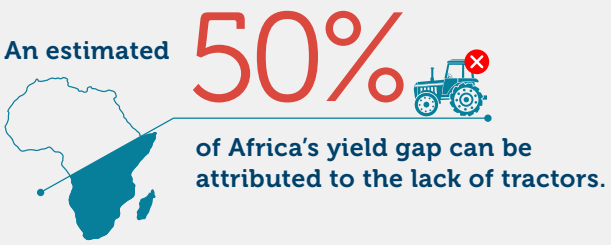
1.0 Executive Summary

1.1

Africa's Mechanization Challenge

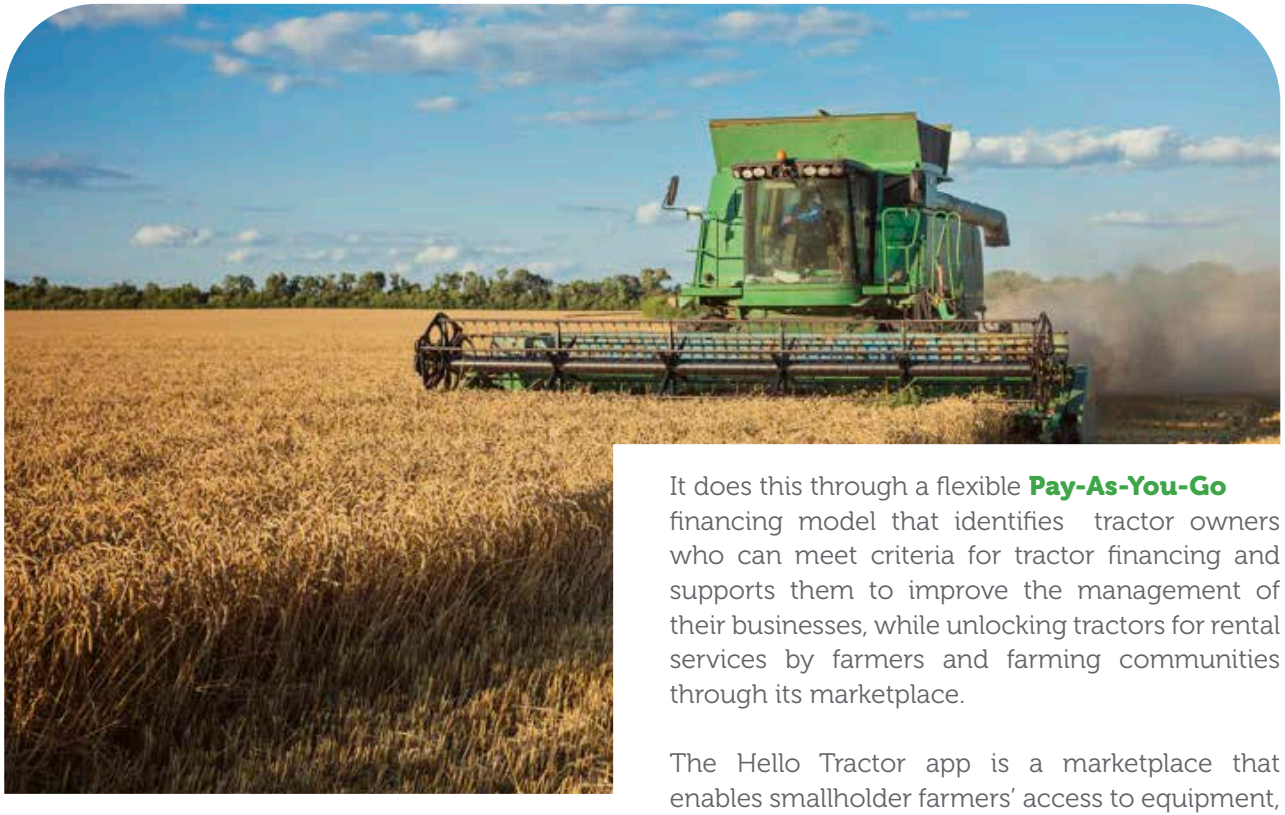
Africa is confronted with a significant mechanization hurdle, largely stemming from its status as the least mechanized continent globally. With just 13 tractors per 100 square kilometers (10,000 hectares) of arable land, Africa significantly lags behind the global average of 200 tractors per hectare of arable land

Smallholder farmers in Africa cannot afford to buy or lease tractors, neither can they access tractor rental services in its traditional model. They are therefore losing money, time and yield because of labour-intensive and time-consuming farming practices.



For instance, in Nigeria, according to the Journal of Human Ecology (2022), only 28% of smallholder farmers use tractors for their farm operations. This is largely due to non-availability of tractors, lack of financing, and challenges related to the underdeveloped ecosystem.

Smallholder farmers in Africa, therefore, are disadvantaged and getting the lowest return on their effort across the agriculture value chain, driving them further below the poverty line. This labour-intensive nature of farming practices also contributes to making agriculture unattractive for young people, leading to a huge migration of youth from farms to the cities.



1.2

An Innovative Solution

While the challenges persist, there are social enterprises in Africa addressing these problems by leveraging technological innovation to aid mechanization. These enterprises are creatively bringing more machinery into agriculture in the continent, thereby supporting smallholder farmers to boost productivity and improve incomes.

Hello Tractor, a critical mechanization solution provider in Africa, is an agricultural technology company that connects tractor owners to smallholder farmers in need of tractor services. It does this through a flexible **Pay-As-You-Go** financing model that identifies tractor owners who can meet criteria for tractor financing and supports them to improve the management of their businesses, while unlocking tractors for rental services by farmers and farming communities through its marketplace.

The Hello Tractor app is a marketplace that enables smallholder farmers' access to equipment, while enhancing profitability for equipment owners and building technical capacity. The app works by identifying and listing equipment owners looking to rent, recruiting booking agents and establishing them as links between equipment owners and farmers' requests for equipment leasing. This information available on the app also provides financiers with the data and ability to calculate returns and measure results.

Hello Tractor leveraged catalytic funding from Heifer International's Agriculture, Youth and Technology (AYuTe) Initiative to kickstart expansive operations. One of the pillars of the AYuTE Africa Initiative is an annual competition that awards cash grants to promising young agritech innovators and firms across the continent — professionals who are using technology to reimagine farming and food production in Africa. The competition is a catalyst for growth, combining grants with business development initiatives to translate the energy and ideas of young African innovators into meaningful impact for African farmers. With the grant in place, Heifer International and Hello Tractor co-designed a mechanization program to ensure maximum impact and sustainability.

Heifer International provided

US$4.5 million

in grant financing to pilot the model in three countries

1 Nigeria

2 Kenya

3 Uganda

In two years, this grant financing further unlocked commercial capital of about

US$7 million

for increased tractor penetration and ecosystem development.

With this support from Heifer International, Hello Tractor was able to significantly scale its service to smallholder farmers by growing the amount of equipment available in the market, financing the unbanked, and promoting conservation agriculture practices. By creating equitable access to tractor services, Heifer International, through Hello Tractor, enables smallholder farmers to earn more and grow more, improving livelihoods and food security for their families and communities.

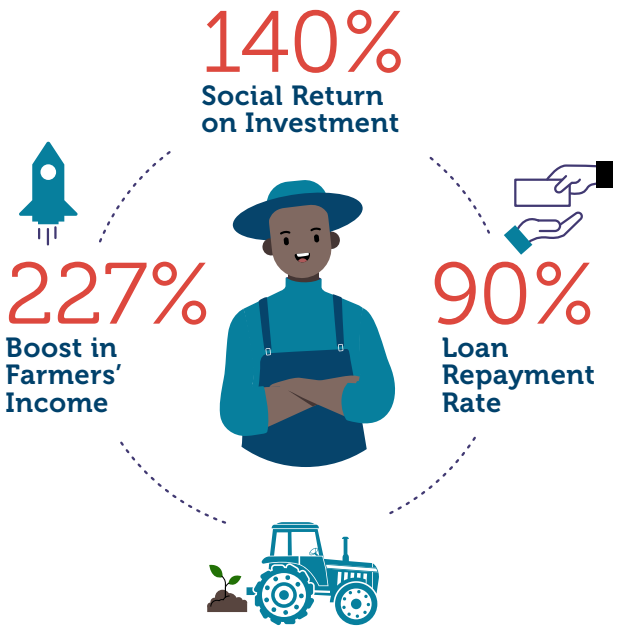
1.3

Impressive Results

An assessment study of the project revealed that as of December 2022, 104 tractors have been purchased and handed over to smallholder farmers across Nigeria, Kenya and Uganda through the Pay As You Go model. The initiative has provided service to 21,048 smallholder farmers in need of mechanization services and created opportunities in terms of direct jobs for over 312 youth to earn an income serving as booking agents and tractor operators. The initiative also created 784 indirect jobs across target communities in the 3 countries where the project is being piloted.

This pilot resulted in an impressive 227% boost in farmers' income and above 90% loan repayment rate. The intervention also showed a positive net Social Return on Investment rate of 140%. Beneficiary smallholder farmers reported that the project contributed to their overall progress and in some cases, demand was not sufficiently met.

104 Tractors → **21,048 Farmers** → **312 Direct Jobs** → **784 Indirect Jobs**

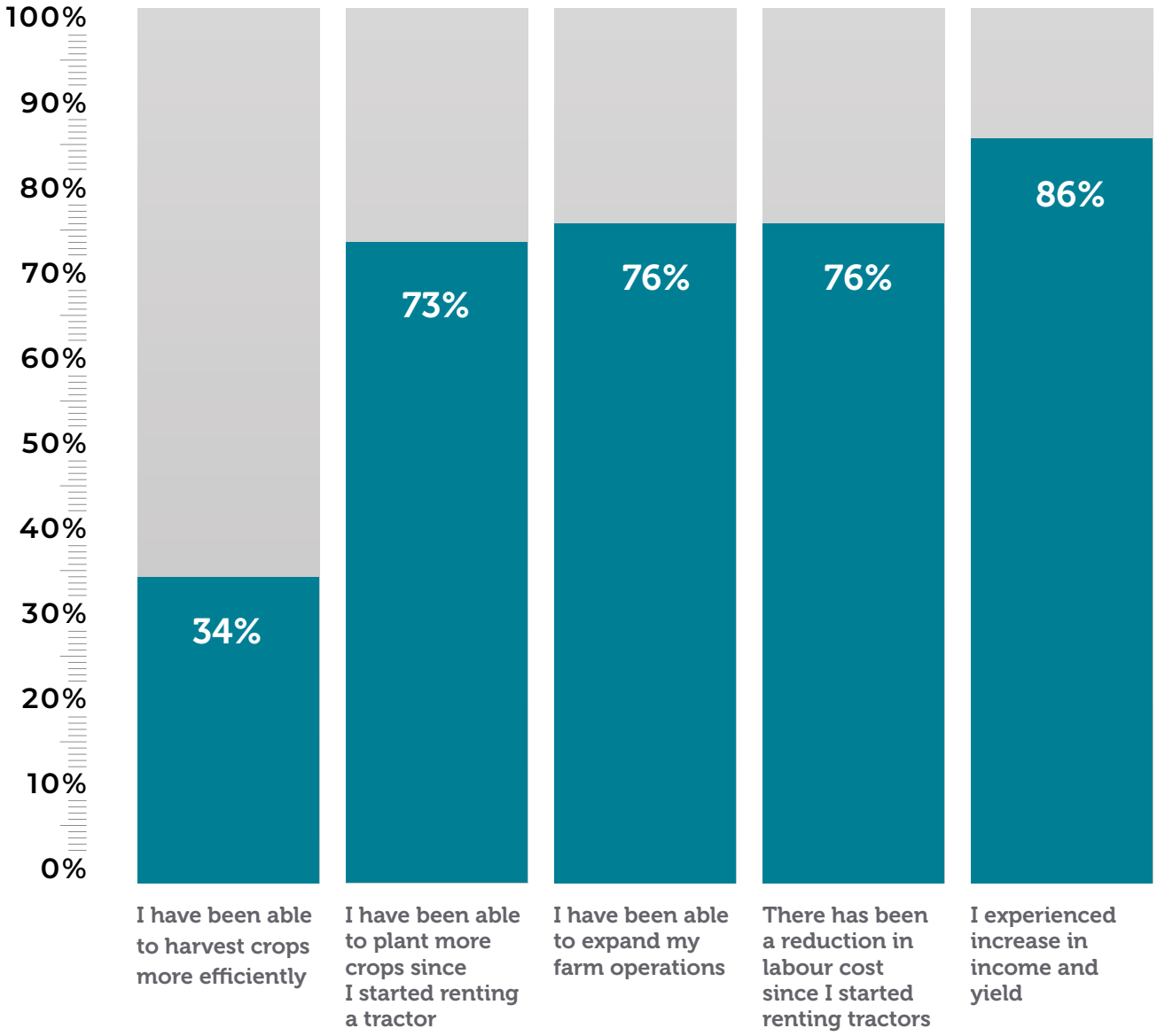


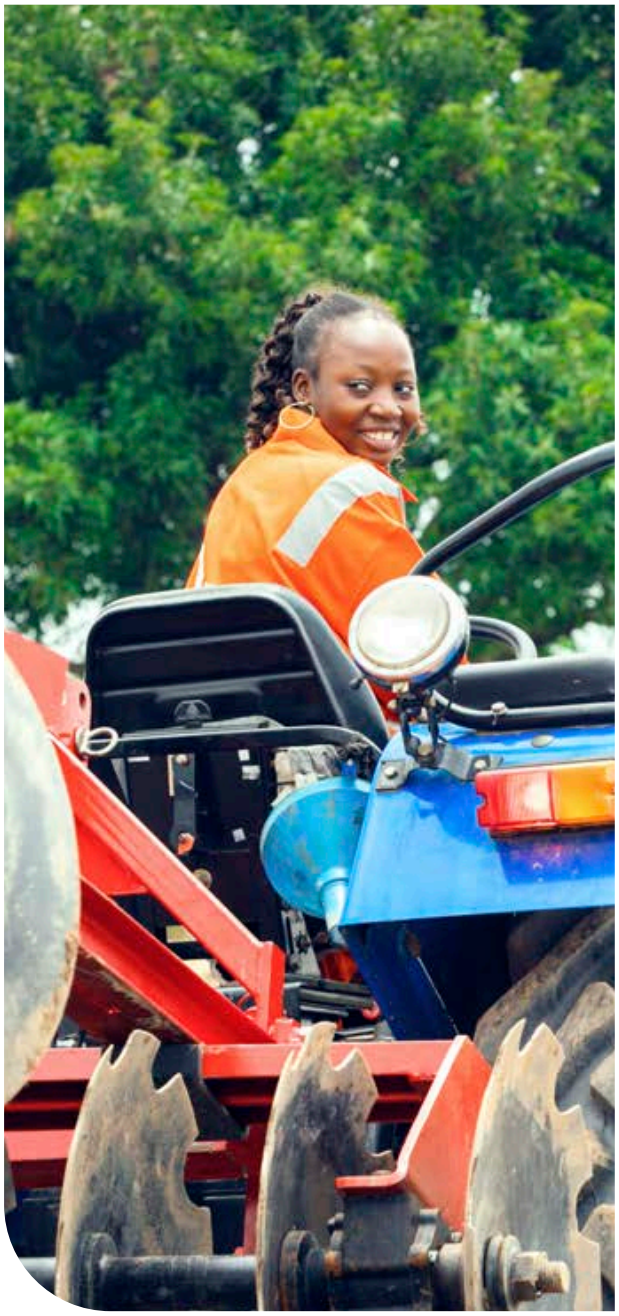
The project pilot has effectively fulfilled its objective of enhancing farmers' incomes by facilitating increased acreage through improved access to tractors. This accomplishment demonstrates the project's efficiency, relevance, and effectiveness.

The project is expected to scale up to other African countries, reaching more smallholder farmers over the next years. This pilot also provides a model for impact investing, both grants and commercial financing, to enhance the mechanization of agriculture in Africa.

Efficiency of mechanization by beneficiaries

Figure 1.





2.0 Introduction

In recent years, mechanization has emerged as a transformative force in Africa's agricultural landscape.

Traditionally reliant on manual labor and rudimentary farming techniques, the continent is now at the cusp of a technological revolution promising increased efficiency, higher yields, and improved livelihoods for its farming communities.

2.1 Low mechanization in Africa

However, this journey towards mechanized agriculture is not without its hurdles.
One significant challenge arises from the prevalence of smallholder farming, where the economic viability of adopting expensive machinery remains a concern.

Low mechanization in Africa contributes to the major differences in agricultural labour productivity seen across the world.

1 According to the World Bank, the agricultural value-added per worker in Northern America is 66 times higher than that in sub-Saharan Africa.

2 The International Fund for Agricultural Development (IFAD) also states that while maize farmers in the USA obtained 1,319 kg of maize per hour worked in 2001, the farmers in Kenya obtained only 1.2 kg as at 2004.

The key factor driving these significant differences in output is mechanization.

3 According to IFAD, "where farmers work only with hand tools, there is a biophysical limit to the amount of cropland that a single person can productively cultivate. But animal traction – and, even more so, mechanical power – can extend this limit."

Financial constraints further complicate the transition to mechanized farming, as the high cost of agricultural machinery, coupled with limited access to credit, prevents many farmers from investing in modern equipment. The shift to mechanization also requires a skilled workforce proficient in operating and maintaining modern machinery, emphasizing the need for training programs and educational initiatives.

2.2

The Opportunities in Mechanization

Mechanization holds the promise of significantly boosting agricultural productivity in Africa. Efficient use of machinery, from plowing and planting to harvesting, can streamline processes, reduce labor intensity, and enhance overall farm output. Additionally, while concerns about job displacement exist, the adoption of modern farming techniques can create new opportunities in machinery maintenance, technology support, and the development of ancillary services.
Furthermore, the potential benefits extend to food security, as mechanized agriculture contributes to increased consistency and volume of crop yields. With Africa's population rapidly growing, embracing mechanization becomes a strategic imperative to meet the rising demand for food.

The integration of mechanization also opens the door to technological innovation in agriculture. Precision farming, data analytics, and smart farming practices can optimize resource use, minimize environmental impact, and pave the way for sustainable and resilient agricultural systems.

2.3

Creating Context-specific Solutions

While mechanization in African agriculture faces formidable challenges, the potential benefits are immense. The key lies in developing context-specific solutions that address the unique needs of the continent's diverse farming communities. By fostering innovation, providing adequate support, and promoting inclusive policies and projects, Africa can harness the power of mechanization to usher in a new era of agricultural prosperity and sustainability.

The key to mechanization in African agriculture lies in developing context-specific solutions that address the unique needs of the continent's diverse farming communities.

In this report, we examine the pilot phase of the innovative tractorization partnership created by Heifer International and Hello Tractor to tackle the challenge of low mechanization across Africa's agricultural landscape through innovative impact financing.

The report presents the results of the pilot of this transformative project aimed at increasing productivity, improving livelihoods, enhancing output by smallholder farmers, and growing food security.

In collaboration with implementing partners, data was sourced extensively from areas of operations to ensure that a wholistic appraisal was done. The findings provide a roadmap for leveraging innovative financing to tackle the continent's agricultural challenges, harness the benefits of mechanization, and unlock commercial financing for Africa's agricultural sector.

> "Where farmers work only with hand tools, there is a biophysical limit to the amount of cropland that a single person can productively cultivate. **But animal traction – and, even more so, mechanical power – can extend this limit.**"
>
> ***International Fund for Agricultural Development (IFAD)***

1 World Bank. Washington. "World Bank Open Data." 2022. https://data.worldbank.org/

2 & 3 Gollin, Douglas. Oxford University. "Farm Size and Productivity: Lessons from Recent Literature." IFAD Research Series, December 2018. https://www.ifad.org/documents/38714170/40974017/Research+Series+34.pdf/64a10247-6fdd-e397-b75b-3d45767d956c

3.0 Statement of Problem

Africa, with its vast arable land, faces a significant agricultural challenge marked by the lowest yield per hectare globally. This situation is intensified by the continent's huge mechanization deficit, with a mere 13 tractors per hectare compared to the global average of 200 tractors. The impact of this inadequacy is acutely felt by smallholder farmers, who, unable to afford tractors or access traditional tractor rental services, grapple with labor-intensive and time-consuming farming practices. This inefficiency translates into economic losses, diminished yields, and a perpetuation of poverty among smallholder farmers.

The impact of this mechanization gap is evident in the estimated 50% yield gap across Africa, attributed to the absence of tractors. Because only a few smallholder farmers utilize tractors due to non-availability, financing challenges, and an underdeveloped ecosystem, the consequences are profound. Smallholder farmers, operating at a distinct disadvantage, experience the lowest returns across the agricultural value chain, pushing them further below the poverty line. Furthermore, the labor-intensive nature of these farming practices contributes to the unattractiveness of agriculture for the youth, fostering a significant migration from rural farms to urban centers.

In response to this challenge, innovative solutions are emerging, particularly through social enterprises leveraging technological innovation for mechanization. This report seeks to delve into the intricate dynamics of Africa's mechanization challenge, focusing on the financial and infrastructural impediments hindering the widespread adoption of modern farming practices.

By closely examining the case of Heifer International and Hello Tractor's partnership on mechanization, the report aims to unravel the nuanced complexities and potential avenues for scaling successful models. Through an in-depth analysis of the initiative's results, the report endeavors to provide valuable insights and recommendations for stakeholders, paving the way for sustainable and inclusive mechanization in African agriculture.

This Assessment study sought to answer the following questions:

1 What are the primary financial barriers preventing smallholder farmers in Africa from accessing and adopting mechanized farming practices, particularly tractor usage?

2 How does this initiative, with its innovative Pay-As-You-Go financing model, address the financial challenges faced by smallholder farmers and contribute to increased access to tractor services?

3 In what ways does the Hello Tractor app function as a marketplace to enhance smallholder farmers' access to agricultural equipment, and how does it contribute to the profitability of equipment owners while building technical capacity in the farming ecosystem?

4 What are the social and economic impacts of this project, and how has it influenced smallholder farmers' incomes, job creation, and overall progress in the target countries?

4.0 Aims & Objectives of the Study

The overall objective of the assessment was to evaluate the activities implemented in the 2-year pilot phase of the program, towards achieving the expected outcomes and to make recommendations on further replication, scaling up or continuation of the project.

The study looked closely at the following specific objectives:

1. To assess the **relevance** of the project in terms of the priorities, objectives, and implementation plan as defined by the program i.e. its usefulness and alignment to the needs of the beneficiaries who are smallholder farmers and youth.

2. To assess the results and progress of the project in terms of **effectiveness** (achieved outcomes versus planned outcomes) and the **efficiency of implementation** (output achieved against inputs and budgets used).

3. To assess the **feasibility and sustainability** in terms of design, scope, implementation, partnerships, management and steering of the project.

4. To identify evidence of **programming strengths, weaknesses, emerging opportunities and lessons learned.**

5.0 Scope of the Study

This impact assessment was conducted in selected countries, states, regions and communities where Heifer International is supporting smallholder farmers with mechanization through the Hello Tractor organization. The study area reflects the overall characteristics of the population.

The report covers two countries in two regions of Africa including West and East Africa as follows:

Countries	State / Region / County	Study Community
Nigeria	Nasarawa State	Awe, Nasarawa Toto
Kenya	Kisumu County	Rabuor, Ahero

6.0 Methodology and Approach

6.1 Population and Sampling Frame

The beneficiaries of this initiative are smallholder farmers in Nigeria, Kenya, and Uganda.

As at January 2023, the project had a total direct beneficiary population of

21,520

these include

- Tractor owners
- Technicians
- Small holder farmers
- Tractor drivers

The assessment was conducted among smallholder farmers and tractor owners in Ahero, Rabuor, and Kisumu counties in Kenya, as well as Awe and Nassarawa Toto local government areas in Nassarawa State in Nigeria. In Nigeria, 155 farmers and 16 tractor owners were surveyed, while in Kenya 169 farmers and 10 tractor owners were surveyed.

6.2 Sample size

The sample size was calculated from 95% confidence interval and 5% margin of error which gave 377 smallholder farmers. Stratified simple random sampling method was adopted to ensure all categories of beneficiaries including tractor owners, farmers, booking agents and tractor technicians were adequately represented in the sample and surveyed

350 beneficiaries

formed the sample size and participated in the quantitative study.

[324 farmers and 26 tractor owners]

6.3

Method of Data Collection

This research used qualitative research methodology to gather data and create an understanding of the problem statement as it affects stakeholders in the countries in focus. Focus group discussions were employed to give an in-depth analysis of the efficiency and effectiveness of project delivery. To complement data gathered through the focus groups, surveys were administered by enumerators in two of the project countries (Nigeria and Kenya), using a simple random sampling technique. Beneficiary profiling was also employed to interview beneficiaries with interesting impact stories. Finally, questionnaires and key informant interviews, deployed by the implementing organization, were used to understand the state of play of the project, the project outcomes, and to shed more light on the challenges, opportunities and sustainability of the project.

The data collection process was meticulously prepared to ensure accuracy and reliability. Prior to the rollout, data collection instruments were thoroughly tested and a pilot study was conducted. Focus Group Discussions (FGDs) were conducted in pairs, with one field supervisor facilitating the discussions while another enumerator took notes. Each FGD typically included 8-10 participants and lasted approximately one hour. The discussions allowed for the active participation of men, women, and youth, and the venue was selected in collaboration with community members and the research team. The Preparation of Study Tools and Validations phase involved the development of draft study tools based on the initial insights. Findings from the pilot were documented and used to refine the data collection tools. Data collection was for a total of 15 days in the selected areas. Data was collected through face-to-face interviews, focus group discussions, and key informant interviews.

Women, men and youth groups participated in the qualitative study using the focus group discussions

2 of the 3 project countries were surveyed

Nigeria

Kenya

7.0 Partnering for Impact - Hello Tractor

Heifer International's mechanization program aims to provide affordable farm equipment through a digital tractor-sharing model. The overall goal is to support potential entrepreneurs who will employ tractor operators and booking agents to create direct jobs, while giving smallholder farmers access to equipment that will increase their yield, and provide additional yearly income to the farmers.

Hello Tractor, the project's implementing partner, is an agricultural technology company that connects tractor owners to smallholder farmers in need of tractor services and supports tractor owners to improve the management of their businesses.

The PAYG tractor financing product was launched on January 14, 2022, in Kisumu, Kenya. Six tractors were distributed to booking agents who had qualified for the financing by booking the required five hundred hectares (500ha) of farmland to be cleared using the Hello Tractor App. Between March and September 2022, six additional launches were held in Kenya, Nigeria, and Uganda.

As at December 2022, the program had purchased and successfully handed over 104 tractors across Nigeria, Kenya, and Uganda, surpassing the set target. Hello Tractor has also provided service to 21,048 smallholder farmers in need of mechanization services and created opportunities for over 250 youth to earn an income serving as booking agents and tractor operators. Project beneficiaries have been trained to make bookings through the Hello Tractor platform and to properly operate and maintain tractors in the field.

Hello Tractor has also secured partnerships with five manufacturers and dealers to supply tractors, implements, and after-sales support to farmers. The project is currently in an active phase in which it is providing beneficiaries

with round-the-clock hands-on support, monitoring data trends, and repayment activities, and incorporating lessons learned into the project's value chain.

As at December 2022, a total of 104 beneficiaries had become tractor owners, and 208 booking agents, 157 tractor operators and 3 tractor technicians have been employed. The beneficiaries are located in Nigeria, Kenya and Uganda.

21,048
beneficiary farmers

104
new tractor owners

368
new jobs created — **[250 youths]**

21,520
overall direct beneficiaries

8.0 Key Findings

8.1

Tractor Owners (Nigeria & Kenya)

All the tractor owners surveyed gave positive feedback on the intervention.

Positives:

High Demand: There is a high demand for tractor services by farmers which is beneficial for their businesses.

Confident of Repayment: Due to this high demand, all the tractor owners are optimistic about being able to complete the tractor payments before the end of the provided five-year period.

Quality App and Data: Tractor owners stated that Hello Tractor provides them with an app that enables them to track their work, activities, and progress.

Access to support services: They also have access to a hub of engineers and can request the services of those close to their tractors.

Challenges:

The high cost of diesel, lack of rainfall, and security issues in some areas, limit where they can go to provide services to farmers.

8.2

Farmers [Nigeria]

The majority of farmers in the Awe local government area in Nassarawa State are rice farmers, while those in Nasarawa Toto are maize and sesame seed farmers.

Positives:

Farm and cultivation expansion: According to the farmers, having access to tractors has enabled them to expand the size of their farms and land cultivated.

Savings in Time and Money: They stated that they prefer the use of tractors to manual labour because it saves time and money, pointing out that the estimated cost of labour is twice that of using tractors for land preparation activities.

Lower Rental Fees: The farmers further stated that Hello Tractor rental fees are significantly lower than those of other commercial tractors. However, they requested a price reduction so that more farmers could afford to pay for tractor services.

Challenges:

Few tractors available: The farmers' main challenge is the long waiting period of about three to four weeks before they can access the tractors because there are not enough tractors to service all of the farmers.

Need for closer support service: When the tractor needs repairs, they have to wait for the technical team to come from Abuja to carry out repairs.

8.3

Farmers [Kenya]

The majority of farmers in Kisumu County are rice farmers, with a few intercropping maize, sorghum, vegetables, and sugarcane.

Positives:

Significantly increased yield and acreage: According to the farmers' feedback, the introduction of Hello Tractor services in their communities has significantly increased their yields and acreage.

Agricultural transformation with technology: Most farmers were very optimistic about the transformation that technology is bringing to the area, and they believe that the service should be expanded to other areas across Kenya, to spur agricultural growth.

Lower rental fee: The cost of hiring the tractors is marginally lower than the county government tractors and other private tractor owners previously used.

Challenges:

Few tractors available: Similar to farmers in Nigeria, farmers in Kisumu County must wait several days before it is their turn for the tractors to cultivate their farms due to the increased number of farmers in the area serviced by Hello Tractor.

High overall costs: Kenyan farmers stated that the cost of hiring tractors is still relatively high. While the Hello Tractor rental fees are approximately $5 lower than other private tractor owners and county government tractors, the overall cost is still high for many smallholder farmers.

Based on overall feedback received from the beneficiaries interviewed, the Hello Tractor Pay-As-You-Go model has proven to be more affordable and effective for smallholder farmers than commercial renting in terms of rental costs, insurance, and technical support.

9.0 Analysis of Findings

9.1

Nigeria

Increase in income

According to farmers interviewed, the use of tractors made land clearing much easier, ultimately leading to a significant increase in farm size from 3 to 6 hectares.

On average, their income increased from $1,084 to $3,251 per hectare, bringing about a substantial improvement in their financial situation.

Improved farming practices, including increased farm size, increase in commodity prices, and access to tractors, have led to a significant increase in the income of farmers.

The income of female farmers increased by 380% and 138% for male farmers. This suggests an impressive improvement in productivity and efficiency.

Farmer's demographics

In Nigeria, an average Hello Tractor customer is a male farmer between the ages of 25 to 40 years. This demographic accounted for 60% of the respondents interviewed. In line with empirical data, there are more male farmers than female farmers in Nigeria. Regardless of cultural and land ownership limitations, many female outliers are successful farmers, supporting their families and communities. An inspiring example is Doris Joshua, a 27-year-old female farmer residing in Toto, Nasarawa.

> When we didn't have access to tractors, things were quite challenging. However, once we started utilizing tractors, our income grew exponentially, surpassing our expectations. We can now afford to provide our children with quality education, and we've been able to invest our savings in securing additional land.
>
> ***Doris Joshua, 27-year-old, female farmer***

At least 90% of the farmers who were surveyed have been involved in farming activities for 10 to 20 years. A significant proportion of the farmers, 74% of them, are heads of households, responsible for supporting a family of 3 to 10 individuals. The data highlights the importance of farming activities in the region, particularly in supporting the livelihoods of households, and their dependence on this sector for income and sustenance.

Cultivated crops

Farmers are primarily engaged in crop farming as it is the most dominant agricultural value chain in the region. The most commonly cultivated crops were maize, rice, cowpea, sesame, melon and groundnut. This suggests that these crops are historically the most profitable and viable options for the farmers in the area, and they have a competitive advantage in terms of demand and supply.

The farmers have significant expertise and experience in growing these crops, which may have been passed down through generations. The focus on crop farming also suggests that the region has favourable climate and soil conditions for growing these crops, which may have led to the specialization in this value chain.

Land size cultivated

The survey also revealed that before the intervention, the average land size cultivated by the farmers was 4.8 hectares. However, after the intervention, the average land size cultivated increased to 7.4 hectares, indicating a 54% increase.

Manual labour went from 4.8 hectares to 7.4 hectares using tractors.

54% increase in land cultivated by tractors

This suggests that the intervention was successful in improving the productivity and efficiency of the farmers, allowing them to expand their cultivation activities and potentially improve their income and livelihoods. The forecast from interacting with farmers is that the land size cultivated will continue to increase partly due to access to tractors.

Hectares serviced

Based on the survey data provided, Hello Tractor serviced 95% of the total hectares requested to be serviced.

On average, each farmer requested 7.2 hectares to be serviced while only 6.8 hectares were serviced. This suggests that Hello Tractor is operating at very high efficiency, as they were able to meet most of each farmer's needs.

Reasons for the shortfall in the number requested versus the numbers serviced include the fact that Hello Tractor did not have enough tractors or manpower to service all the requested hectares within the planting season, while there were logistical challenges in reaching certain farms. Some farmers may have also requested more hectares than they needed or could afford to pay for, which could contribute to the difference between requested and serviced hectares.

According to the farmers interviewed, there is a shortage of tractors and the waiting time during the planting season is between three to four weeks. This was reechoed by Shekwolo Abu, who said

> "We do not have access to tractors on time. It takes three to four weeks of waiting time during the planting season."
>
> ***Shekwolo Abu***

Overall, while Hello Tractor was able to service a majority of the requested hectares, there are still some areas for improvement in their operations to increase efficiency and ensure that their customers' needs are met.

Rental cost per hectare

Hello Tractor's current rental cost in Awe and Toto, Nasarawa, is between

$54.31 to $65.17 per hectare,

while other commercial service providers charge between

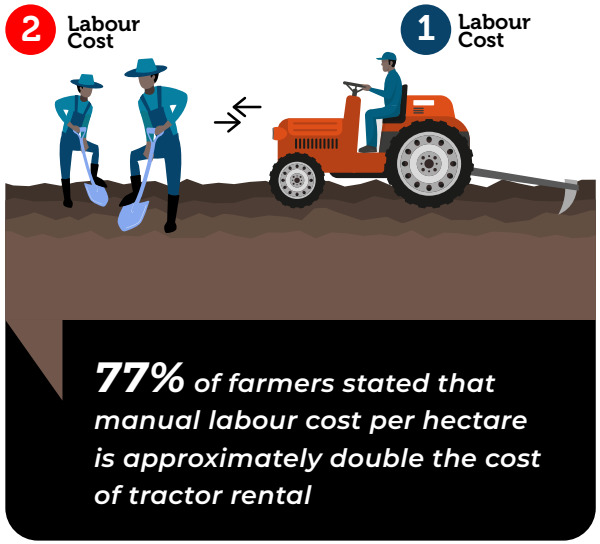
$65.17 to $86.9 per hectare for their rental services.

This suggests that Hello Tractor is competitively priced compared to other service providers in the area.

This is a key factor in their ability to attract and retain customers who may be looking for more affordable tractor rental options. However, it is important to note that there are other factors that customers consider besides price, such as the quality of service, availability of tractors, and ease of use, which may also impact their choice of service provider. .

Comparative analysis of tractor and labour cost

77% of the farmers surveyed agreed that tractor cost per hectare is more cost-effective than labour cost per hectare.



This suggests that the farmers perceive tractor rental as a more efficient and cost-saving option for their farming activities.

According to farmers surveyed, manual labour cost per hectare is approximately double the cost of tractor rental, which implies that the use of tractors is significantly more economical than relying on manual labour. Where family labour is used, manual labour costs are lower than hiring manual labour from outside sources.

The choice between using tractors or manual labour may depend on various factors, such as the availability of family labour, the size of the farm, financial capacity, and the type of crops being cultivated.

Provision of other value-added services

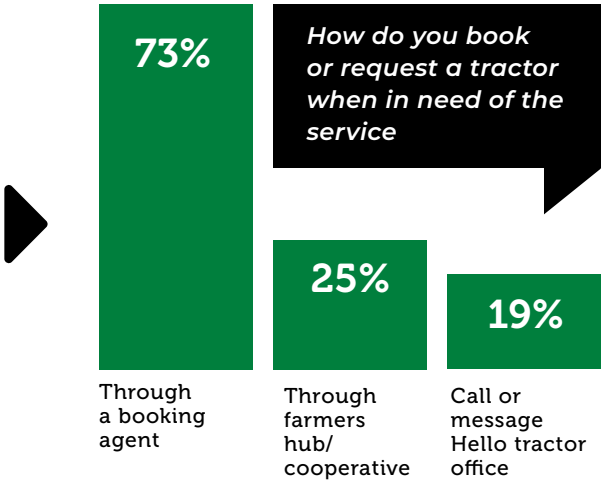
Currently, in Nigeria, farmers have access to tractors, while tractor owners have access to additional value-added services such as tractor technicians and spare parts services. With the setting up of a Hub in Toto, Nasarawa, in May 2023, farmers now also have access to other value-added services.

How farmers request for a tractor

Farmers in the surveyed area have access to multiple channels for booking tractors, including booking agents, farmers' hubs/cooperatives, and direct communication with tractor rental companies. Most of the farmers surveyed prefer to book tractors through booking agents. 7 out of 10 farmers surveyed have used this method, which suggests that it is a popular choice among farmers.

The popularity of booking agents among farmers indicates that these intermediaries play an important role in facilitating access to tractor services in the area.

Figure 2.



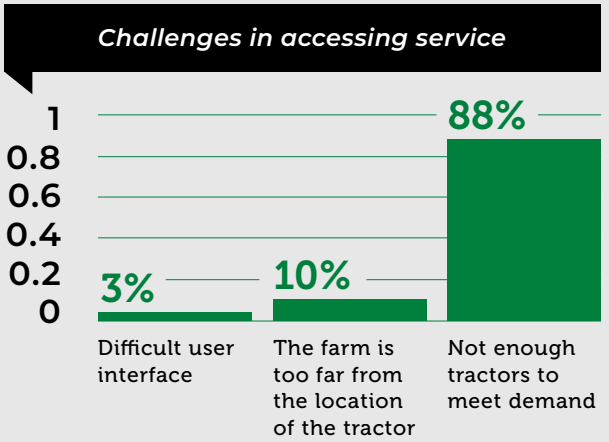
Challenges identified by farmers

Two key challenges identified by farmers are insufficient tractors and pricing. Farmers suggested an 8 to 20% reduction in rental cost to enable them to service more hectares

They also requested an increase in the number of tractors to cut down on waiting time and accessibility. Other challenges identified by the farmers include maintenance downtime, and inaccessibility of their farms as the farmland is separated by a river.

Overall, farmers in Nigeria identified that renting a tractor has helped improve farming practices and agribusiness as shown in figure 4.

Figure 3.



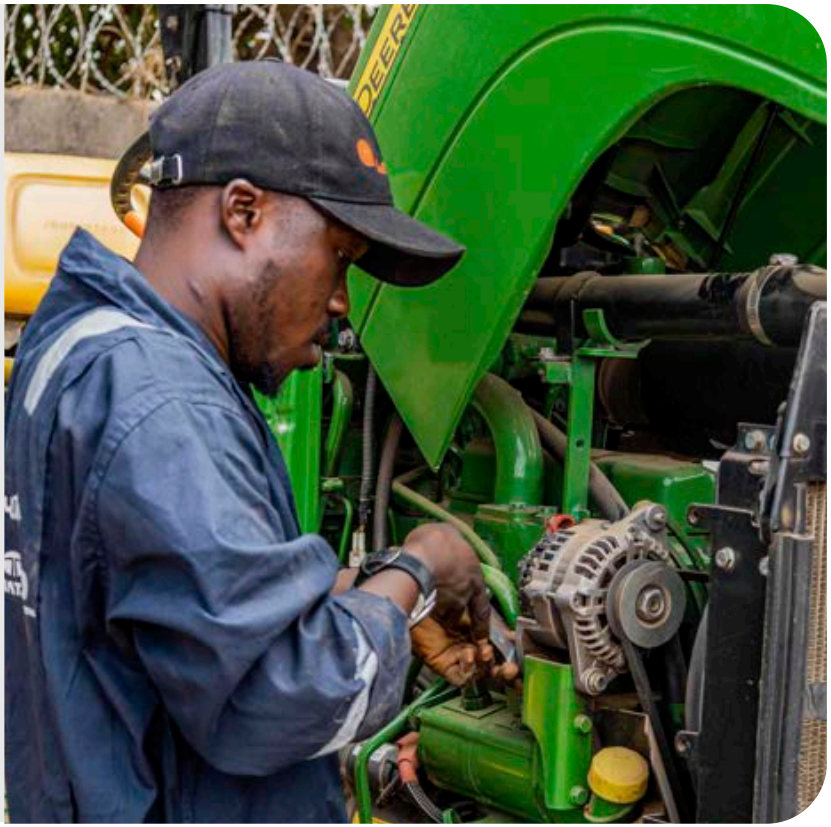
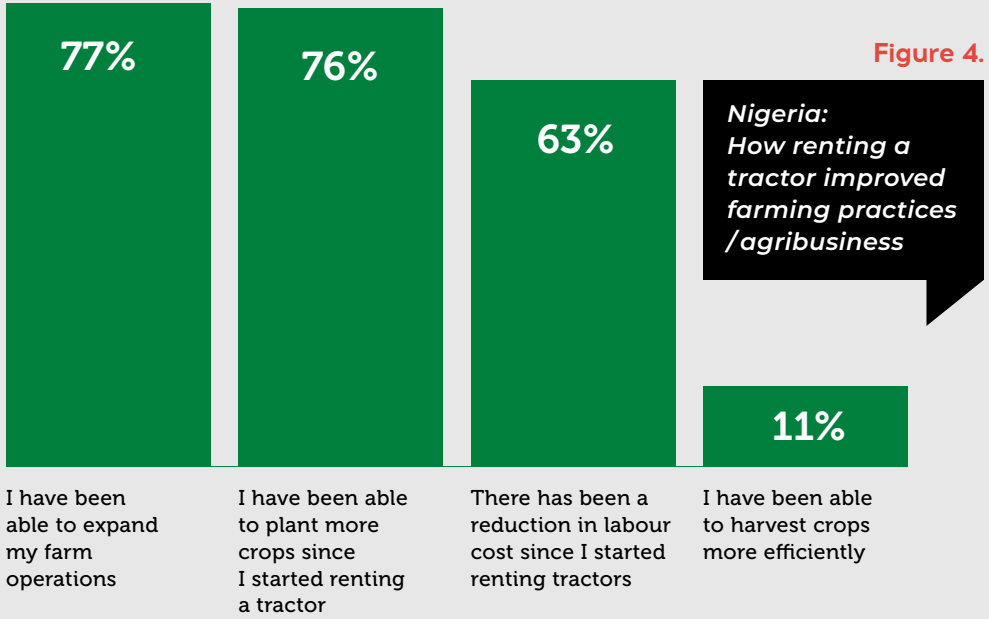


Figure 4.

Nigeria: How renting a tractor improved farming practices /agribusiness



9.2

Kenya

Increase in income

In general, the income of Kenyan farmers increased significantly with mechanization.

Male farmers experienced a 102% increase and female farmers experienced a 42% increase in income.

According to the survey respondents, this increase can be attributed to various factors especially improved access to resources like tractors, fertilizers, herbicides or pesticides, improved seedlings, and access to irrigation. The stabilization of commodity prices by the national cereals and produce board in Kenya was also identified as a key factor.

The surveyed tractor owners have an average monthly income of $4,610. This indicates that tractor ownership is a lucrative venture, as these owners are earning a substantial income from their services. Furthermore, 88% of tractor owners surveyed currently employ one to two tractor drivers and at least 70% support between 1 to 10 people. 58% of tractor owners are working with 1 to 2 booking agents, 27% work with 3-4 booking agents and 15% work with more than 5 booking agents.

Farmer demographics

The survey results indicate that 51% of respondents in Kenya are female farmers, and most of them farm to feed their families, while men are more predisposed to farming on a larger scale primarily for business. This suggests that women are more likely to engage in subsistence farming while men are more likely to engage in commercial farming.

The results also show that 69% of the women surveyed are heads of households, while 98% of female respondents support between 1-10 people, indicating that women play a critical role in supporting their families. Furthermore, 33% of the female farmers have more than 5 years of experience in farming, while the rest have less than 5 years of experience. The women farmers have an average farm size of 0.75 hectares, which is relatively smaller compared to male farmers.

Conversely, 90% of the men surveyed are household heads while 86% support between 1-10 people, with 10% supporting more than 10 people. 53% of the male farmers have been farming for more than 5 years, while the rest have less than 5 years of farming experience. The male farmers have an average farm size of 1.25 hectares, which is larger than that of women.

The results suggest that gender differences in farming practices in Kenya are driven by socio-economic and cultural factors.

Women are more likely to engage in subsistence farming due to limited access to resources and markets, while men are more likely to engage in commercial farming due to their economic and social status. The smaller farm sizes of women also reflect their limited access to land and other resources.

Cultivated crops

The more commonly cultivated crops in Kenya were maize, rice, groundnut, bean, melon, millet and tomatoes. This suggests that these crops are historically the most profitable and viable options for the farmers in the area, and they have a competitive advantage in terms of demand and supply.

Land size cultivated

A significant number of farmers, 76% of the respondents, have been able to expand their farm operations since they started renting tractors.

76% of the farmers reported a decrease in their labour costs since they began renting tractors

This suggests that access to tractors has facilitated the growth and scalability of their farming activities.

> **We used to use our hands in harvesting and we could not harvest well, so most of the produce remained on the farm. As of now, harvesting has been made easy**
>
> ***Zacchaeus Okoth, a 40-year-old rice farmer***

Hectares serviced

92.9 hectares of land was serviced monthly by tractor owners in Kenya

However, their service volume decreases during the off-peak season, suggesting a correlation between tractor usage and seasonal agricultural activities.

Rental cost per hectare

The more commonly cultivated crops in Kenya were maize, rice, groundnut, bean, melon, millet and tomatoes. This suggests that these crops are historically the most profitable and viable options for the farmers in the area, and they have a competitive advantage in terms of demand and supply.

Hello Tractor's current rental cost in (Kisumu-Kenya) is between

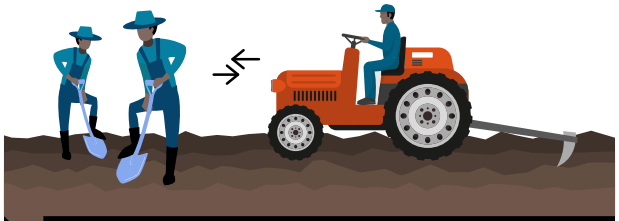
$87.5 to $100
per hectare

while other commercial service providers charge between

$150 to $175
per hectare for their rental services.

This suggests that Hello Tractor is competitively priced compared to other service providers in the area

Comparative analysis of tractor and labour cost



87% of the farmers surveyed believed that renting tractors is a more cost-effective option compared to manual labour involving the use of workers or animals. 76% of the farmers reported a decrease in their labour costs since they began renting tractors.

This indicates that utilizing tractors has helped them save on labour expenses.

Provision of other value-added services

Farmers in Kisumu also have access to a suite of services through the Hello Tractor Hub. These include subsidized fertilizers and seeds provided by Hello Tractor, as well as extension services.

Joshua Ochieng, a 45-year-old rice farmer, notes that

> back then, there were no fertilizers but as of now, we have access to quality fertilizers and pesticides

How farmers request for a tractor

Data showed that 59% of the farmers surveyed were able to make bookings independently without any assistance, utilizing their phones directly. On the other hand, 31% of the farmers required some assistance while booking, whereas 11% experienced issues and could not book tractors at all

Challenges Identified

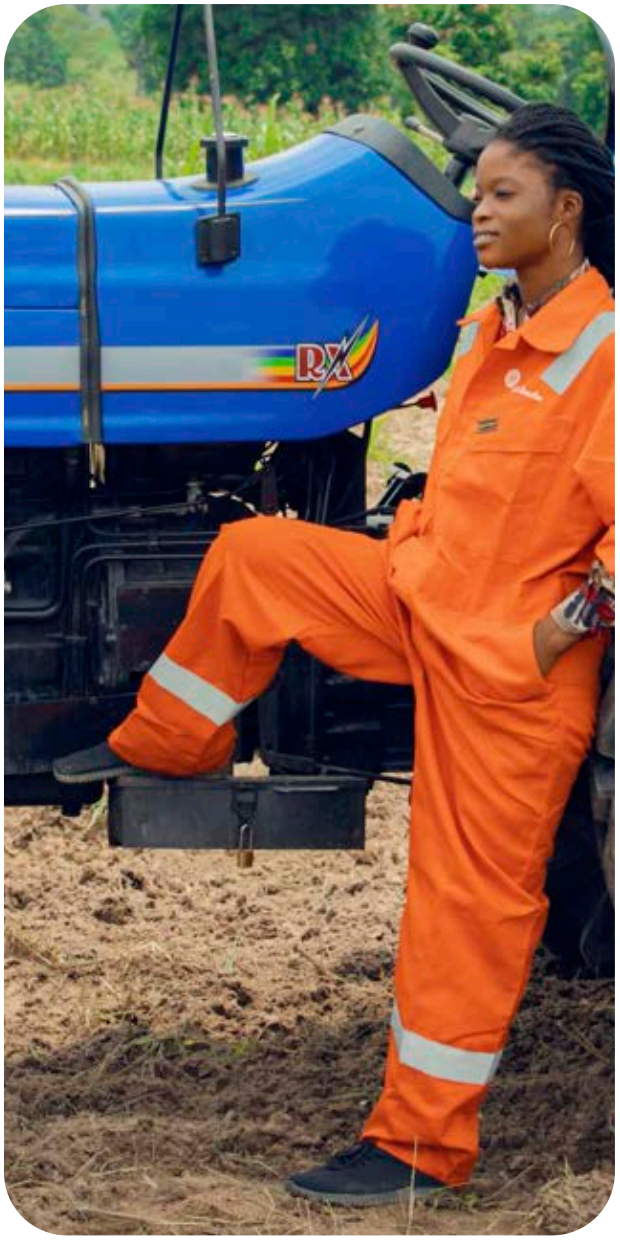
The primary challenges reported by farmers include insufficient tractor availability, as indicated by 9 out of 10 farmers, and pricing concerns, as mentioned by 5 out of 10 farmers. Additionally, inadequate access to capital was identified as a barrier to utilizing tractor services effectively, with some farmers requesting the flexibility of paying tractor rental costs after the harvest.

The assessment also revealed additional challenges specific to the sample population in Kisumu and Ahero. These challenges predominantly arise from climate change, pest infestations, and diseases. Farmers highlighted the need for increased support to combat these issues

> The use of tractors is good however; we need to have water pumps. This is the main challenge for small-scale farmers,

says Leah Akoth, a 27-year-old rice farmer

The assessment also underscored the significant impact of environmental factors. Sherine Omondi, a 40-year-old maize farmer, emphasized the heavy reliance on rainfall for farming activities, making farmers vulnerable to losses during periods of insufficient rainfall. Anthony Onyugi, a 45-year-old farmer cultivating maize, rice, and tomatoes, also highlighted the detrimental impact of birds that often consume a substantial portion of the crops, leading to significant yield losses.



Overall, Kenyan farmers acknowledge that the use of tractors and the Hello Tractor Hub services have improved agricultural practices for farmers as shown in Table 1.

Table 1: Beneficiaries' yield data

Yield [kg]	Maize	Rice	Groundnut	Beans	Melon	Millet	Tomatoes
Before intervention (kg)	62,745	513,183	24,800	9,360	109,730	2,600	4,050
After intervention (kg)	118,040	711,635	35,550	13,470	155,790	3,300	4,410
Percentage increase (%)	88%	39%	43%	44%	42%	27%	9%

9.3

Nigeria and Kenya

Overall, the availability of tractors has had a significant positive impact on farmers in both countries. Most farmers surveyed believed that renting tractors is a more cost-effective option compared to manual labour. The income of farmers also increased significantly with mechanization.

The availability of tractor financing has also had a significant impact on tractor owners. 73% of tractor owners stated that they would never have been able to purchase a tractor without financing options.

This demonstrates the critical role that financing plays in enabling tractor ownership, empowering a substantial portion of tractor owners who would otherwise not have the means to make such a purchase.

The primary challenge faced by 88% of the surveyed farmers is the inadequate availability of tractors. This shortage hinders their ability to access and utilize tractors effectively. In terms of rental prices, 46% of the farmers expressed a desire for a reduction in rental fees.

The repayment of tractor financing in Nigeria, Kenya, and Uganda has been exceptional with a 90% repayment rate.

Figure 5.

Comparison between tractor and labour cost per hectare, which is more cost-effective?

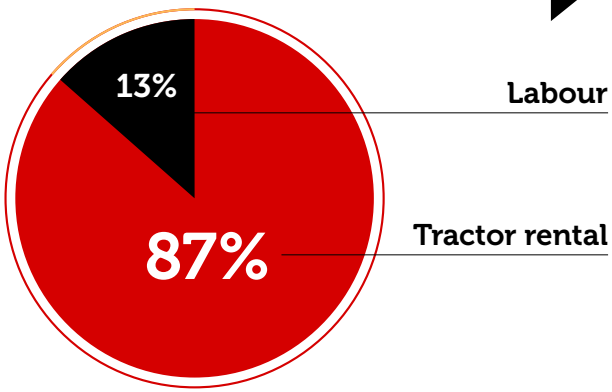


Figure 6.

How renting a tractor improved farming practices / agribusiness

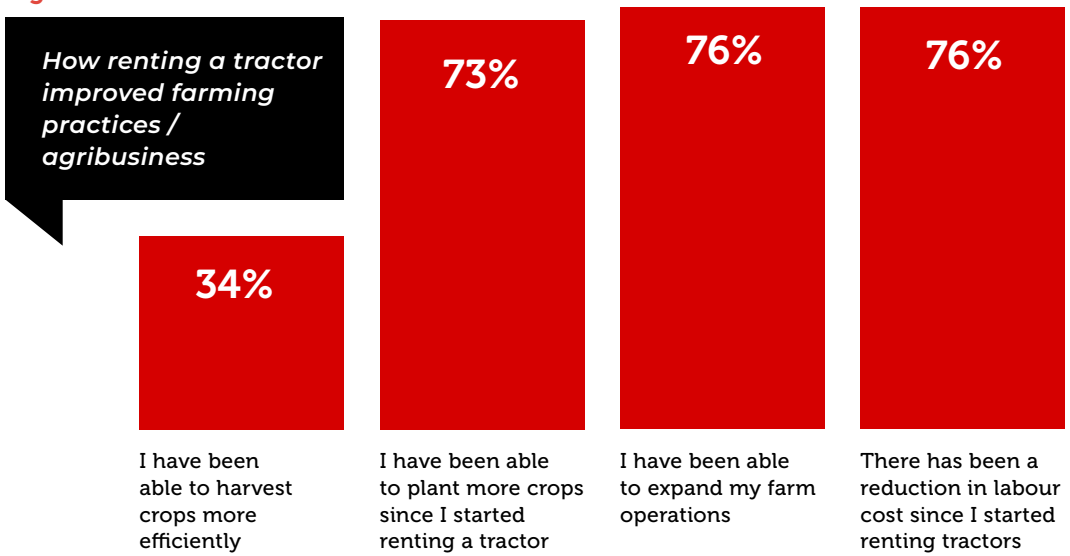
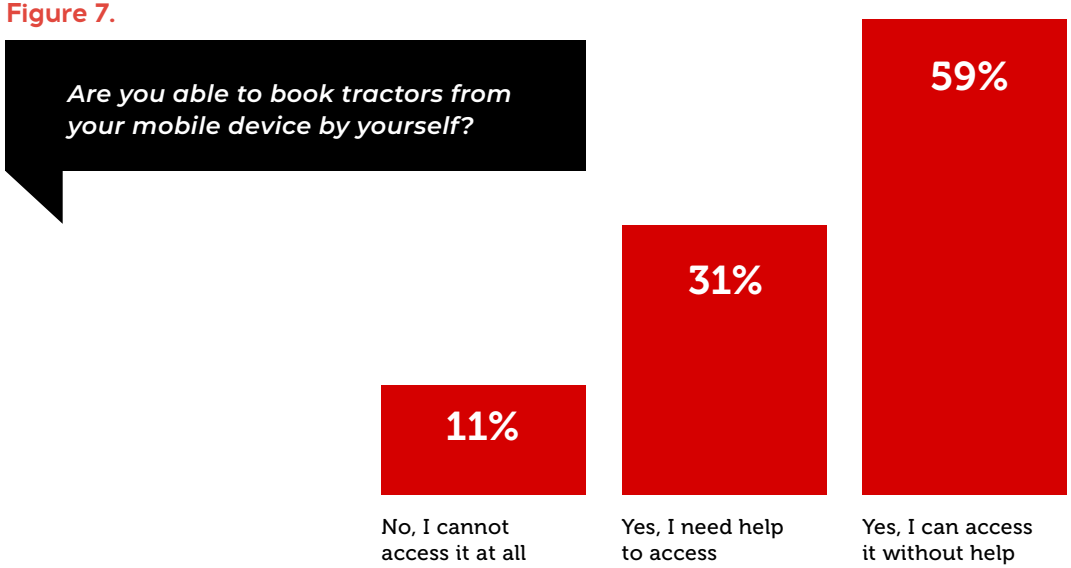


Figure 7.

Are you able to book tractors from your mobile device by yourself?



10.0 Farmer Recommendations

Increasing the number of tractor owners: The demand for tractor services exceeds the number of tractors available to serve farmers. As a result, by increasing the number of tractors, farmers will not have to wait as long to access this service, allowing planting and other farming activities to be completed on time.

Introducing credit/loan services: The farmers suggested that loans and credit services be made available at the Hub. The majority of them stated that this would allow them to increase the number of acres cultivated each season. They suggested that payments be made after harvest because most of them do not have enough money to pay for the tractor services during land preparation.

Introducing the use of USSD code: The farmers believe that introducing a USSD code will allow farmers who use basic phones to easily access booking services rather than relying solely on booking agents.

This will also make the tractor service accessible to farmers in areas where booking agents are unable to reach.

Service extension: The farmers suggested that Hello Tractor should extend its services to meet some additional farming needs. Some of the recommended services include:

- **Availability of extension officers to provide necessary information to the farmers.**
- **Availability of quality fertilizers and seedlings at subsidized prices to the farmers.**
- **Availability of combined harvesters along with the current cultivation tractors to help speed up the entire farming process.**
- **Availability of pricing information and access to markets.**

11.0 Social Return on Investment (SROI)

One of the key objectives of this study was to evaluate the social value of Heifer International's investment in the project. The project provides financing for tractor ownership and access to tractors for smallholder farmers in Nigeria, Kenya and Uganda.

The social return on investment component of the study is focused on measuring the tangible and intangible value and impact of the project using clearly defined outcome indicators. The overarching objectives for SROI evaluation are:

1

Establish the SROI of projects to direct and indirect beneficiaries and the community. For example, "A $1 investment in providing farmers with access to tractors has generated an SROI of $2.4; this translates to an increase in farmers' income and an improvement in health and economic outcomes. "

2

Recommendations for the extended long-term impact of social investment. For example, "An investment in a tractor mechanization project in Nigeria, Kenya and Uganda gives a 140% net SROI, through a sustained increase in farmers' income, health and economic outcomes, development of self-esteem and an opportunity to contribute to the immediate economy."

Table 3: Project benefits

Indicators	Success rate | No of beneficiaries	Monetary Value per unit	Total Estimate ($)
Increase in family savings	76% | 16,355	$480	$7,850,400
Healthy living habits	76% | 98,124	$10	$7,850,400
Increase in productive hours because of good health	76% | 16,355	$10	$163,550
Increase in school enrolment	64,560 (at least 3 children enrolled in each family)	$20	$1,291,200
New business opened	104	$100	$10,400
Increased self-esteem	21,520	$10	$215,200
Capacity development for tractor operators	157	$100	$15,700
		Total value of benefits	$10,527,690

* *Success rate: 76% of farmers surveyed have been able to expand their farm operations and consequently increase income.*

Table 4: Direct and Indirect beneficiaries as of January 2023

Item	Direct beneficiaries	Indirect beneficiaries
Farmers serviced	21,048	126,288
Tractor owners	104	624
Booking agents	208	1,248
Tractor operators	157	942
Tractor technician	3	9
Total	21,520	129,111
Total direct and indirect beneficiaries	150,631	

** *Assumption: each direct beneficiary supports at least 5 to 6 people. This is supported by the survey data.*

Table 5: SROI table

Items	Values
Project Cost	$4,400,000
Benefits (in numbers)	10,527,690
SROI	2.4
Net SROI	1.4
Net SROI (%)	140%

3

The SROI ratio of 2.4 indicates that the project was able to generate $2.4 of social value for every dollar invested in providing tractors to smallholder farmers. This means that the project was highly efficient in creating social impact and yielded a significant return in terms of social value.

4

The Net SROI value of 1.4 indicates that the project produced a positive return on investment. It means that the social value generated was 1.4 times greater than the resources initially invested. This outcome suggests that the project was not only successful in achieving its intended social goals but also exceeded expectations by delivering additional value to society.

5

Overall, these values paint a positive picture of the project's benefits. The SROI ratio of 2.4 demonstrates the project's ability to leverage resources effectively and create substantial social value. This is significant given that the project benefits are just unravelling and the project has just crossed the one-year mark. This indicates a promising potential for even greater social value creation as the project continues to progress and expand its reach.

6

Financial return on investment: The loan repayment rate serves as an indication of the financial return on investment. This shows how successful the financing initiative has been in terms of recouping the funds invested. The project's 90% repayment rate suggests that the project is financially viable and sustainable, ensuring an availability of funds for future tractor financing.

This is also an indicator of the project's success in achieving its social goals. When tractor owners are able to repay their loans, it implies that they are generating sufficient income from servicing smallholder farmers.

Quotes from Beneficiaries

"I have been looking at mechanisation for a long time but building capital was a problem. If I can get more on the same terms, I'll get up to 50 tractors because the opportunities are enormous. We get about 5 calls every week and we haven't even been able to satisfy our customers. So the demand is high, even though it's a seasonal business, you can succeed at it with proper planning"

Munza Ambima,
serviced up to 625 hectares to date.
(He services Nassarawa, Abuja, Kogi, Delta and Taraba)

"Being a female in the agric field, there are some discriminations from male farmers but consistency, and being a booking agent earlier has helped me. The female farmers trust me more and prefer to work with me. Some male farmers also prefer to work with me because they think I'm more empathetic"

Blessing Agu –Abuja,
Female farmer and Tractor owner.

Quotes from Beneficiaries

"Access to tractors and inputs has contributed to an increase in income for me. When using cows before, the process was tedious and slow as it can take one or two weeks to cultivate my farm but with a tractor, I can do the job in a day."

Jane Atieno,
Female farmer in Rabuor Kenya.

"It has improved my business as I have been able to improve the acreage I do every year. From the profits, I am able to improve my productivity to buy quality farm inputs for my farm. I am able to keep my family in a stable financial position."

Samsung Opiyo,
Muhoroni, Kisumu, Kenya,
Farmer and Tractor owner.

"Hello Tractor provides a sophisticated mobile app which allows me to track my tractors' location, carry out routine maintenance, know the number of hectares done and also know the amount of fuel consumed which has helped my business a lot and helps it to run smoothly."

Samson Enesi,
Abuja, Civil servant and Tractor owner.

12.0 Conclusion

Heifer International, through Hello Tractor, is successfully accomplishing one of its key objectives of boosting farmers' income by enabling greater land cultivation through improved tractor accessibility. The results of the pilot phase of the mechanization project demonstrates the project's relevance, efficiency, and effectiveness, resulting in an impressive 227% boost in farmers' income while creating 368 new jobs. The project has had a positive impact on 21,520 direct beneficiaries and another 129,111 indirect beneficiaries.

The intervention also showed a positive Social Return on Investment and a 90% loan repayment rate. In addition, all the tractor owners and farmers surveyed gave positive feedback on the intervention.

The project, by directly solving a significant challenge faced by smallholder farmers, serves as a model for effective leveraging of grants to power innovation, and unlock commercial financing that increases the output of smallholder farmers, thereby leading to a transformed agricultural ecosystem.

Appendix

List of Tables

List of Figures

List of Acronyms and Abbreviations

ANACIM: Agence Nationale de l'Aviation Civile et de la Météorologie

PAH: Pay-at-harvest

PAYG: Pay-as-you-go

PAYS: Pay-as-you-store

SROI: Social return on investment

T4A: Tractors for Africa

HEIFER INTERNATIONAL

www.heifer.org

AYuTe Africa CHALLENGE

www.ayute.africa

MECHANIZATION FOR AFRICA

Innovative Financing for Agricultural Transformation and Youth Job Creation.