

2WT BUSINESS MODEL APPRAISAL IN FACASI PROJECT AREAS-KENYA

SYNTHESIS REPORT ON THE ADOPTION AND IMPACT OF 2WT BUSINESS MODELS ON FARM HOUSEHOLDS IN KENYA

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EXECUTIVE SUMMARY

Background: In many parts of Kenya, small scale farms remain at the center of agriculture and rural development. However, productivity of these farms is dismally low leading to high level of food insecurity. One of the main causes for the low level of agricultural productivity is the lack of appropriate agricultural machines and equipment that cater to and suit the requirements of small scale farms. CIMMYT through FACASI funded a programme in Kenya to disseminate 2WT based agricultural mechanization technologies and other small farm machinery technologies to smallholder farmers including ploughs, planters, trailers, Sheller, threshers among others.

This synthesis report was funded by FACASI and focused on the assessment of the Performance of 2WT-Business Models and the benefits and impact the 2WTs has brought to the Service providers and users of 2WT mechanization hire service.the. In Kenya FACASI project operates in two regions; Laikipia and Bungoma counties,

Study objectives: The main objective of this Business Model Analysis research was to assess the performance of 2WT-Business Models in Kenya. The study also aimed at assessing the adoption and scaling up of 2WT mechanization by small scale holders farmers in Laikipia and Bungoma counties in Kenya. The specific objectives were to; i) Assess the performance of the 2WT hire service business models, ii) Assess the benefits and impact to the users of 2WT mechanization hire service, iii) Assess the critical success factors for improvement of the performance business models and iv) to examine the Agribusiness Hub model performance and its impact on farm household utilizing the hire services.

Methodology: The study was designed to follow qualitative and quantitative methodologies, employing a case study approach to analyses selected business models. In undertaking this study, 2WT business models were first selected. A detailed analysis of various variable including; resources and activities, key partners and collaboration, business organization, business performance, offering, value proposition, flow of services and distribution, utilization of good and services, customers, sustainability, business environment, business growth and strategy and critical success factors were investigated. Data collection entailed field visits and household interviews using two data collection instruments. During field visits, key informant interviews were conducted with 2WT individual owners, 2WT hire services providers, users of 2WT hire service.

Key findings: This study has revealed that the market performance for 2WT BM in Kenya is low. Majority of SPs offered very few services that were demanded by users.. Most SPs were constrained in mechanized service diversification by lack of 2WT equipment's and accessories like Shellers, trailers etc. that limited greatly the range of services they could offer to their customers. For 2WT business model to be profitable, it is recommended for SPs to own more than one 2WT accessories and to bundle their services.

On the other hand, mechanization levels among smallholder farmers are particularly low in Bungoma and Laikipia regions. While adoption and use of 2WT in Kenya is still low, the demand is slowly growing. The increasing demand is attributed to the high land fragmentation that are making operations of 4WT within the small sized land holding uneconomical. In general across the country, the niche for service providers of 2WTs based mechanization is becoming attractive owing to the increasing land fragmentation, the high operational and maintenance cost of alternative mechanization like animal draught and 4WTs and the diminishing human drudgery.

This study also revealed that the 2WTs Business models in Kenya are few and generally weak but have prospects for growth if well managed. Majority of 2WT mechanization Service Providers (SPs) models studied are individually owned and operates private enterprises with just 1 unit 2WT and 1 unit plough and offered ploughing which was the most demanded service.

In upgrading the existing business models there is need for much efforts to be put on the demand side to increase the attractiveness of the business since most BMs identified had very few customers. Measures like conducting field demonstrations on the use and operation of the 2WTs must be instituted to create the demand.

Good entrepreneurship skills and improvisations skills added onto SP's passion for mechanization were identified as most important factor in running a successful 2WT hire service business. Few 2WT owners and SPs exhibited a high level of innovation in terms of 2WT modification and fabrication. They said that innovations skills in the mechanization services (especially modifications of 2WTs to suit local conditions) is very important to the sustainability of their business. In terms of risk mitigation, most owners and SP effectiveness in mitigating risk is quite low

In terms of value proposition, most SPs attributed quality and timely services they offered as key to retaining their customers. Beyond hire mechanization service provision, some SPs were found to provide their customers with agronomic advice especially on conservation agriculture and marketing information on a need-to-know basis. Other BMs like AgriHub and Nyabon also offered farmers training and filed demos on the use of these machineries. The value proposition for AgriHub BM is modeled in providing a one-stop-shop for all mechanization services a farmer would need in addition to providing an end-to-end market linkages for farmers, farm mechanization hire services and agro-inputs services to smallholder farmers

In terms of gender mainstreaming in mechanization hire service, finding from the study show that most SPs did not have any incentives to attract women and youth. Only the Hub had instituted mechanisms to attract youth and women to utilize mechanization hire services.

The customer segmentation for most BMs was small scale individual farmers/households who mostly farm for subsistence purposes. SPs used various methods to attract customers including referral from those farmers they have offered services, word of mouth, returning customers from previous seasons.

In terms of customer satisfaction, majority of users said they were satisfied with services offered. Users were also satisfied with these charges. The custom hire charges offered by SPs did not differ much across the regions. Again majority were very satisfied with quality of work SPs provided. In terms of technical advice, almost half of the respondents said they were quite satisfied with the advice they received from SPs a large number expressed satisfaction with the reliability of services offered by their 2WT SPs. However, there were low satisfaction with timeliness of services offered as most said hire services are not always timely availed and are only available sometimes when they need them. This can be attributed to breakdown of 2WTs and lack of spare parts and skilled mechanics to fix them.

In terms of business linkages many 2WT owners and SPs business had established strong linkages with the hire service users. However, they had very weak linkages with other actors (dealers, suppliers, government and financial institutions) within the agriculture value chain. Only AgriHUB and Nyabon enterprise had established relatively strong linkages with other actors.

The managerial capacity for most BMs was found to be very weak. Lack of management and leadership skills for group based model of TUUTI was self-evident. In addition most SPs had not instituted any movement strategy and operated without any plan. Their record keeping was very poor and the reason why they could not exactly know the amount of profit or loss they were making.

The probability of 2WT BMs was found to be low. Most SPs said their immediate main constraint to improved profitability of their business was the lack of equipment's like planter, tiller, sheller and trailers to enable them diversify in range of hire services they offer thereby diversifying income generation streams.

In terms of source of finance to support BM expansion strategies, the business financing market in Kenya is well developed and very competitive, there are many commercial banks and micro finance institutions who have developed various financing models and products aimed for the agribusiness sector. However, affordability of such product is a key detriment for small sized BMs and for small scale farmers whose income earnings from their farm activities is quite low and unable to service the high interest rates the loans attract. Therefore majority of BM relied on their little income earning and personal saving to acquire 2WT equipment. This has hindered their business' assets expansion.

In terms of business growth and expansion strategies, many owner/operator of hire services expressed desire to buy 2WT implements like plough, sheller, trailer, harrow that will enable them diversify the range of services they offer to their customers. Their future expansion strategy is to upgrade to 4WTs. Integrated BM of Nyabon growth strategy and sustainability is hinged on provision of farm mechanization solutions (as a packaged service product) to small and medium scale farmers along key agricultural value chain. For the corporate BM of AgriHub the business growth strategy adopted is to provide all the mechanization farm needs their customer requires at the hub (one-stop-shop), offering complementary bundles of services to farmers and intensifying provision of high quality mechanization service from planting to post harvesting for customer.

In terms of business operating environment, most SP reiterated that government support is very weak and there are no clear policies targeting small scale mechanization. Existing Institutional support frameworks and policies are weak in supporting grassroots mechanization and indeed were found to have very little impact at the grassroots level.

The critical success factors impeding the successive adoption of 2WT mechanization services were identified to be; unavailability of spare parts, affordability concerns, low capacity and skills of operators, lack of access to finance, lack of access to markets, quality concerns of the supplied machinery and unavailability of after sale services. On the other hand most users of 2WT mechanization services rated quality of services, affordability and timeliness of operation key factors they consider when seeking out 2WT mechanization services.

Challenges facing 2WT business models in Kenya included;

- Low affordability of 2WT and accessories due to very high price of 2WT for most SPs to afford.
- Lack of spare parts is a big problem for 2WT owners/SPs
- Lack of skilled mechanics and garages/workshops to repair 2WTs
- Low awareness of 2WTs mechanization amongst farmers.
- Low technical skills to operate 2WTs. Training is critical of 2WTs operators

- Low business management skills and weak entrepreneurship skills for most SPs
- Very poor record keeping for all BMs.
- BMs had weak linkages with dealers, financial institutions and output market
- Weak government policy support for 2WT BMs and small scale mechanization in general.
- Poor roads conditions a big deterrent to 2WT entrepreneur in offering mechanization hire services.

For conclusions and recommendations in improving performance and scaling up of 2WT mechanization in Kenya, the following measures should be considered;

- As an entry point for 2WT adoption, target existing SPs who have good entrepreneurship skills, high improvisations skills and who have passion for mechanization who are then provided (at a subsidized rate) 2WTs and their accessories to provide services to small-scale farmers.
- The best model for scaling up 2WT based mechanization would be small scale 'individual owner/operator model' that has SPs owning 2WTs exclusively for service provision. Caution must however be put in choosing the most competent and active SPs for engagement.
- As much as corporate Led model would seems most suitable for scaling up 2WT mechanization technologies, it's most difficult one to implement due to capital intensive nature for starting and replicating such Hubs in other region in Kenya. Group models should be avoided as they are most challenging to manage and operate.
- There is need for provision of technical training to owners and SPs to improve use and adoption of 2WTS. Provision of government support in making sure affordable machinery is available is critical.
- If the 2WTs are to be adopted, then manufacturers and dealers must integrate SPs advice on certain modifications to be carried out on 2WT to improve their effectiveness and functionalities.

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ABBREVIATIONS

ATDC	:	Agricultural Technology Development Centre
ACIAR	:	Australian Centre for International Agricultural Research
AgriHub	:	Agribusiness Mechanization Hub
ATDC	:	Agricultural Technology Development Centers
BM	:	Business Model
CA	:	Conservation Agriculture
CBO	:	Community based Organization
FACASI	:	Farm Mechanization and Conservation Agriculture for Sustainable Intensification
FTF-KIE	:	Feed the Future Kenya Innovation Engine
FAO	:	Food and Agricultural organization
GDP	:	Gross Domestic Product
GOK	:	Government of Kenya
KENDAT	:	Kenya Network of Dissemination of Agricultural Technologies
KRA	:	Kenya Revenue Authority
KNBS	:	Kenya National Bureau of statistics
MOA	:	Ministry of Agriculture
NGO	:	Non-Governmental organization
SACCO	:	Savings and Credit Cooperative Organizations
SP	:	Service Provider
TOTs	:	Trainer of Trainers
USD	:	US dollar
Kshs	:	Kenya Shillings
2WT	:	Two-Wheel Tractor
4WT	:	Four-Wheel Tractor

1.0 INTRODUCTION.

This report synthesizes an in-depth research conducted In Kenya on the use and adoption of 2WT Mechanization technologies for small scale farmers in Laikipia, Bungoma and Kisumu districts in Kenya. The study focused more on small scale entrepreneurs' business models who either own (Owner-operators), or provide services (hire services) using two wheel walking tractors. In total, six business models were analyzed;

- | | | | |
|----|-----|---------------------|-----------------------------------|
| 1. | BM1 | Maurice Kakhame | [Individual/owner operator model] |
| 2. | BM2 | Vincent Sikuku: | [Individual/owner operator model] |
| 3. | BM3 | TUUTI CBO: | [Group based ownership model] |
| 4. | BM4 | Mabanga ATDC: | [Government led model] |
| 5. | BM5 | Nyabon Enterprises: | [Integrated dealer model] |
| 6. | BM6 | Agribusiness Hub: | [Corporate owned model] |

In Laikipia region one business model was assessed- the Corporate Business Model of “Agribusiness Hub” owned and operated by an NGO called Kenya Network of Dissemination of Agricultural technologies (KENDAT). *In Bungoma region*, four business models were assessed; i) Vincent Sikuku and Robert Wanyonyi (father and Son), ii) Maurice Kakhame iii) Mabanga Farmers Training College as a disseminator of mechanization technologies in the region and iv) a group based model called TUUTI CBO. *In Kisumu Region*, Nyabon enterprises- a dealer-led integrated business model was assessed.

A total of 10 farmers who use the 2WT hire services from the 2WT SPs were interviewed in Bungoma. These business models were selected based on their performance in the promotion and use of 2WT mechanization technologies, their dissemination of mechanization services with special emphasis on small scale holder farmers and their involvement in educating farmers on conservation agriculture. Another criteria applied for choice of these models was their involvement in the FACASI funded project in the Kenya.

1.1. State of agricultural mechanization in Kenya

Agriculture sector in Kenya contributes about 30% of the country's GDP (MOA, 2015; KNBS, 2016). At the same time, agriculture provides more than 18 % of formal employment and about 70 % of informal employment (World Bank, 2013) in the rural areas where the majority of the population resides. In addition to influencing the overall economic performance through its contribution to GDP, agriculture in Kenya contributes to about 40% of government revenue and more than 60% of the total export revenue while feeding the country (MOA, 2016). In the year 2015, the agricultural sector grew by 6.2 per cent to become the economy's biggest booster (KNBS, Economic survey, 2016).

Mechanization is on the rise in Kenya but there is more emphasis on 4WTs than 2WTS. Most of the 4WTs operating in the country are, however, concentrated on larger scale commercial farms. The present level of agricultural mechanization in Kenya ranges from 95% on large farms (mostly private owned) to as little as about 4% on small scale holdings (World Bank, 2013).

In many parts of Kenya, small scale farms remain at the center of agriculture and rural development. Agricultural production in Kenya largely involves small-scale farmers owning on average 0.2–3.0 hectares and accounts for about 75 % of agricultural output and 70% of the marketed agricultural produce (GOK

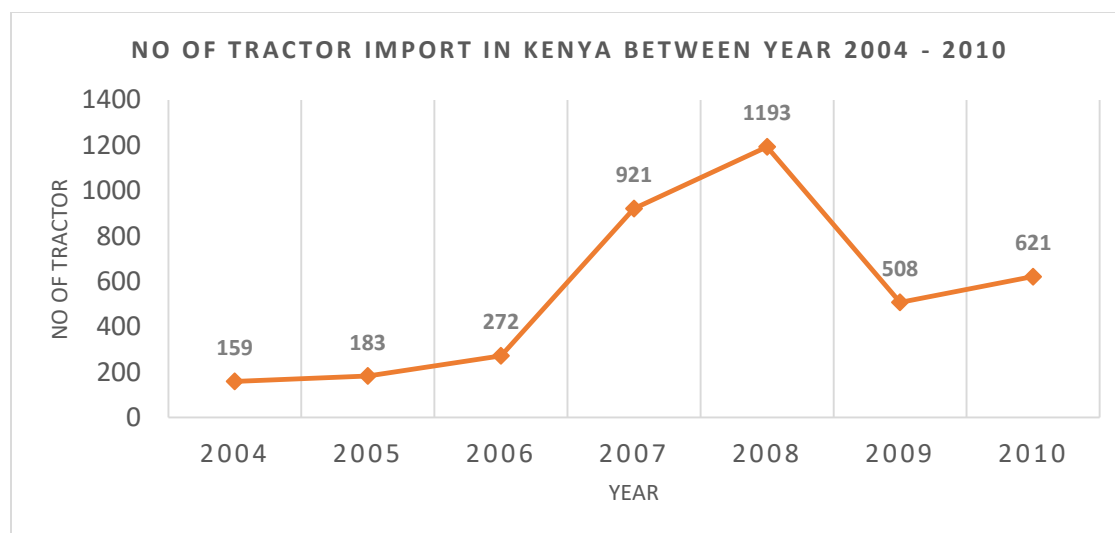
2010). However, productivity of these farms is dismally low leading to high level of food insecurity. This is because Kenya’s agriculture is mainly rain-fed and is entirely dependent on the bimodal rainfall in most parts of the country. Another causes for the low level of agricultural productivity is the lack of appropriate agricultural machinery and equipment that cater to and suit the requirements of small scale farms. For this reason, many small farms are deemed as unproductive and inefficient.

The small-scale farmers generally operates on a commercial basis in the country’s high-potential zones while on low-potential zones-arid and semi-arid zones most operator for subsistence purposes. The medium-scale farmers who possess on average 3–49 hectares generally engage in commercial agriculture and tend to adopt new technology at a high rate. The large scale producers normally hold more than 50 hectares and account for about 30% of the agricultural produce marketed in Kenya. This category is characterized by significant investments in inputs and high yields and produce for commercial purposes.

The degree of mechanization in Kenya according to Agribusiness Indicators study done by World Bank between 2011/2012 is about 3 tractors per 1,000 hectares or 26.9 tractors per 100 square kilometers— much higher than in most other Eastern African countries, including Tanzania and Uganda (World bank, 2013). On the whole, it is estimated that only about 30% of the operations on small farms are done using motorized power (tractors and motorized equipment) while 50% use human power and 20% use animal draught power at 20% (GOK, 2015). In terms of mechanization for small-scale farmers in Kenya, use of tractor-drawn implements are relatively high in the high-potential agricultural areas of the Rift Valley and Western Lowlands, where heavy rains sometimes result in waterlogged and caked soils, which are difficult and labor-intensive to prepare for planting using simple hand implements. In Kenya, smallholders have as a matter of necessity embraced the use of tractors for land preparation, particularly for tillage and harrowing.

According to World Bank, Kenya has an estimated fleet of about 14,400 tractors that are still within their economic lifespan; More than 70% are medium-sized tractors between 80 and 120 horsepower (HP).

Figure 1: Tractor imports, Kenya (2004-2010)



Source: Ministry of Agriculture annual report, 2012

Tractor imports appear to have spiked (figure 1) as a direct response to the high food prices of 2007/08, as farmers sought to take advantage of high food prices and increase their scale of production. According to an FAO (2013) study, there is a growing demand for Agricultural equipment's that offers opportunities for suppliers.

The increasing demand has led to emergence of various chain-actors including importers, service providers, manufacturers and repairers. However, the agricultural machinery industry in Kenya is currently dominated by the private sector. Even in the private sector, the market for tractors and other heavy farm equipment in Kenya tends to be concentrated in very few hands. In recent years the government has continued its divestiture and privatization of parastatals to make them profitable and self-sustaining. The result is that private companies, rather than the government, now import tractors. Most importers represent established tractor manufacturing firms overseas, and each private importer specializes in specific brands (table 1). As illustrated in table one, only three firms, including CMC Motors Ltd. and two other companies representing Ford and New Holland, supply about 90 percent of the tractor imported in the country between 2004 and 2010.

Table 1: Types of tractors imported into Kenya (2004-2010)

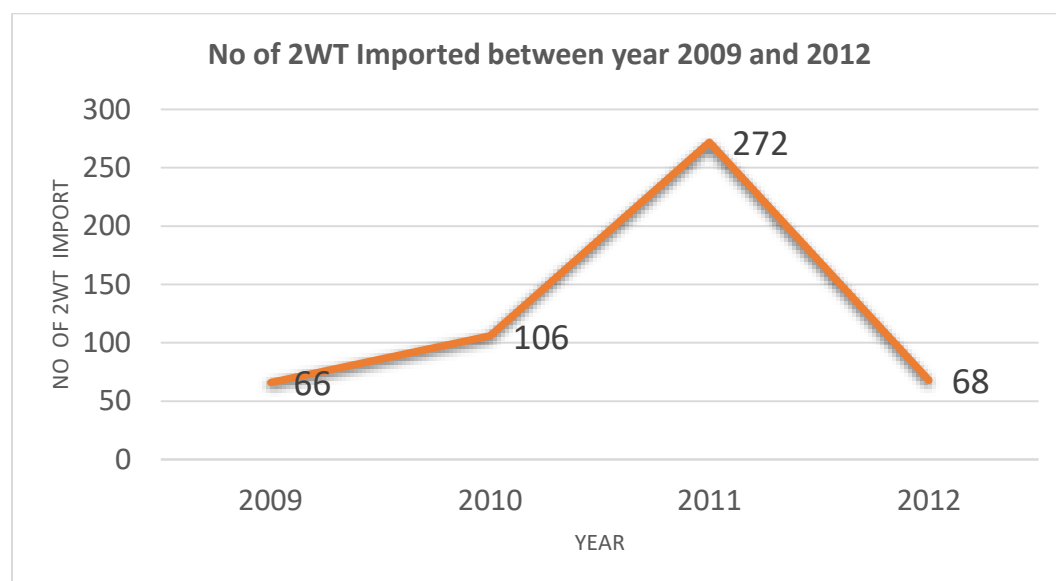
Tractor type	2004	2005	2006	2007	2008	2009	2010	Total
Massey Ferguson	39	66	119	367	678	211	67	1,480
Ford/New Holland	115	112	146	434	439	213	460	1,459
SAME	0	0	0	35	8	2	54	45
John Deere	3	2	4	53	1	28	0	91
Fiat	0	0	0	10	0	4	0	14
CASE	0	0	0	0	12	48	0	60
Other	2	3	3	22	55	0	40	85
Total	159	183	272	921	1193	508	621	3,234

Source: Agricultural engineering services, MoA.

1.2. The market for 2WT in Kenya

The market for 2WT is not well developed in Kenya, the services are almost non-existent in maize agricultural value chains in small holder farmers. From available figures from the Kenya Revenue Authority since 2005 only some 512 units of 2WTs have been imported, with a peak of 272 units in 2011.

Figure 2: Importation of 2WT in Kenya from 2009 – 2012



Source: KRA, 2005

Most of the 2WTs, however, are used in the horticultural industry to transport flowers from farms to pack-houses. The imported makes of 2WTs are largely Chinese Dongfeng and Japanese Kubotas. Some of the importers operate on a one-off basis. The number of annual imports has since declined to only 68 units in 2012 as dealers have cut back on imports owing to low market demand. This can largely be attributed to the relatively high cost of imports and low awareness among smallholder farmers. Very few importers are willing to invest in creating demand citing the low margins obtained from the sales of the 2WT.

The relatively low level of adoption of mechanization by small holder farmers is due to a number of challenges facing the sub-sector; the high cost of acquisition of farm machinery that has acted as a deterrent to majority small scale farmers owning and using them. The traditionally based human labour is still popular and practiced by majority of subsistence farmers. In many cases, this mode presents major constraint to increasing agricultural production as farmers are not able to meet their market needs in terms of quantity, quality and timely delivery of produce to markets. Policy frameworks supporting agricultural mechanization.

Full benefits of using multiple modern agronomic inputs cannot be realized without using improved tools and machinery. Mechanization reduces the drudgery of agriculture and frees farm labor for other, often more productive, purposes. Tractors are regarded as the most important and versatile equipment used by farmers wanting to mechanize some or all of their farm operations. The country therefore must support the adoption and scaling up of mechanization initiatives through sound policy and institutional framework that support mechanization at the grassroots level.

1.3. Agriculture mechanization policy status in the country

In regards to the country's agriculture mechanization policy status, Kenya has operated for a long time without a clearly defined agricultural mechanization policy. The country's small scale agricultural sector exhibits low levels of mechanization despite the sector being the largest contributor to GDP. The existing

National agricultural Mechanization strategy (NAMS) adopted by government in 1995 has not sufficiently addressed agricultural mechanization challenges leading to the low level of agricultural mechanization in the country. In addition, the Kenya's National Agricultural Research System Policy 2012 broadly aims at creating an enabling environment for sustainable growth of agriculture has not addressed issues relating to agricultural mechanization in a holistic manner.

Strategy for Revitalizing Agriculture (2004-2014) identifies low levels of mechanization as one of the main causes of low agricultural productivity in the country. It identifies the three main causes of low utilization of mechanization as:

- Inadequate mechanization extension services
- Inadequate access to mechanization technologies, and
- Lack of finance available to farmers.

According to current GoK statistics, the use of agricultural machinery has generally declined; the purchase of new machinery declined from an annual average of 1500 pieces 20 years ago to about 300 per year in the last 3 years. The increased reduction in farm size through sub-division makes the use of large machinery and mechanization of farming generally uneconomical. Most of the farm equipment, machinery and spare parts are imported making their access difficult to majority small scale holders

1.4. Present efforts in agricultural mechanization

In recent times, the need for agricultural mechanization has been brought to the fore by the decreasing availability of farm labour, lack of interest by the youth in farming activities, and adverse effect of climate change. In this regard the government of Kenya has endeavored in creating a conducive enabling environment for agribusiness and agro-enterprise development. This is being promoted through formulation of a draft Agriculture Mechanization Policy 2015. The overall objective of this policy is to sustainably raise the level of agricultural mechanization for increased productivity and creating a strategic institutional and enabling market environment that provides a choice of agricultural machinery, equipment and technology, within a sustainable delivery and support system. This will be achieved through research and technology development, local manufacture and distribution, agricultural mechanization quality assurance, investments in mechanization services, extension and technology adoption and improved institution and legal frameworks.

Apart from the draft policy, other major government initiatives aimed at improving agricultural sector include provision of subsidised fertilizers, provision of improved seed in order to improve harvests, and infrastructural development to help farmers access to markets. The government has also substantially improved the availability of farm credits through the Agricultural Financial Corporation (AFC) and the many vibrant private finance sector (banks and microfinance organisations who has focused more on this sector to provide cheap credit facilities to farmers.

The government is in the process of developing a National Agriculture Mechanization Policy which will provide guidelines that will set standards and regulate the use of agricultural machinery and further work with development partners to enhance easy access of the machinery. The ministry of agriculture had enacted a number of legislation and regulatory reforms that are geared toward creating and enabling environment for agriculture mechanization. The enactment of the Agriculture Fisheries and Food (AFFA)

Act, 2013, the Crops Act, 2013 and the Kenya Agricultural and Livestock Research (KALR) Act, 2013 consolidated the numerous pieces of legislations within the Agriculture Sector to address the overlap of functions, obsolete legislations and to benefit from economies of scale. Other relevant existing legislation include the Land Act, Standards Act Cap 496, Appropriations Act, Dairy Act, Fisheries Act, Water Act 2002, National Cereals and Produce Board Act, Micro and Small Enterprises Act, Environmental Management and Coordination Act (1999), Devolution Act, Intergovernmental Relations Act, 2012. However, all these Acts are vague in addressing agricultural mechanization.

With the promulgation of new Kenya constitution in year 2010, two tier level of government have been created - National and county government. At the national government, the provisions related to agricultural mechanization include but not limited to: protection of the environment and natural resources, construction of dams, agricultural policy, capacity building, and technical assistance to the counties.

At the County government level, functions assigned by the constitution include but not limited to Agricultural extension and farmer advisory services, implementation of programmes in the agricultural sector to address food security in the county. The ATDCs previously at the national government have been devolved to the counties to assist national government in influencing policy development, applications of quality assurance and standards, and monitoring and evaluation of agricultural mechanization technologies. They are also tasked with quality assurance through machinery, equipment and implements testing and evaluation.

1.5. Objective of the study.

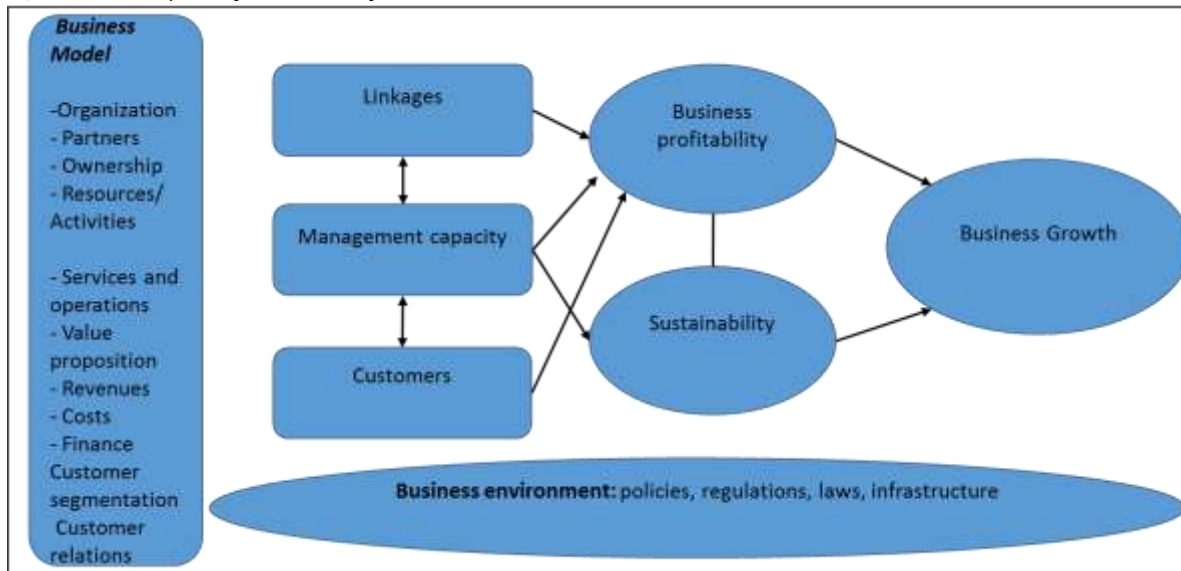
The objective of this Business Model Analysis research was to assess the performance of 2WT-Business Models in Kenya. The study also aimed at assessing the adoption and scaling up of 2WT mechanization by small scale holders farmers in Laikipia and Bungoma counties in Kenya. Specific sub objectives for this study were to;

1. Assess the performance of the 2WT hire service business models.
2. Assess the benefits and impact to the users of 2WT mechanization hire service.
3. Assess the critical success factors for improvement of the performance business models.
4. Examine the Agribusiness Hub model performance and its impact on farm household utilizing the hire services.

2.0. METHODOLOGY.

In undertaking this study, 2WT business models were first pre-selected from a report on 'Market Analysis for Small Mechanization in Kenya' prepared in January 2015 by way of literature review and interviewing several actors in Kenya including the FACASI project beneficiaries in the project areas. The Business Models (BMs) were selected based on various variable listed in the conceptual framework below.

Figure 3: Conceptual framework for business model used



Source: Agribusiness models specialist -David Kahan (FACASI).

Using this framework, a detailed analysis of various variable including; resources and activities, key partners and collaboration, business organization, business performance, offering, value proposition, flow of services and distribution, utilization of good and services, customers, sustainability, business environment, business growth and strategy and critical success factors were investigated.

2.1. The study design.

A Case study approach was used for this study. According to Kumar (2005) this approach helps to investigate a social phenomenon through an analysis of an individual, group or communities. This helps in corroboration of collected information and also helps to collect variety of data and information as it narrows its focus to the area under investigation. Under triangulation approach embedded in the case study approach, a conceptual business model framework illustrated in figure 2 above was developed with various variables whose information was collected and synthesised for this study. On this basis, the case study approach was used to document the interplay of all these variables of each selected business model at the micro level in order to get a comprehensive understanding of 2WT business operations and performance in the two regions of study.

2.2. Data collection.

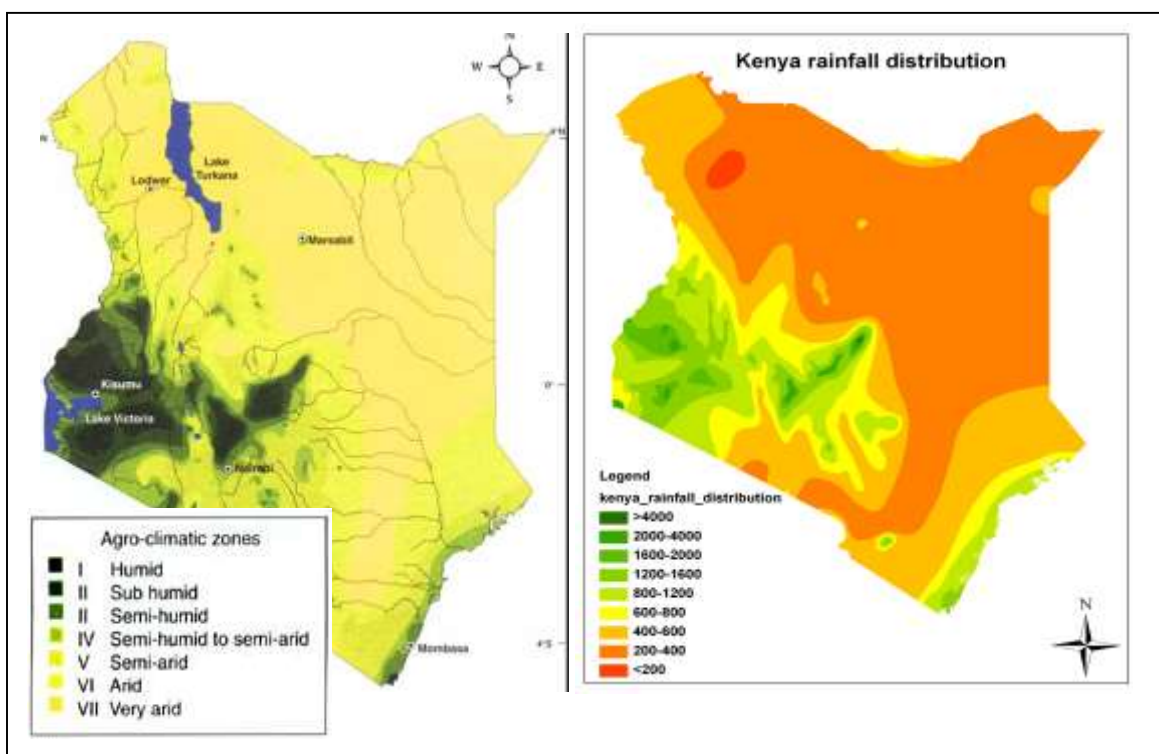
Data collection entailed field visits and household interviews using two data collection instruments i) Business model survey questionnaire and ii) hire services user's questionnaire developed before the study commenced. During field visits, key informant interviews were conducted with 2WT individual owners, 2WT

hire services providers, users of 2WT hire service, manager of ATDC Mabanga, committee members of TUUTI Community CBO in Bungoma and proprietors of the Agribusiness Hub in Laikipia. Field visits also involved a household interviews of farmers who use 2WT hire services in their farm operations. Actual fieldwork was carried out between the month of August and October 2016.

2.3 Study area overview

Kenya has an area of about 581,309 km². Of this land mass, 80% of this land fall under ASAL areas with only 20% falling in productive areas commonly referred to the bread basket or white highlands (Figure 2). On the other hand, about 60% of the Kenyan population lives in rural areas, with 70% of rural households dependent on agriculture as the main livelihood pillar. Ministry of Agriculture states that of the total 3 million hectares under food crops in Kenya, 50 per cent of this land is prepared using hand tools, 20 per cent by animal-drawn equipment and the remaining 30 per cent by tractors (Republic of Kenya, 2013).

Figure 4: The agro-climatic zones of Kenya and rainfall distribution



NB: Virtually 80% of the country lies in the semi-arid to very arid Zones (ASALs), which are predominantly inhabited by the pastoralists and agro-pastoralists.

A large proportion of the country, is semi-arid and arid (Map 1 L) with an annual rainfall average of 400 mm (Map 2 R on rainfall distribution). Droughts are frequent and crops fail in one out of every three seasons- This is according to ministry of Agriculture (MOA). Agriculture is mainly rain-fed and is entirely dependent on the bimodal rainfall in most parts of the country. However, farmers rarely prepare their land and plant on the onset of rain season.

2.4 Farming systems in Bungoma region

Bungoma County is located in the western side of Kenya and comprises 282 square kilometers of arable land. According to 2009 National population census, the county has a population of 224,122 people. The average farm size holding is between 1. - 3 acres per household. The county experiences two rainy seasons; March to May (Long rains) and September to November (Short rains). Generally rainfall distribution and reliability is good. Temperatures range from 16 -30 degree Celsius with a mean of 23 degrees.

The major farming system practiced in Bungoma is mixed subsistence farming by small scale farm holders where maize is the most dominant crop grown by many as a food crop. Other crops grown includes bananas, sweet potatoes, cassava, and vegetables. Main livestock breeds are: zebu cattle, local poultry, exotic poultry, pedigree cattle, pigs, bees and fish farming. Bungoma region is characterized by loamy soils and the topographical gradient is generally flat in most of the areas.

For cash crop, there is overreliance on sugarcane farming. Sugarcane takes 2 years to mature which is then bought by sugar factories in the areas. Considering the long duration of time it takes to mature and the small size farm holdings in the area, the return on investment for sugar cane growing is dismally low. As such, Bungoma region has higher poverty prevalence than other regions that are considered productive areas.

2.5 Farming systems in Laikipia region

The expansive Laikipia County is located on the windward Eastern slopes of Mt Kenya. It extends from the North – East foot of the Nyandarua Range to the west foot of Mt. Kenya, It consists mainly of an elevated plateau covered by volcanic ashes. The altitude ranges from 1800m to 2000m. The County spreads from the humid upper to the lower flatter zone neighbouring semi-arid Isiolo. The humid upper zones are good for potatoes, commonly grown in rotation with the peas, be they, snow, garden or sugar snaps, runner beans, cabbages or onions.



The average rainfall on the plateau is relatively high ranging from 600 – 850 mm but is unreliable and scattered during the year. First rains fall between April to May (long rains) and have a 66 % reliability of about 100 mm. The middle rains in June –July expect with more than 120mm, and the third rains October – November with more than 60mm. The annual temperature of the county ranges between 16 and 26 degree Celsius. This is as a result of relief and trade winds resulting to cooler conditions in eastern side which is near Mt. Kenya and hotter in the low-lying area in the North. The western and southern part of the county have cooler temperatures with the coolest month being April and the hottest being February.

Laikipia is characterized by large commercial farms that are privately owned where wheat and barley is mostly grown for commercial purposes. These private ranches exhibit a large degree of mechanization where conservation agriculture is practiced.

2.6. Spatial suitability characteristics of regions for 2WT based mechanization

A comparative analysis of the two regions FACASI project operates was done based of the following parameters; land size, soils, gradient, rainfall, farming systems and crops grown and regions' degree of mechanization (FIGURE 5). Based on those parameters the most suitable region to support 2WT mechanization was identified to be Bungoma region.

Figure 5: Comparative analysis of Bungoma and Laikipia region.

Google earth image of Bungoma region	Google earth image of Laikipia region
	
<p><i>Region characterized by</i></p>	<p><i>Region characterized by</i></p>
<p>1.Land sizes</p> <ul style="list-style-type: none"> • Small farm holding • AV farm size holding btm 1-3 acres/ hh • High land fragmentation 	<p>1.Land Sizes</p> <ul style="list-style-type: none"> • large commercial private farms • AV. farm size holding >50 acres/ private farm • Low land fragmentation.
<p>2.Soils and gradient</p> <ul style="list-style-type: none"> • Loamy soils • Generally flat gradient 	<p>2.Soils and gradient</p> <ul style="list-style-type: none"> • Volcanic red soils • Generally sloppy gradient
<p>3.Rainfall</p> <ul style="list-style-type: none"> • Reliable rainfall 	<p>3.Rainfall</p> <ul style="list-style-type: none"> • Unreliable rainfall
<p>4.Farming system & crops grown</p> <ul style="list-style-type: none"> • Mixed subsistence farming practiced. • Food crop: Maize is dominant • Cash crop: sugarcane farming 	<p>4.Farming system & crops grown</p> <ul style="list-style-type: none"> • Mono cropping on large farms practiced. • Food crop: Maize and potatoes • Cash crop: Wheat & barley
<p>5.Degree of mechanization</p> <ul style="list-style-type: none"> • Small degree of mechanization • CA adoption rate in the area is low 	<p>5.Degree of mechanization (mostly on large farm)</p> <ul style="list-style-type: none"> • Large degree of mechanization • CA adoption rate in the area is high
<p>VERDICT: Suitability for 2WT mechanization: HIGH</p>	<p>VERDICT: Suitability for 2WT mechanization: LOW</p>

3.0 BUSINESS MODEL PERFORMANCE

3.1. Business models identified

The study identified 6 2WT business models for analysis; 5 of which were in Bungoma region and one in Laikipia region. A total of 10 users of 2WT hire service were interviewed.

Figure 6: 2WT- Business model identified and their ownership.

BM	2WT-Business ownership	Type of model	Region operating
BM1	Maurice Kakhame	Individual/owner operator	Bungoma
BM2	Vincent Sikuku	Individual/owner operator	Bungoma
BM3	TUUTI CBO	Group based ownership	Bungoma
BM4	Mabanga ATDC	Government led model	Bungoma
BM5	Nyabon Enterprises	Integrated dealer model	Kisumu
BM6	Agribusiness Hub	Corporate owned model	Laikipia

Majority of 2WT mechanization Service Providers (SPs) models studied are individually owned and operates private enterprises with just 1 unit 2WT and 1 unit plough. However, Vincent Sikuku- an owner/ operator SP from Bungoma own just one tractor and one plough but has more than 100 customers (quite a unique case compared to other SPs interviewed). This unique case success is attributed to his good entrepreneurship skills and impressive improvisations skills added onto his passion for mechanization that has enabled his 2WT business to operate efficiently and effectively thereby expanding his customer base progressively over the last 3 years.

The corporate owned BM model (AgriHub) has four 2WT – (of which 2 units are not functioning due to mechanical problems) and a number of 2WT accessories. Only Mabanga ATDC (government led) and AgriHub (corporate owned) operate both 4WT and 2WT with various accessories.

3.2 Characteristics of service providers and users of hire services (Age, Education & income)

Most owner/operator business models identified are small and cannot reliably support SPs household financial needs. In effect the household income is generated from other farming activities and supplemented by mechanization hire services proceeds. The observation during study showed that all SPs used 2WT in their farm production operations in addition to offering same services to other users at a fee.

Most of 2WT business model SPs were between 60 to 65 years age bracket except Robert Sikuku (Bungoma) who was 30 years. Robert Sikuku is a son of an experienced 2WT owner who was training him on the business. .

In regards to adoption of 2WT mechanization by the younger generation, there were younger users (20-30yrs) of 2WT hire services (figure 5) meaning that more young farmers are adopting the use of mechanization in farming. Also older users of mechanization hire services were also as many.

In terms of education level, many 2WT business owners possessed post-secondary level of education with a range of between 3 to 5 years of experience in the 2WT business. On the other hand, most users had secondary education (figure 7)

Figure 7: Age of interviewed users of 2WT hire service

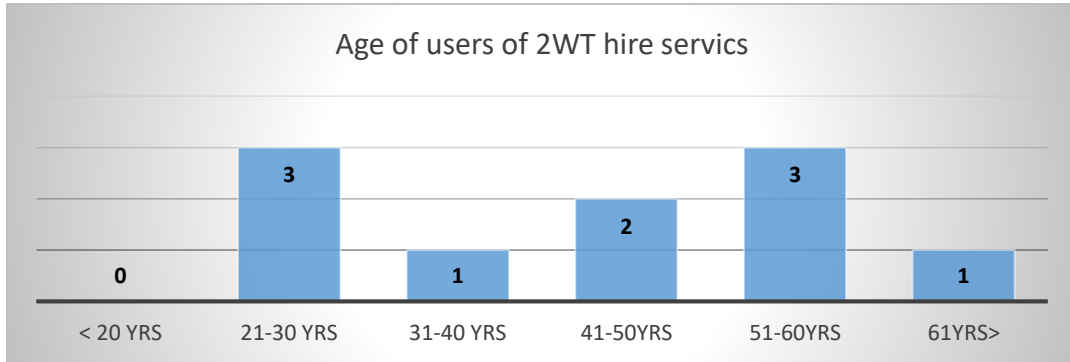


Figure 8: Education level of users of 2WT hire services

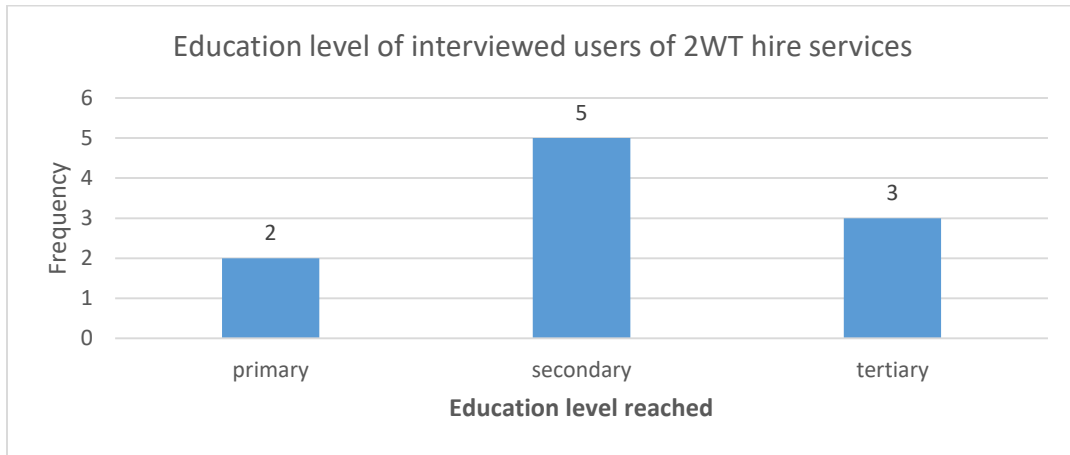
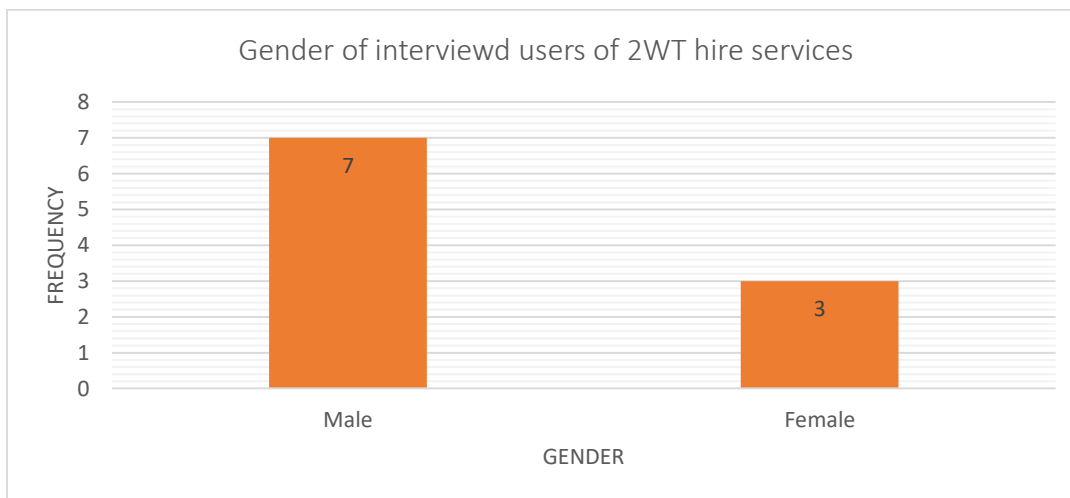


Figure 9: Gender of interviewed users of 2WT hire services



4.0. SUMMARY OF THE BUSINESS MODELS (BM_s)

4.1. BM1: Individual/Owner Operator Model

Maurice Kakhame operates a sole proprietorship (owner operator) business model that he started in the year 2010. It has neither a formal registration certificate nor a formal organization structure. The main reason for starting the business was out of his personal necessity to lower his farm operation costs that were escalating due to high cost he was incurring in hiring human labour and oxen that had reduced significantly profit margins he was getting from farming activities.

As an owner/operator, he is a self-taught provider of mechanization services, who does not possess any formal technical knowledge relevant for mechanization hire service, and has never attended any professional training relevant to mechanization hire service business. His customer base is very small. Since he started his business 5 years ago, he has only managed to get 7 customers. He has only one partner- the 'Marina machinery' who sold him the 2WT. His business networking skills is poor; he does not participate in any collective associations or collaborations nor does he have any intermediaries in the flow of service as his business still small.

In terms of business size and capitalization, using his personal savings to buy equipment, he owns 1 unit plough, 2 units 2WT (only one operational) and a fabricated trailer- all costing about USD 5000. He has 2 part time employees whom he engages during rainy season. He has co-opted his son and has been training him to operate the 2WT. the profits margins from his business is quite small; 70% of his annual average income is from farming while hire services only earns him 30% (about Kshs. 20,000 per year translating to about Kshs 1,600 per month).

On mechanization hire service, he only provide ploughing and harrowing services to his customers with the most popular services demanded by customers being ploughing. Despite him owning a fabricated trailer, he doesn't provide transport services as he uses it for his own farm transport needs. He charges Kshs. 2,000 to plough one acre. His main gains from 2WT mechanization is that 2WT has reduced greatly the over reliance on oxen for ploughing, has reduced the expenses of keeping an oxen and has saved him much time he used to waste on oxen plough

He faces two main challenges in his business; lack of technical skills to operate his 2WT that has hampered greatly his service provision and second, lack of spare parts and or improvisations skills to repair his 2WT to effectively plough. His 2WT is still not fully functional as it require additional modification to reach operational optimum. For sustainability of his business, he requires 2WT operation training, he requires more equipment (sheller, miller chaff cutter, plough and furrow) accompanied with affordable credit facilities to enable him buy these accessories and spare parts.

4.2 BM2: Individual/Owner Operator model

Vincent Sikuku and Robert Wanyonyi (father and son) operates a joint ownership 2WT business model they started in year 2013. His SP business has no formal registration but seems to have simple organization structure where the son is in charge of day to day 2WT operation (ploughing and harrowing) while the father acts as the business development manager. The main reason for buying the 2WT was his desire to shift away from the manual farming that had proved tedious, time consuming and costly for his family.

However, when his neighbors and other farmers saw the technology, they started requesting for ploughing services and he seized the opportunity and has expanded it since.

Vincent is self-taught 2WT operator who provide ploughing and harrowing services but has also a big passion for conservation agriculture. Ploughing is the most demanded service. He charges Ksh. 3500 for ploughing one acre and Ksh. 2,800 per acre for harrowing- the prices of which are set based on prevailing market rates. Though the son has had no formal training on the use of machineries, his father has taught him much of the 2WT operation and he is one of the most experienced operators of 2WT in Bungoma region. For repair and maintenance of their 2WT, he has quite impressive improvisation skills which has enable them to reduce repair costs as does it himself. There are very few mechanization support services (dealers, supplier, and garages) in Bungoma town where his business operates.

From an entrepreneurial qualities perspective, the SP possess high level confidence, and has creativity skills which has enable to grow and expand his business. He has extensively modified both the 2WT and plough and is able to effectively plough and harrow He is able to maintain a competitive edge by providing high quality personalized services. He says due to the quality of his ploughing, his customers has been able to harvest more as compared to when they were ploughing using hoe and oxen.

In terms of assets base, business size and profitability, Vincent who has more than 100 customers, owns just 1 unit second hand 2WT and 1 unit plough all valued at USD 1000. The hire service business earns him about 20% of the average annual income and farming contributes 80%. Overall, he says his business scores an average in financial profitability with an annual net profit turnover of Ksh. 50,000.

The major challenge he experience in his business includes; Lack of mechanization implements and tools, lack of availability of spare parts or workshops / mechanics to repairs his 2WT and lack of access to credit to buy the equipment.

Vincent attribute 2WT business sustainability to one major skill: business innovation through improvisation skills. He reiterates that the configuration of the 2WT that are sold in the market are not properly adopted to Kenya situation and for them to effectively work they must be improvised. As part of expansion strategy, he plans to provide additional support services like shelling, transports services and water pumping using 2WT. He is also planning on expanding his operation base from the current catchment area of 3km radius to 5 km radius in the coming year.

4.3. BM3: Group Based Ownership model

The TUUTI Community driven Committee is a good example of a group service provider business model. The group was given 1 unit 2WT and 1 unit trailer from West Kenya Special Programme operated under the Ministry of Planning. Group membership at the beginning of the project was 276 households though it has drastically reduced as some have opted out. The group selected 5 person committee to manage the machine. The members who require hire services pays cash to the driver who later gives the management committee for banking. Initially they had 3 trained drivers who operated the tractor. They charge Ksh 500 per trip (from farm plot to homestead) for transportation. This price is set depending on the prevailing market rate. However, the group has faced numerous challenges. Lack of access to spare parts, poor feeder roads, lack of skills in servicing, and shortage of skilled mechanics who can repair a 2WT. Most farmers

would like to use the machine for ploughing but they do not have the equipment. The machine has not been used for quite a long time.

Many people hold the view that introduction of mechanization services through farmers groups at the grassroots level is the best strategy. However, the rationale of the existence of these groups should be investigated first before a group is engaged. If the group are formed just to receive the equipment for free, a dependency syndrome is created-where the members join just to receive the benefits accruing from donors, or government or organization fronting the project. The member who join such group if not assessed well are just opportunists without a shared vision and objective of the group purpose.

For TUUTI BM, since the benefits were not direct-member had to utilize the tractor to earn profits that is then shared among them. The group did not achieve much. When the 2WT stalled tractor due to punctured tires, it has remained idle for a whole year as no member is unwilling to commit his own money to buy new tires. The group based BM (TUUTI CBO) only provided transport service at Kshs 500 per trip. However, for the year 2016, their 2WT had broken down and lay idle due to lack of spare parts.

The group based 2WT model of TUUTI exhibited poor governance structure: lack of leadership and management skills was a salient skill lacking in running the group. There was apparent managerial ineptitude to an extent that their 2WT lay idle a whole year after it broke down and have not agreed on the best approach to raise fund to fix it. The disadvantage with group asset owned model is that there is poor management of resources and services as is clearly evident in TUUTI BM. The group leaders lacked facilitation skills to be able to tap the skills and abilities of individual group members and have been unable to harness the group dynamics that can be the strength point for running a successful 2WT business model.

Poor leadership, lack of focus, social loafing, ineffective communication strategy and dominant personalities within the group affected greatly the performance of the group to a point that they abandoned their 2WT. Another key weakness observed for group based model is that the roles of each group member was not assigned hence over relying upon the group leadership (that was subsequently weak) to make decision on their behalf.

TUUTI BM that has very low prospect for growth. The option can be to consider leasing the machine to a entrepreneur SP from the group members who then uses it and manages it on behalf of the group. Because of the mixed composition of the group with members who do not have a shared vision for the group or interest in farming, membership should be renewed.

4.4. BM4: Government led model

The Mabanga Agricultural Technology Development Centre (ATDC) is a government owned institution located in Bungoma County that works with farmers in localizing new technologies and promoting adoption of appropriate technologies that are affordable for farmers. Previously before the new constitution dispensation in year 2010, it used to be run and operated by national government through the ministry of Agriculture (MOA). Now all ATDCs in the country have been devolved to the County governments and should ideally be able to closely provide and serve farmers mechanization needs at the grassroots. Mabanga ATDC is mandate is conducting field trials and upscale of agricultural technologies to meet local demand. It conducts promotions for farmers to adopt technologies; and trains individual farmers and groups of farmers using platform like organized farmers field day demonstration and exhibitions in annual

agricultural trade fairs. Mabanga ATDC has various mechanization equipment among them 1 unit 2WT that the Ministry of Agriculture gave it for demonstration purposes.

Critical assessment from this research on using/relying on government led model as entry point for 2WT mechanization adoption and scaling up is bound to end in failure as was the case for Mabanga ATDC.

Such government institutions- not only Mabanga for this matter, exhibit high level bureaucratic red tape and administrative ineptitude. Executing even simple decision by lower managers without involvement of those on top of the bureaucratic ladder was found to be difficult. For managers of Mabanga, apart from not having any strategic plan for the year they did not provide any work schedule for trainings done to farmers using the 2WT that was just lying idle for most of the season. Despite Mabanga semi-independent institutions that is supposed to operate using its own strategic plan, their decision making model was firmly anchored on bureaucratic rational choice model commonly used by governments ministries where daily operations and decision are prescribed from above (either from parent national ministries or through the county governments). The managers seemed to be just there to enforce what has been prescribed to them by parent government organs. This was clearly evident where even small decisions like training farmers on the use of 2WT must be budgeted for from the top and put in the financial year expenditure plans.

For example when we explored why they have not used the 2WT that was freely donated to them by parent ministry, they responded not to have received government disbursement for the financial year and so technically they could not do anything. For Mabanga ATDC, it seemed the management decision, financial planning and visioning must be approved from the top and devolved/imposed on them and any other advice not originating from there from there is unlikely to be enforced at the grassroots.

The merits and demerits of considering such a model in future as the entry point for 2WT mechanization hire service adoption and scaling up must be critically assessed.

4.5 BM5: Dealer led integrated model

Nyabon enterprises is a medium sized business model owned by an experienced entrepreneur David Osomba and started in year 2014. It's an Innovative business model that provide affordable farm mechanization technologies for smallholder farmers to support key crop value chains. The company is an importer, dealer, and provider of mechanization services. It has 6 employee who hold various positions including mechanization expert, Machine operators and Mechanics. Its current focus is at the bottom end of the value chain - pre-planting, land preparation, seed/seedlings planting and weeding.

The company offering includes importation of 2WT tractors, power tillers and other equipment for purchase or rental. In terms of market structure, Nyabon is the sole distributor of Power Tillers, Compact Tractors and implements in the Kenyan market from VST Tillers and Tractors Ltd (VTTL) and Khedut Agro Engineering Ltd (KAEL), both leading farm mechanization companies in India.

As an integrated model and provider of mechanization hire service, the mechanization service the company provides includes; contract tilling to farmers groups, farmers training and field demos on the use of these machineries in the company's 55 acre model farm pilot project for rice growing. In addition, it has also established a sales-training and service workshop for its customer's majority of which are rice farmers.

The value proposition for the customer is its ability to provide a 'packaged product' of mechanization services to farmers, both individual and groups in the maize, rice and potato value chains. The mechanization services provided by the company includes; ploughing, seeding, chiseling, spraying, wheat harvesting and transport.

In terms of sales volume, since it started operations in 2014, Nyabon enterprise has sold 20 units 2WTs and 2 units 4WTs and 2WT accessories that include; 20 units Rotary Ploughs, 10 units Cultivators, 20 units Mould Board Ploughs, 1 unit manual seeder and 1 unit Automatic Seed Drill.

The target customers for Nyabon includes various customer segments including; Individual small / medium scale farmers, Young entrepreneurs, NGOs working in agricultural sector, farmers groups, youth groups, farmers co-operatives movement and county governments.

For business sustainability, Nyabon business model relies on two revenues streams namely; outright sales of machines to address various mechanization applications and service provision. It also provide strong after sales support to ensure farmers and stakeholders get value for their money. Also for sustainability, it has partnered with key players including government ministries and institution, farmers groups, financial institutions, research institution and various stakeholders that includes NGO's operating in the farming sector.

4.6. BM6. Corporate Owned Business Model.

The KENDAT Agribusiness Mechanization Hub (Simply Hub) is an example of Corporate Owner/Operator Business Model that was started in year 2015 and became operational in March 2016. The Hub is providing small scale farmers with affordable and accessible mechanization hire services and supplementary services (CA, inputs, agronomic advisory etc.) in a central location. The hub is therefore acting as a walk in one-stop-supermarket for all mechanization needs for smallholder farmers, either individually or for organized farmers groups. The hub model is based on the fact that the high cost of farm machinery and accessibility factor has made majority of small scale farmers to continue with the rudimentary tools in farming.

On the technology and preference of tractors the stocked with 2WTs and 4WTS with associated equipment's and accessories that offer farmers a wide range of choice for their farm mechanization needs. KENDAT had for a long time been training service providers and farmers on CA and use of animal draught technology as an alternative and relatively affordable mechanization service as opposed to human labour. Upon establishing partnership with FACASI- they started a programme on mechanization hire services using the 2WTs and associated equipment including; plough, furrow, planter, boom sprayer, single row potato digger, mini weeder and 2WT trailer.

The Hub has established a chain of partners and collaboration within the agricultural value chain including County Government, Ministry of Agriculture, and micro finance institutions to develop financing mechanisms to its farmers. The partnership with Feed the Future Kenya Innovation Engine (FTF-KIE) has been instrumental in setting up the Hub. The hub also collaborates with Australian Centre for International Agricultural Research (ACIAR) through the Farm Mechanization and Conservation Agriculture for Sustainable Intensification (FACASI) programme. This FACASI-KENDAT partnership has been promoting the use and adoption of 2WT as an ideal mechanization equipment and has led to increased demand for farm mechanization services in the region. Other partners includes; Cereal Growers Association, KFIE and BIDCO that are using the hub to recruit farmers to grow Sunflower and soya beans through contract farming.

In terms of organization structure, the corporate led business model has clear organization structure; at the top of the organogram is the board of directors, then hub manager who oversees daily hub operations. There are also machine operators both for 2WT and 4WT, mechanic and a Hub administration assistant. The financial management of the Hub is supported from KENDAT headquarters in Nairobi.

In regard to its offering, the hub serves farmers with a range of mechanization operations including ploughing, ripping, harrowing, planting, spraying and transport services. In addition, farmers also get training services on Conservation Agriculture- this is mostly done during farmers' field days. The hub has established facilities including a mechanization demo model farm where it trains farmers on machinery operations and mechanization services. The Hub also offer complementary bundles of services to farmers that include advisory services on contemporary agronomic practices.

In servicing and maintaining of its tractors and equipment, the hub has set up its own mini repair and maintenance garage where all repairs, modifications and servicing for the machinery is carried out by a mechanic and machine operators.

In reaching out to its customer segment, the hub uses various channel to deliver its value proposition that includes; direct walk-ins by farmers at the hub, mobile telephone, word of mouth and field sales representatives. It also uses intermediaries like farmers groups, contract farmers and past and present farmers in order to access new farmers. The hub operates on a structured business model where farmers are clustered based on their spatial proximity to make easier provision of mechanization services.

With regard to utilization of good and services for mechanization hire services, 2WTs are mostly used in transport business and spraying while all major farm preparation has been take up by 4WTs. A total of 147 farmers have been served by the hub in year 2016. Total acreage served for year 2016 is 109 acres; ploughing (2 acres), harrowing 59 (acres), planting (41.5 acres) and ripping (6.5 acres).

The hub current customer segment are small holder farmers who own between 1-10 acres that are within a radius of 25km.

The hub's value proposition is to provide end to end market linkages for farmers, farm mechanization hire services and agro-inputs services to smallholder farmers in Laikipia Regions. It's modeled as a one-stop-shop for all agribusiness partners to congregate and build business relationships. It also aims to focus on crop aggregation, storage and agro processing for value-addition thereby creating winning links to input and output markets outlets and industrial processors for farmers. With the assistance of Hand in Hand NGO is training farmers on enterprise development and microfinance where a total of 99 farmers have been trained.

It has also gender mainstreamed its mechanization hire services and offers a 15% discount to female farmers and youth under 35 years of age. Also, farmers who help assemble land (land aggregation) to include their neighbors in order to minimize number of trips the machinery makes to the same area gets the same discount.

The hub's custom hire charges for various mechanization services include; ridging (Kshs Kshs 1500 per acre), ploughing (2500 per acre), harrowing (kshs 1500 per acre), planting maize and wheat, (kshs 1500 per acre), planting peas and bean (ksh 2000 per acre), and mowing and bailing at kshs 80 per bail.

For customer demand, ploughing is the most demanded service at the Hub. Though the demand has increased significantly, the usage and uptake of 2WT based mechanization is very low. This is attributed to relatively hard soils in the region that make use of 2WT quite laborious especially for ploughing. 2WT services are used in transportation purposes and occasional spraying.

In terms of costs and revenues, setting the hub and all the machinery and equipment has cost KENDAT more than Kshs 17 million (USD 172,000). The return on investment is quite low and return on investment is very low since the hub is not yet fully operational. The total profit for the 7 months the Hub has been operational is Ksh. 138,937 (equivalent to USD. 1,389 at current market rate of 1 USD=Ksh 100).

The hub equipment acquisition was financed using various methods including; private equity investment, partners like USAID, and FACASI. Equipment Lease companies (Quipbank/VAELL, Rivires fiancé (Chase bank), RentCo and Phatisa have been approached on possible support on equipment.

For sustainability of the hub, it's using an alternative corporate service model-where aggregated farm mechanization services are bundled in "alternative solution packages" cutting across the whole agricultural value chain. Depending on customer needs and affordability, farmers actually hire solutions that best fit their farm needs. In terms of innovativeness, the Hub is acting as a multi-purpose mechanization hire service, training and information exchange shop where - depending on the customer needs – farmers walk in and hire "a bundle of mechanization services" they need at competitive and affordable market driven prices. In mitigating risks associated with vagaries of weather, the hub has approached a number of credit lending micro finance organization that will provide credit and crop insurance to farmers. So far, it has linked farmers with Siraji SACCO that has trained them in Table-Banking. activities and services designed to enhance income generation in off-seasons has been started that includes selling building bricks, water vending, hiring of its Hydra form interlocking brick making machine and general transport services using the 2WT.

The hubs business growth strategy is to continuously seek aggressively, the interactions with private sector to pursue business partnerships, equity and collaboration. The agribusiness Hub strategy is to establish a sharing platform where farmers exchange knowledge and skills on best farming and farm mechanization practices to increase their farm productivity.

The biggest challenge the Hub faces is lack of enough capital to buy the necessary mechanization equipment's. In addition, lack of good rural roads, low awareness levels of mechanization among the small scale farms and increasing unpredictability of climatic variabilities affecting land preparation are among challenges that continue to affect the hub operations. Again, the use of traditional farm implements like the hoe, pangas and jembes in land preparation, planting, weeding, spraying and harvesting is still widespread. This has led to low attrition levels in the uptake and use of mechanization services.

5. Strengths and weakness of each BM and improvement strategies

The table below summaries each BMs strength, weaknesses and actions that need to be done to improve the BM.

Table 2: Strength and weakness and improvement strategy for BMs

BM	Strength	Weakness	Improvement strategy
Individual owner/ operator (Maurice+Vincent)	<ul style="list-style-type: none"> • Quick decision making • Ready to take risks • More business focused • Trusted • Increased commitment 	<ul style="list-style-type: none"> • Difficult to access finance • Limited capacity to operate • Takes time to develop customer base 	<ul style="list-style-type: none"> • Skills development (technical, operational, management) • Strong marketing (bundling of service) • Quality service training • Institute record keeping
Dealer-led integrated model (Nyabon Enterprise)	<ul style="list-style-type: none"> • Strong support infrastructure 	<ul style="list-style-type: none"> • Restricts farmers to choosen manufacturer • Single sourcing risks 	<ul style="list-style-type: none"> • Building capacity of agro dealer • Contract farming

	<ul style="list-style-type: none"> • Direct feedback mechanism from farmers • Provide linkages to relevant stakeholders 	<ul style="list-style-type: none"> • Can be easily undermined • Could exploit famers • Working capital constraint 	<ul style="list-style-type: none"> • Awareness creation through field demonstrations. • Insurance for contract farming and financing
Corporate led Model (AgriHub)	<ul style="list-style-type: none"> • One stop shop for range of services • Crop value chain support • Training base for farmers and SPs • Quality assurance of Services 	<ul style="list-style-type: none"> • High capital investment • Heavy management requirement • Heavy infrastructure requirements • Difficult to replica elsewhere due to high capital demand 	<ul style="list-style-type: none"> • Strong operational and mgt support • Market the concept • Strong management and governance structure • Develop good linkages with relevant players • Strict Record keeping
Group led model (TUUTI CBO)	<ul style="list-style-type: none"> • Social capital • Ready market • Collateral security for finance 	<ul style="list-style-type: none"> • Slow decision making. • Disagreements, conflict • Ownership challenges • Poor maintenance • low income (shared among group) 	<ul style="list-style-type: none"> • Capacity building (technical, operational, management) • Improve group dynamics • Governance structures • Facilitate market linkages, • Record keeping system

5.0 THE OFFERING

Most 2WT SP business offers two mechanization services i) ploughing and ii) harrowing. These are the most prioritized operations to customers.

For the AgriHub the services it provides to its customers include ploughing, harrowing, planting and ripping. The table below summaries various land preparation activities and acreage served in year 2016.

Table 3: Mechanization activities offered by AgriHub and Acreage served:

		Season		short rains		
		Long rains				
		Month	March	April	Aug	Sept
No.	Land prep. Activities offered	acres served				
1	Ploughing	62.5	2	9.25	6.75	
2	Harrowing	4.5	59	-	13	
3	planting	10	41.5	5	-	
4	Ripping	0.5	6.5	25	9.25	
Total acreage served		77.5	109	39.25	29	

The Hub also offer complementary bundles of services to farmers that include advisory services on contemporary agronomic practices. Such advice includes the correct usage of the type, quality and quantity of inputs - seed, pesticides, fungicides, herbicides etc. a farmer should use to enhance productivity.

5.1 Technologies and preferences of tractors/ power tillers

Majority of owner/operator SPs possess one 2WT and one plough (figure 6 below) and provide ploughing and harrowing services only, apart from Maurice Kakhame who fabricated his own trailer though he doesn't offer transport services. The integrated led dealer model (Nyabon) stocks equipment as per demand.

Table 4: Asset base of various business model

2WT-Business ownership	Region of Operation	No of 2WT	2WT-ACCESSORIES
Maurice Kakhame	Bungoma	2 unit 2WT (1 never used)	1 unit plough, 1 unit fabricated trailer
Vincent Sikuku	Bungoma	1 unit 2WT.	1 unit plough
TUUTI CBO	Bungoma	1 unit 2WT	1 unit plough
Mabanga ATDC	Bungoma	1 unit 2WT Many 4WTs	1 unit trailer many 4WT accessories
Nyabon Enterprises	Kisumu	dealer stocks on demand	Stocks on demand
Agribusiness Hub	Laikipia	4 units 2WT (2 not working) 2 unit 4WTs	Various accessories

In terms of asset base, the corporate model of AgriHub has the highest asset base - majority of which are 2WT accessories (though they are not often used). The AgriHub is providing both 2WT and 4WT based mechanization hire services.

2WT has not been suitable for ploughing in Laikipia region due to relatively hard soils present in the region. The market for 4WT tractor services is well developed in Laikipia County that provide fierce competition for 2WTs in the region. Since acquisition of 4WT by the Hub, the 2WT usage and uptake seems to have been overtaken by more efficient and terrain adopted 4WTs. The hub is stocked with diverse farm machinery and equipment's that offer farmers a wide range of choice for their farm mechanization needs.

Table 5: Asset base of Agribusiness hub (corporate owned model)

No	Equipment	Quantity
1	4WT tractors (75HP)	2
2	2WT tractors	4
3	2WT two-row double disk furrow opener Brazilian planters	4
4	2WT single-row tine furrow opener Brazilian planter	1
5	2WT two-row tine opener planter, Africa made planter	1
6	2WT single-row tine furrow opener, US made planter	1
7	2WT multi-row tine furrow opener planter from India,	1
8	2WT multi-row strip till planter from china	1
9	2WT two-row tine furrow opener planter from China	1
10	2WT single-row automatic potato planter	1
11	2WT single-row semi-automatic potato planter	1
12	2WT boom sprayer	1
13	4WT single-row potato digger	1
14	2WT mini weeder	1
15	2WT trailer	3
16	5 ton trailer,	1
17	MUST maize/sheller cum thresher & trailer	1
18	Knapsack sprayer	1
18	Interlocking brick making machine, no. 1	2
19	Motorcycle – 125cc TVS	1

5.2 Value proposition

With the high quality and timely services most SPs offers, they are not only able to retain their customers but also attracts news one. Beyond hire mechanization service provision, some SPs were found to provide their customers with agronomic advice especially on conservation agriculture and marketing information on a need-to-know basis. The communication strategy employed by most SPs is through word of mouth and face-to-face interaction with their customers. As a value proposition for Agrihub BM, It's modeled as a one-stop-shop for all agribusiness partners to congregate and build business relationships. The agribusiness hub was focusing on crop aggregation, storage and agro-processing for value-addition thereby creating

winning links to market outlets and industrial processors for farmers. In promoting youth and women to utilize mechanization services.

5.3. Gender mainstreaming in mechanization hire service by SPs

In regards to gender mainstreaming in agricultural mechanization service, gender dimensions is an integral part of mechanization interventions. Studies have found that women and young farmers generally face more socio-cultural and socio-economic constraints than men. Consequently, women have more demand on their labour and experience drudgery due to the kinds of technologies used and their labour contribution is not commensurate with the returns they get.

Finding from this study show that only one BM - (the corporate BM of AgriHub) had instituted specific incentives in its hire service to attract more women and youth into using mechanization services. The hub has gender mainstreamed its mechanization hire services by offering a 15% discount to female farmers and youth under 35 years of age who came to seek for mechanization service at the Hub. Also, farmers who helped assemble land (land aggregation) to include their neighbors in order to minimize number of trips the tractors would makes to the same area gets the same discount

Some SPs like Vincent Sikuku were very positive that his hire service business has helped women though indirectly. He said once the land are ploughed and harrowed using 2WT, it becomes soft and hence easier when weeding. Women now spend relatively shorter time to weed on these softer soils thereby saving productive time that is used for other productive work.

However, in terms women operating 2WTs threw s general consensus that they are not women friendly as they are laborious to operate and requires a lot of masculine power than a normal woman might have.

5.4. Utilization of goods/ services (for mechanization hire services)

The uniqueness and value of the services provided by SPs mostly depended on quality of work, timeliness of operations and affordability by users. A summary of how various BM utilized their 2WTs is summarized in the table 7 below.

Table 6: Utilization of 2WTs services in identified BMS in year 2016

BM	No of days 2WT was in service	acreage served (acres)	Profit Margins (USD)
Owner/operator (Maurice Kakhame)	80	15	200
Owner/operator (Vincent Sikuku)	120	30	500
Corporate led (AgriHub)	100*	255*	900
Dealer- led (Nyabon enterprise)	50	60	1650

NB: * for both 2WT & 4WT

For owner/operator BM of Vincent Sikuku. He has more than 100 customers of which he served 15 customers long rain season of year 2016. The land sizes for these customers size ranged from ¼ acres (smallest) to 2 acres (largest). On a typical year, his tractor becomes idle for about 146 days due to breakdowns. Last year (2015), he only utilized his 2WT for 120 days (85 days in the long rain season and 35 days in the short rain season).

Maurice Kakhame, another owner/operator BM, has only 7 customers whom he says were attracted to his service through observation from his farm when he was ploughing. They then requested if he could plough for them. In the last one year, he has used his 2WT to plough for less than 80 days and 13 days he used it for own transportation.

For the dealer led model utilization of goods and services, Nyabon enterprise has sold 20 units 2WTs and 2 units 4WTs and 2WT accessories that include; 20 units Rotary Ploughs, 10 units Cultivators, 20 units Mould Board Ploughs, 1 unit manual seeder and 1 unit Automatic Seed Drill. (Table 7).

Table 7: No of 2WTs and 4WTs units and accessories sold Nyabon enterprise (dealer led BM)

2WT sales			4WT sales	
No of tractors sold	Accessories sold		No of tractors sold	Accessories
20 units	No of units	Name of Accessory	2 units	none
	20 units	Rotary Ploughs		
	10 units	Cultivators		
	20 units	Mould Board Ploughs		
	1 unit	manual seeder		
	1 unit	Automatic Seed Drill.		

For the corporate BM of AgriHub, a total of 147 customers were served last year (2016). In the long rain season, a total of 54 farmers were served in the month of March while 50 customers were served in the month of April. In the short rain season, 14 farmers were served in the month of August while 29 were served in September (table 6). The AgriHub serves customers within a 25 Km radius from its location at Mwireri market in Laikipia.

Table 8: Customers served by the AgriHub (mostly using 4WT)

Month	season	long rains					short rains				
	Feb 2016	Mar	April	May	June	Jul	Aug	Sept	Oct- Dec		
No of served customers	started operation	54	50	-	-	-	14	29	-	-	-

5.5 Customers

5.5.1 Customers segmentation and flow of service and distribution

Majority of SPs focus their service on small scale individual farmers/households who mostly farm for subsistence purposes. The SPs use various method to attract customers including referral from those farmers they have offered services, returning customers from previous seasons and observation and testing.

The integrated dealer 2WT model of Nyabon enterprises target those individual customers with ability to purchase 2WT or medium scale farmers organized in farmers group. It also target young entrepreneurs, NGOs working in agricultural sector, youth groups, co-operatives and county governments. For Nyabon it uses a variety of strategies to market its 2WT including; fields days that are typically organized by co-operatives and farmers groups, agricultural shows and exhibitions, online advertisements(social media),

contract tilling and partnering with NGO operating in the farming sector. The distribution channels for Nyabon include Sub-dealers, SACCOs, NGOs and County governments.

The current customer segment for the AgriHub are small to medium holder farmers who own between 1-20 acres. The hub serves famers within a radius of 25km. These farmers are served either in groups or individually. In reaching out to its customer segment, the AgriHub is using various channel/route to deliver its value proposition that includes; direct walk-ins by farmers at the hub, mobile telephone, word of mouth and field sales representatives. Since different farmer value chains are clustered in registered groups, the hub also uses the following intermediaries in order to access these farmers; Farmers who have already been working with KENDAT from past and ongoing KENDAT programs in conservation agriculture, Cooperative Societies (SACCOs) & other farmer associations/groups and contract farming.

5.5.2. Customer's demand on services.

The demand for 2WT based hire services is increasing in Bungoma region while shrinking in Laikipia region. The increasing demand is attributed to the high land fragmentation in Bungoma that are making operations of 4WT within the small sized land holding uneconomical. Another reason is that the cost of maintaining healthy oxen is increasing due to decreasing pastures and the high cost of animal feeds.

On the other hand, the scaling up and adoption of 2WT in Laikipia was being spearheaded by KENDAT, with the setting up of AgriHub, the preference seems to have shifted to the more versatile 4WT in land mechanization. 2WT demand is slowly ebbing and their use has now been relegated to less horse power demanding activities like spraying and transports services.

5.6 Custom hire charges

The charges offered by various SPs do not differ much. Only a slight differential in prices for ploughing (it is the most costly hire service and also most demanded). Nyabon enterprise (Integrated BM) and Vincent Sikuku (owner operator BM) charged the highest for ploughing services. For Vincent, he has monopoly of the market as he does not have any 2WT competitor in his catchment. Also he has many royal customers (>100). For Nyabon enterprise, he currently offers contract ploughing to groups.

Table 9: Price charges for various mechanization hire service by SPs

Business Models (BMs)	<i>Charges for the mechanization hire services (Kshs)</i>					
	Ploughing per acre	harrowing per acre	ridging per acre	planting per acre	transport	mowing & bailing
BM 6	2500	1500	1500	1500	500 per trip	80 per bail
BM 5	3000	2500	1500	2000	160 ton/km	-
BM 4	-	-	-	-	500 per trip	-
BM 3	-	-	-	-	-	-
BM 2	3500	2800	-	-	-	-
BM 1	2000	-	-	-	-	-

Key: BM6>Agribusiness Hub: [Corporate owned]; BM5>Nyabon Enterprises: [Integrated dealer]; BM4>Mabanga ATDC: [Government led]; BM3>TUUTI CBO: [Group based ownership]; BM2>Vincent Sikuku: [Individual/owner operator]; BM1>Maurice Kakhame [Individual/owner operator]

Table 10: Size of business models by number of customers

Region	BM Owner	No of customers	Radius of operation
Bungoma	Maurice Kakhame	7	<2km
Bungoma	Vincent Sikuku	>100	<3 km
Bungoma	TUUTI CBO	<5	<5km
Bungoma	Mabanga ATDC	<3	>10km
Kisumu	Nyabon Enterprises	20-50	<15km
Laikipia	Agribusiness Hub	50-100 (for both 2WT & 4WT)	<25 km

5.7 Business Linkages

Many 2WT owners and SPs business had established strong linkages with the hire service users. However they had very weak linkages with other actors in the agriculture value chains. On the other hand, many interviewed users intimated they have very good relations with the SPs as shown in figure 9 below. These strong linkages has acted as a customer retention strategy for many owners and SPs despite there being new entry of competitors in the market.

However, there was found to be a very weak linkage between SPs and suppliers/dealers of farm machinery and also between them and government institutions. This among other factors can be the reason why 2WT mechanization business ownership is still low. Also it was observed that many SPs had weak linkages between SPs and financial institutions and the reason why many providers and users of hire serve could not access the much needed credit facilities to either expand their business or in improving their farm productivity.

The model that was found to have strong linkages with the mechanization supply chain- including farmers, financial institution, suppliers/dealers of mechanization equipment was the AgriHub business model. Indeed the Hub was established on the value proposition of having an end-to-end market linkages for farmers, farm mechanization hire services and agro-inputs services to smallholder farmers in Laikipia Regions. It's modeled as a one-stop-shop for all agribusiness partners to congregate and build business relationships.

Figure 10: Relations users have with their SPs



On the other hand, the integrated dealer model of Nyabon enterprises had strong linkages with the manufacturers of 2WT-VTTL and KANEL Company in India. It handles and processes all customer orders and maintains stocks of tractors, implements and spare parts for the parent company here in Kenya. Apart for the linkage with the manufacturer, it has also established linkages and partnership with government and nongovernmental institutions aimed at promoting the use and adoption of its preferred brand of 2WT mechanization through farmers training and field demos on the use of these machineries.

5.8. Management capacity and entrepreneurship

The managerial skills for most 2WT owners and SPs interviewed was found to be low. This can be attributed to the reason why SP like Maurice Kakame who has operated hire service for 3 years had only managed to get 7 customers.

For group based 2WT model, lack of management skills was a salient key lacking in TUUTI CBO. There was apparent managerial ineptitude to an extent that their 2WT lay idle a year after it broke down and have not agreed on the best approach to raise fund to fix it.

The group leaders lacked facilitation skills to be able to tap the skills and abilities of individual group members and have been unable to harness the group dynamics and to run a successful 2WT business model. Poor leadership, lack of focus, social loafing, ineffective communication strategy and dominant personalities within the group seem to have affected greatly the 2WT TUUTI group model to a point that they abandoned the 2WT and has not provided any service for a whole year. Another key weakness observed for group based model is that the roles of each group member was not assigned hence over rely upon the group leadership to make decision on their behalf.

In terms of management strategy, the best model that had clear strategic plan was the corporate model (AgriHub) and integrated dealer model (Nyabon enterprises). Their management and entrepreneurship capacity was quite high since they are run as profit making entity models that hinge their decision making on economic rationality models. However, even with the strategic plan in place running such BMs demanded so much time and commitment from the entrepreneurs.

This is in sharp contrast to group led and government-led business model like Mabanga ATDC whose decision making model is hinged on bureaucratic rational choice model where daily operations and decision are prescribed from above. The managers are just there to enforce what has been prescribed to them by parent government organs. This was clearly evident in Mabanga ATDC where even small decision like training farmers on the use of 2WT must be budgeted for from the top and put in the financial year expenditure plans. For example when we explored why they have not used the 2WT that was given to them to practically demonstrate SPs and farmers on how it's used, they responded that the financial allocation and plan of activities for that period did not include 2WT training. For Mabanga ATDC, it seemed the management decision, financial planning and visioning must be approved from the top otherwise it's unlikely to be enforced at the grassroots.

Therefore, relying on established government institutions as entry point 2WT mechanization adoption and scaling up is bound to end in failure as the case for Mabanga ATDC due to bureaucratic red tape and administrative ineptitude. Using such a model in future as the entry point for 2WT hire service adoption must be questioned.

5.9. Performance and sustainability

Mechanization levels among smallholder farmers are particularly low in Bungoma and Laikipia regions. The market performance for 2WT for small holder farmers in Kenya is low and yet to be exploited. Indeed, 2WT mechanization services are yet to gain ground. However, they present growing potential for owners and SPs who may decide to capitalize on 2WT market niche that is growing. As noted from the study, the demand for 2WT is increasing especially in Bungoma region where land fragmentation is high.

From the interviews done with 2WT owners and SPs, the most demanded mechanization hire service in land preparation was ploughing, and harrowing. However most SPs were constrained in mechanized service diversification by lack of 2WT equipment's and accessories. Many noted that their immediate main constraint to improved profitability of their business was the lack of equipment's like planter, tiller, sheller and trailers. The sustainability of their business they said was pegged on these plus availability of spare parts.

6.0 BUSINESS PROFITABILITY

6.1 Service Provider's gross margin

The probability of 2WT BMs was found to be low. Most SPs said their immediate main constraint to improved profitability of their business was the lack of equipment's like planter, tiller, sheller and trailers to enable them diversify in range of hire services they offer.

Table 11: Profit margins

BM	No of days 2WT was in service Yr 2016 (estimates)	acreage served Yr 2016 (acres)	Profit Margins Yr 2016 (USD)
Owner/operator (Maurice Kakhame)	80	15	200
Owner/operator (Vincent Sikuku)	120	30	500
CORPORATE led (AgriHub)	100*	255*	900
Dealer- led (Nyabon enterprise)	50	60	1650

The return on investment for 2WT business model is low with low profit margins recorded. The low profit margin is attributed to lack of 2WT accessories for most SPs that can enable them to diversify their income streams. Though the return on investment for most SP is quite low, they are hopeful this will change as the demand for 2WT is increasing attributed to increased awareness and uptake of hire services they offer in their respective area.

6.4 Sources of finance

The business financing market in Kenya is well developed and very competitive, there are many commercial banks and micro finance institutions who have developed various financing models and products aimed for the agribusiness sector. However, affordability of such product is a key detriment for small sized BM and for small scale farmers whose income earnings from their farm activities is quite low and unable to service the high interest rates the loans attract.

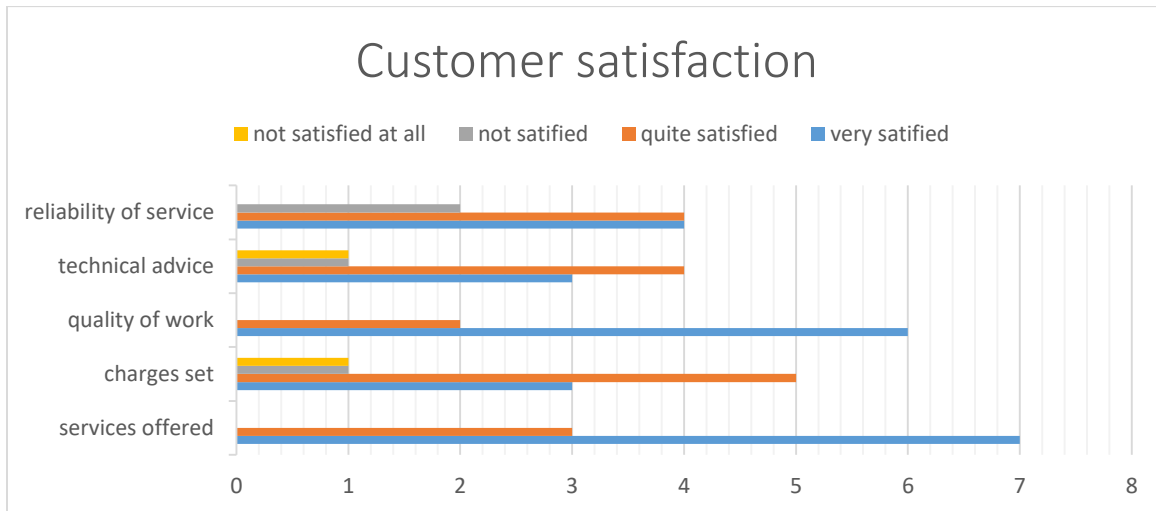
In financing their 2WT business startups, most SPs said they relied on personal savings to buy their 2WT. Only Maurice took a loan of Kshs. 250,000 from Mwalimu Cooperative SACCO society to buy his 2WT. However, it is unlikely his 2WT will be able to repay the loan due to lower profit margins he earns as he has only 7 customer and only provide ploughing services. In expanding their business, some SPs are considering applying for loans from SACCOS and micro finance institutions that are readily available in Bungoma and Laikipia although their concerns were on the high interest rates charges compared to marginal profits they earn that might not be able to service their loan.

For the corporate model BM that is a highly capital intensive venture, KENDAT owners sort a number of financial sources for setting the AgriHub and acquiring equipment needed,. These included; personal contribution, private equity, contribution from partners (FTF-KIE, FACASI). KENDAT also sought financial help from leasing companies who presented them with various asset acquisition models like lease-to-own or through equity. They approached a number of equipment leasing companies like (Quipbank/VAELL, Rivires fiancé (Chase bank), RentCo and Phatisa) to understand and compare the ownership to leasing acquisition models in order to choose the least cost effective one. Aggressive follow-ups on lease companies and equity providers is part of the strategy to finance the Hub business plan in the future.

6.5 Customer satisfaction

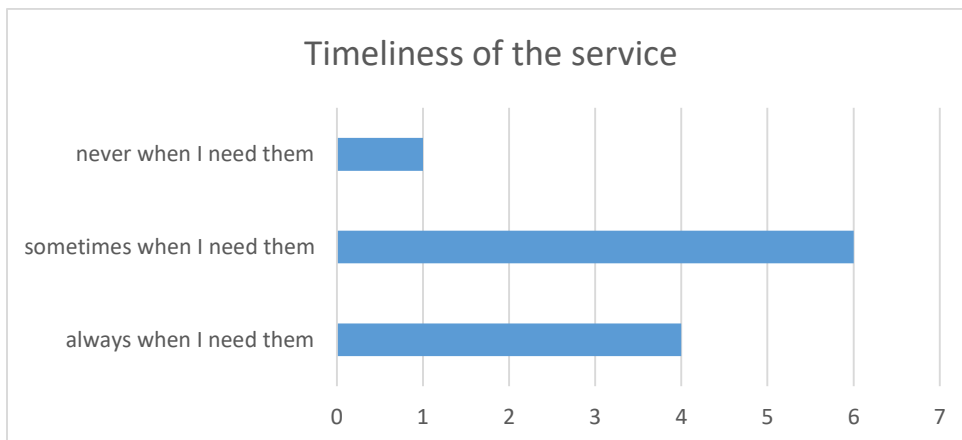
In terms of customer satisfaction, majority of users said they were satisfied with services offered by the SPs and with charges set. Again majority were very satisfied with quality of work SPs provided. In terms of technical advice, almost half of the respondents said they were quite satisfied with the advice they received from SPs a large number expressed satisfaction with the reliability of services offered by their 2WT SPs. (figure 11 below).

Figure 11: Customer satisfaction with variety of service provided by SP



When asked on their satisfaction with the timeliness of services offered by various SP, most users replied that services are not always timely availed but only available sometimes when they need them. The reason attributed to this is that most of 2WT could break down and SPs could either not find the spare parts, or they could not find a skilled person to repair the 2WT. Quite a number said the services are always timely when they need them.

Figure 12: Timelines of service provided by SPs



6.6 Range of hire services offered by SPs

Majority of SPs offered few services that were demanded by hire service users. This is attributed to lack of associated 2WT implements by many SPs. For majority of individual SPs, they just owns one 2WT and a plough.

Figure 13: Range of hire service on offer



In terms of diversity of service provided by various BMs as indicated in table 13 below, only AgriHub (BM6) and Nyabon (BM5) offers their customers' variety of hire services. However, it should be noted that KENDAT combines 2WT and 4WT use in providing these services. Individual owner/operator SPs (BM2 & BM1) only provided ploughing as the main service. Mabanga ATDC (BM4) and TUUTI CBO (BM3) only provided transport service due to managerial and operational challenges expounded elsewhere in this report. The table below summarizes various mechanization hire service offered by different SPs.

Table 12: Summary of 2WT mechanization services offered by various business models

Business Models (BM)	Mechanization hire service offered					
	Ploughing	harrowing	ridging	planting	transport	mowing & bailing
BM 6	+	+	+	+	+	+
BM 5	+	+	+	+	+	
BM 4					+	
BM 3					+	
BM 2	+	+				
BM 1	+					

NB: Agrihub MODEL provide services using both 2WTs and 4WTs

Key:

- BM6 Agribusiness Hub: [Corporate owned]
- BM5 Nyabon Enterprises: [Integrated dealer]
- BM4 Mabanga ATDC: [Government led]
- BM3 TUUTI CBO: [Group based ownership]
- BM2 Vincent Sikuku: [Individual/owner operator]
- BM1 Maurice Kakhame [Individual/owner operator]

6.7 Sustainability (innovation, risk mitigation, competitiveness)

Few 2WT owners and SPs exhibited a high level of innovation in terms of 2WT modification and fabrication. They expressed optimism that innovations skills in the mechanization services (especially modifications of 2WTs to suit local conditions) is very important to the sustainability of their business.

Success story of Innovation as a driver to 2WT business success- Case of Vincent Sikuku & Son

Vincent has been very successful in the improvisation of his 2WT tractor and its plough. Initially he converted his 8HP 2WT to 16HP by mounting a second hand 16HP engine he removed from a second hand 2WT he bought from the market. He also had done brake improvisation for easier operation while driving it. 2WTs are usually heavier in the front that makes one to use a lot of effort-and the reason why many women could not operate it. For Vincent, to counter this problem he placed near the handle a heavy load to counter balance engine weight for easier maneuverability while ploughing.

Additionally, he has added weight on the wheels to prevent skidding when ploughing. Again he has done modification on the shaft gear and added another detachable wheel at the front to ease maneuverability during ploughing. He has also to modify his plough by extending it by some few inches so that when ploughing, he can plough at recommended width. These Innovations has made his 2WT most effective and is the envy of others. As the study found out, some SP like TUUTI CBO and Maurice Kakhame who were unable to improvise their 2WT could not offer services and their 2WT were lying idle. This affected their operations and profit greatly.

He attribute his business success to these innovations and says were it not for those innovations, he would not be in business today. This is also the reason he has more than 100 customers while other SPS with even more equipment had has less than 10 customers.

In terms of risk mitigation, most owners and SP effectiveness in mitigating risk is quite low. The biggest risk SPs faced is personal risks like lack of life insurance for their equipment, lack third party insurance policy in case they were involved in accident with other road users. They did not know how to go about insuring their businesses.

For the Agribusiness Hub model, its innovativeness is in terms of service offering. It provides an aggregated farm mechanization services bundled in “solution packages” at competitive and affordable market driven prices cutting across the whole agricultural value chain. This concept makes the hub highly competitive in comparison to other established government owned mechanization institutions like ATDCs. In mitigating risks associated with vagaries of weather, the Hub has approached a number of credit lending micro finance organization that will provide credit and crop insurance to farmers, helping cut down on the risk associated with investing in new technologies.

The same case applies for integrated dealer led 2WT models whose competitiveness is in terms of offering packaged service product to a targeted agricultural value chain.

Table 13: 2WT business model innovation, risk mitigation and competitiveness

2WT-Business ownership/model	Innovation	Risk Mitigation	Competitiveness
Maurice Kakhame Individual/owner operator model	-Fabricated a 2WT trailer.	no risk plan available	-quality services -low charges
Vincent Sikuku Individual/owner operator	-Plough improvisation -2WT improvisation -Changed his 2WT from 8HP to 16HP -Brake improvisation -Weight distribution for his 2WT for easier manoeuvrability - extension of the shaft gear -added another wheel at the front to ease manoeuvrability when ploughing. -added weight on the wheels to prevent skidding when ploughing	no risk plan available	-by offering quality ploughing services -lowering prices -support services -strong market presence -timeliness operation
TUUTI CBO Group based model	none	none	none
Mabanga ATDC Government owned model	none	none	none
Nyabon Enterprises Integrated dealer model	-Marketing through online advertising. -Contract tilling -establishing a pilot model farm for training on the use of machinery	crop insurance	- Dealer cum SP sales training and service workshop
Agribusiness Hub Corporate owned	innovative in terms of wide range of services offered -set up of the hub- a one-stop-shop (mechanization supermarket)	lending micro-finance institution to provide credit and crop insurance to farmers,	Bundle mechanization services. -interactions with private sector to pursue business partnerships, equity and collaboration

6.9. Business growth and strategy

In terms of business growth and expansion strategies identified from discussions with many SPs during this study, many owner/operator of hire services expressed desire to buy 2WT implements like plough, sheller, trailer, harrow that will enable them diversify the range of services they offer to their customers. Their future expansion strategy is to increase asset base by owning a 4WT to enable expand the geographical coverage of their business. This preference is attributed to versatility of 4WTs as compared to relatively slow, cumbersome and high skills demanded to effectively operate a 2WT.

Though many SPs consider having a clear business plan and strategy as an ingredient for successful business venture, almost all had not formulated any plan. They seemed to be just muddling through each day in their operations. Only KENDAT (corporate BM) and Nyabon enterprise (integrated BM) had very clear strategic plans that guided their operations. In addition, all the SPs had very poor record keeping strategies as most relied on their head to store records and transaction done. As such, it proved very difficult to quantify various issues like profitability for this research. As the study found out, Lack of effective training in entrepreneurship and business management is a contributing factor for lack of a clear business development strategy for many small scale SP.

In pursuit of expanding hire service market base for majority SPs, they were focusing on value addition through quality ploughing and harrowing, advising their customers on CA, and some referring and linking up farmers to the market. Also they had plans to acquire more implement in order to provide their customers with a wide range of services to choose from. Also some SPs were also providing additional subsidiary support services like transports services, water vending and brick making (KENDAT).

For the 2WT integrated dealer model of Nyabon enterprises, his business growth and sustainability is hinged on provision of farm mechanization solutions (as a packaged service product) to small and medium scale farmers along key agricultural value chain- with a focus at the bottom end of the value chain i.e. pre-planting land preparation, seed/seedlings planting and weeding. Another strategy implemented was to target farmers group to offer contract tilling. In scaling up use and adoption of machine he supplied and offer training on their use, Nyabon enterprise had established a 55 acre pilot model rice farm where 2WT equipment are demonstrated.

For the AgriHub corporate model, the business strategy adopted is to provide all the mechanization farm needs their customer requires at the hub (one-stop-shop). In addition the hub was already offering complementary bundles of services to farmers that include advisory services on contemporary agronomic practices. Another strategy was to intensify provision of high quality mechanization service from planting to post harvesting for each customer served by the Hub.

Table 14: Summary of business growth and strategy for various business models

2WT-Business ownership	Business Model	Business growth strategy
Maurice Khakhame	Individual/owner operator model	Value addition through quality ploughing and harrowing and diversification of services offered by acquiring more 2WT accessories. -expand market base by acquiring additional 2WT.
Vincent Sikuku	Individual/owner operator	Value addition through improvisation of 2WT to offer quality ploughing and harrowing and also offer support service like agronomic advice and linkages to market. -acquire training on 2WT operation in order to provide quality service

TUUTI CBO	Group based model	Their growth strategy was not clearly defined, though one group member intimated they can hire out the 2WT and invest the returns on the business(he had to consult the group if his idea would be accepted)
Mabanga ATDC	Government owned model	No clear strategy identified for the institution. -preliminary investigation pointed that they may were relying on the directive/ plans made from parent ministries in the counties
Nyabon Enterprises	Integrated dealer model	-Provision of farm mechanization solutions (as a packaged service product) to small and medium scale farmers along key agricultural value chain. -Targeting farmers group – for contract tilling. -establishment of 55 acre pilot model rice farm where equipment are demonstrated.
Agribusiness Hub	Corporate owned	-Start an interactive farmer-services-oriented platform in the hub where mechanization technology and agronomic information will be exchanged on a daily basis amongst the farmers, SPS and actors in agric. value chain. -Acquisition of all farm machinery in order to provide a walk in one-stop-supermarket for all mechanization needs for smallholder farmers, either individually or for an organized group of farmers. -intensify provision of high quality mechanization service from planting to post harvesting for each customer served by the hub

6.10. Business operating Environment

Whereas there are a number of broad policies supporting agriculture sector in Kenya, such policies are very general and do not clearly address agricultural mechanization needs for small scale farmers and SPS. As the study found out, the existing policies have very little impact at the grassroots level. In Bungoma for example, many SPS and users of 2WT services were in close proximity to government owned Mabanga ATDC that is supposed to disseminate mechanization technologies to them but insinuated not to have received any support on training for 2WT mechanization despite the institution having 1 unit 2WT.

Institutional support frameworks existing are weak in supporting grassroots mechanization efforts as most SPS pointed out that both the national and county government have done little if any to improve operational environment for the adoption and use of 2WT mechanization at the grassroots. For Mabanga ATDC, the mechanization preference is more of 4WTs than 2WTs. Currently, the dealers, owners and SPS said there are no subsidies, tax exemption or even training they receive from government in acquiring mechanization equipment. Lack of recognition on the critical roles SP play on the adoption and promotion of small scale mechanization services is a big failure on the part of government.

A favourable noticeable change in the enabling business environment is the improvement of road in the area which will aid private sector to invest in farming and enterprise development. This is expected to ease mobility of 2WT within SP catchment areas.

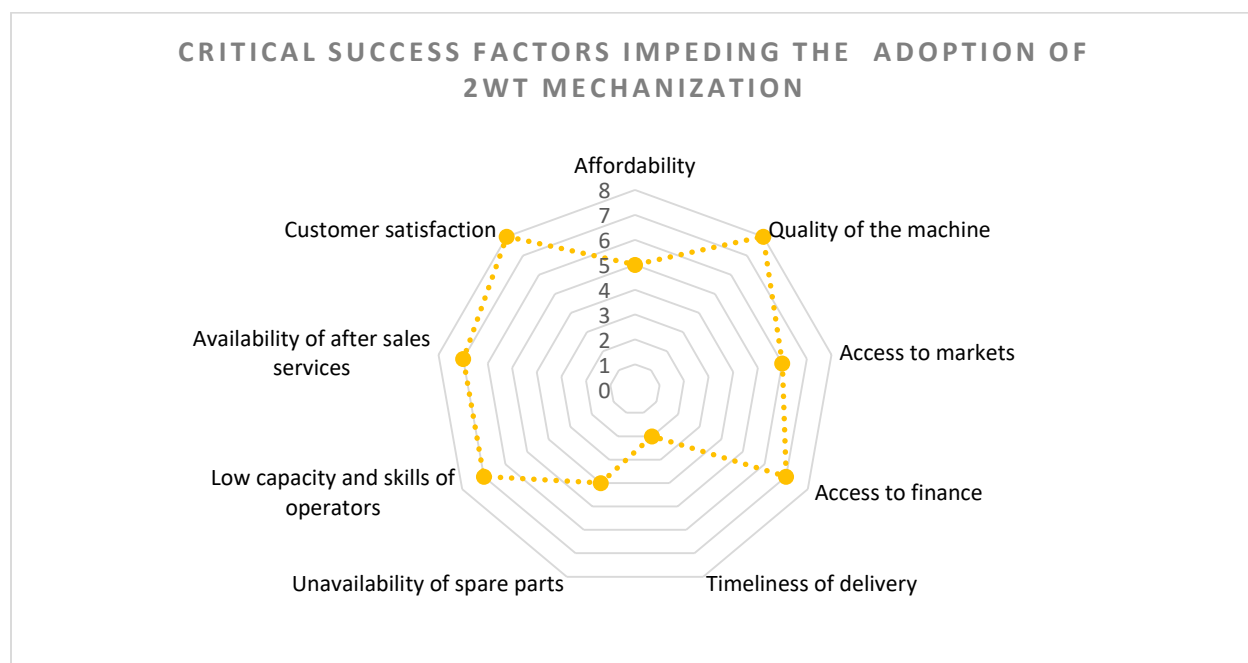
7.0 CRITICAL SUCCESS FACTORS

7.1. Impediments towards Adoption of 2WTs- SPs perspective

Most SPs identified the following critical success factors as impeding the successive adoption of 2WT mechanization services; unavailability of spare parts, affordability concerns, low capacity and skills of operators, lack of access to finance, lack of access to markets, quality concerns of the supplied machinery and unavailability of after sale services (e.g. training on how to operate 2WT) from dealers/suppliers.

For most 2WT SPs business models, unavailability of spare parts was the single most critical factor in the 2WT mechanization business adoption and growth. Nearly all SPs had technical challenges resulting from malfunctions of their 2WT while some SPS (e.g. KENDAT, Maurice Kakhame, TUUTI CBO) had broken-down 2WTs lying idle due to lack of spare parts because of unavailability of vendors/ dealers who stocked them in their region. In mitigating the lack of spare parts, the SPs suggested that government should provide subsidies for 2WT importation so that many people can afford to import spare parts at affordable prices. Lack of finance can be mitigated by having linkages to financial institution like AFC and micro finance institution to provide affordable credit facilities.

Figure 14: Critical success factors impeding the use of 2WT technology



In the entire country, the market for 2WT is not well developed but there are opportunities for 2WT based mechanization niche. Records from KRA shows that, only 512 units of 2WTs have been imported since 2005, with a peak of 272 units in 2011. The number of annual imports has declined to 68 units only in 2012 as dealers have cut back on imports owing to low market demand. This can largely be attributed to the

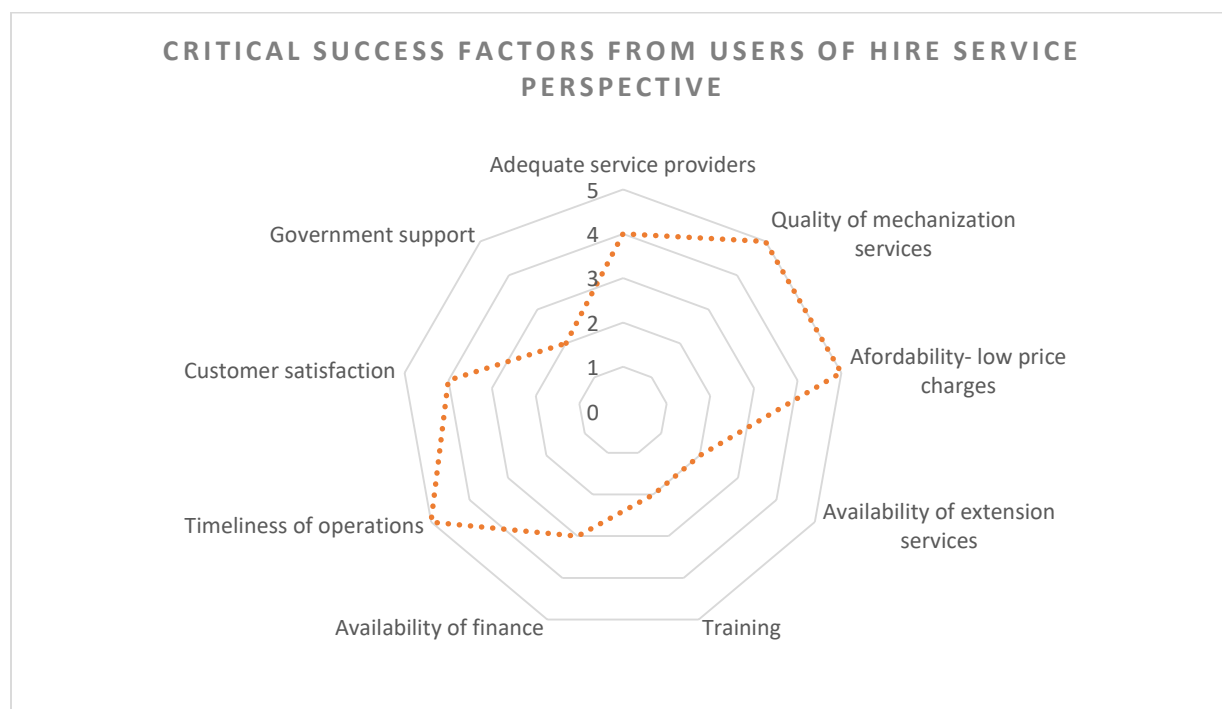
relatively low awareness level among smallholder farmers on mechanization services available and high cost of imports that makes the prices of 2WT to be prohibitive to would be users. Very few importers are willing to invest in creating demand citing the low margins obtained from the sales of the 2WT. Most of the 2WTs, imported are used in the horticultural industry to transport flowers from farms to pack-houses.

7.2 Critical success factor from users of hire service

Most of interviewed users said they are yet to see tangible impact for their use and adoption of 2WT technologies on their farms. Only a few said they have had improved harvest since they started using the services. Few others said they now use improved seeds and able to use correct line spacing using mechanization hire service when planting maize.

Most users of 2WT mechanization services rated quality of services and affordability as two key factors they consider when seeking out 2WT mechanization services. They also pointed out that timeliness of operation is very important as they rely on onset of rainfall for planting and lateness to prepare and plant their land can have consequences in quantity of production. Other factors they considered important is the availability of finance, availability of enough service providers in order to increase competition-which in turn leads to high quality services being offered at cheaper prices and need for extension services for farmers to be trained on mechanization and CA practices.

Figure 15: Critical Success factors from user’s perspective



7.3 Mitigation measure from users perspective

In mitigating the user-identified critical success factors, users of hire services proposed various action/ remedial measures to be instituted by either national or county governments. These mitigations are summarized in the table below.

Table 15: Mitigation measures of Critical Success factors as proposed by users

BM s	Critical success Factors (from users perspective)	How to mitigate them	Priority 1- low : 5 - high,
2WT SPs	Quality of the Mechanization service offered	SPs to be trained by county government ATDCs	5
	Affordability – low price charges	increase competition by having more 2WT service providers	5
	Timeliness of the operations by SPs	Seasonal farming information/calendar to be provided by MOA.	5
	Availability of finance	Govt. to facilitate ease access to finance from micro finance institutions	3
	Availability of extension services	county govt. to employ more extension services	3
	Availability of enough service providers	subsidies by government to increase more 2WT business ownership	4
	customer satisfaction	training of SP by ATDCs and other experienced players like KENDAT	4
	government support	formulation of mechanization policy with special focus on small scale farmers	2
	farmers training on mechanization benefits	ATDCs to play an active role in farmers training	2

8.0 CHALLENGES FACING 2WT BUSINESS MODELS IN KENYA.

2WT BMs in Kenya operate under a myriad of challenges as this study found out. A summary of challenges is first provided in the table below;

Table 16: Summary of main challenges facing 2WT BMs in Kenya

Criteria	Challenge facing 2WT BMs
Affordability	<ul style="list-style-type: none"> Was found to be low due to very high price of 2WT for most SPs to afford.
Access to technology	<ul style="list-style-type: none"> Very few farmers own 2WT and majority don't know where to buy one.
Spare parts	<ul style="list-style-type: none"> Lack of spare parts is a big problem for 2WT owners/SPs
Repairs and maintenance	<ul style="list-style-type: none"> lack of skilled mechanics and garages/workshops to repair 2WTs
Awareness level	<ul style="list-style-type: none"> Low awareness of 2WTs mechanization amongst farmers. Need for field demonstrations to create demand (ASK shows, field days)
Technical skills	<ul style="list-style-type: none"> Low technical skills to operate 2WTs. Training is critical of 2WTs operators
Business management	<ul style="list-style-type: none"> Low business management skills for most SPs weak entrepreneurship skills Very poor record keeping for all BMs.
entry and promotion strategy	<ul style="list-style-type: none"> 2WT entry strategy was weak. Choice of Government institutions & groups to promote 2WT technologies promoted not good – they lack commitments. (Need to promote through entrepreneur SPs.)
Linkages	<ul style="list-style-type: none"> BMs had weak linkages with dealers, and output market
Government policy	<ul style="list-style-type: none"> Weak government policy support for 2WT BMs. Need for Tax exemption on importation of 2WT and their spare parts
Access to Finance	<ul style="list-style-type: none"> BMs had poor Linkages with financial institutions Develop financial products to specifically support small scale mechanization. Provide ease of access to affordable loans to support 2WT BMs.
road infrastructure accessibility	<ul style="list-style-type: none"> Poor roads conditions a big deterrent to 2WT entrepreneur in offering mechanization hire services.

An elaboration of the challenges is provided bellow.

- One of the biggest challenges in Kenya is accessibility of farm machinery and in particular 2WTs to small scale holders. Another major bottleneck that was faced by majority owners and SPs in the provision of 2WT mechanization services is the difficultness associated with accessing spare parts. There were hardly any dealer/suppliers of 2WT spare parts in Bungoma and Laikipia.
- Most SPs lacked technical skills to operate 2WT and could not get anywhere to enlist for training. The SPs noted that neither the manufacturer nor the importers nor the suppliers offer training on the use of 2WTs. Institutions like Mabanga did little to offer the much needed 2WT mechanization training to SPs. On the other hand Lack of recognition on the critical roles SPs play on the adoption and promotion of small scale mechanization services is a big failure on the part of government.

- Discussions with most SPs revealed that the 2WTs are not manufactured with Kenyan soil condition and terrain in mind. In its original manufacturers' configuration, ploughing using 2WT was found to be most challenging activity especially in Bungoma region. They felt there was need for modifications or the manufacturers to work hand in hand with SPs to identify areas that 2WTs must be modified to work effectively. Some SPs like Vincent Sikuku proved that when properly modified, 2WTs can be the best mechanization equipment for small scale holder farmers in Kenya. However, in both regions, there were hardly any skilled people/artisans who could repair/modify a 2WT.
- Operating 2WTs alongside other road users pose both personal risk to the operator and to other road users especially in the provision of 2WT transport services. First, its maneuverability and braking systems is quite cumbersome and has been considered too risky for other road users. In Bungoma for example, the traffic police do not recognize 2WTs as road worth vehicles and some operators have been harassed by police saying they (2WTs) do not meet safety condition (side mirrors, signal light, safety belts) set by the National Transport Safety Authority of Kenya. Second, the police demand for driving licenses and insurance certificates as a condition for the 2WT to be allowed to operate on the roads.
- In terms of ease of accessibility to financial and credit facilities, it is still difficult for SPs business (due to their small profit margin) to qualify for loans due to stingiest conditions required for loan acquisition by commercial banks and micro-finance institutions. The high interest rates on loans is a deterrent to many small scale SPs and farmers in taking loans. The government has not done enough to lower interest rates and to cushion farmers who might want to take such loans. From the analysis of prices of AgriHub mechanization equipment, it can be seen that setting up a mechanization hub is a high capitation venture that raise serious affordability concern for many ordinary SPs and prospective entrepreneurs who barely make enough profit to support household basic necessities.
- In terms of business enabling environment, the current agricultural mechanization policy environment is not so conducive for the adoption of 2WT mechanization hire services. The government has not done enough to enlighten the farmers on the need to mechanize. The county and national government attitude seems lukewarm towards support of 2WT based small scale agricultural mechanization. The mechanization preference seems to be more on 4WTs operating in large scale farms than 2WTs. Currently, there are no subsidies, tax exemption or rebate received from government given to suppliers, dealers or SPs in acquisition of mechanization equipment.
- The spatial dispersal and fragmentation of small scale rural farms and the accompanying poor transport networks for most rural roads is a major barrier to the efficient use of agriculture mechanization by many small scale farmers. The poor roads conditions is also major deterrent to 2WT entrepreneur in offering mechanization hire services.
- In addition, all the SPs had very poor record keeping strategies as most relied on their head to store records and transaction done. As such, it proved very difficult for the researcher to quantify various issues like profitability of various models as there were literally no records. It also proved difficult for many SPs to know the level of profit/loss margins they were actually making in the long term as they did not have a record of all expenses and cost associated with running their business operation. As the study found out, Lack of effective training in entrepreneurship and business management is a contributing factor for lack of a clear business development strategy for many small scale SPs.

9. CONCLUSIONS

Low adoption: This study has revealed that adoption and use of 2WT in Kenya is still low but the demand is growing albeit slowly. Though the SPs says the 2WT niche is attractive for small holder farmers, and that the demand is growing, they have not done enough in the past 5 years to attract more customers.

Weak BMs: The business models analyzed are few and generally weak but have prospects for growth with an exception of group based model (TUUTI) that has very low prospect for growth (because of the mixed composition of the group members who do not have a shared vision for the group). In upgrading the existing business models there is need for much efforts to be put on the demand side. Farmers and services providers have the key to unlock the demand. Farmers need to be convinced that the services of 2WT are cheaper than even 4WTs. Field demonstrations on the use and operation of the 2WTs will help create the demand.

Low asset base: From the interviewed 2WT business models in Bungoma and Laikipia regions, majority owned just 1 unit 2WT and few accessories like a plough and trailer. Only KENDAT through its AgriHub had the largest number of 2WT, 4WT and a host of other 2WT accessories. Most owner/operators business models initially bought 2WT for their farm operations but later ventured into offering hire services.

Cheaper: As compared to both human and animal labour, 2WT mechanization services was considered by most users to be the cheaper option and most economical for 2WT SPs and users.

Low Profitability: The analysis has shown that profitability in the 2WT mechanization business can only be realized when SPs has associated 2WT support accessories to help in diversification of services offered. Most critical implement includes, plough, furrow, tilers, sheller trailer and ripper etc. to support wide range of mechanized services for customers. It's to be noted that land preparation is seasonal and SPs need to cushion themselves during the low season months by providing alternative farm support services like farmers training, transport, agro input and agronomic advice.

Weak policy: In terms of enabling policy environment, most intimated that the current policy environment is not so conducive for the adoption of 2WT mechanization hire services in Kenya. Additionally, there seem to be very weak national institutional framework to support 2WT adoption in Kenya. The existing institution like Mabanga ATDC was found to focus more on 4WT and seemed disinterested in the promotion of 2WT mechanization despite them owning a 2WT for training farmers. The devolved county government has not done enough to train owners, SPs and the farmers on the need for mechanization. Operations of 2WT machinery require trained manpower and county government institutions like Mabanga ATDC that is solely tasked with training farmers and promotion of adoption of agricultural technologies at the grassroots had little impact.

Big opportunity: Most 2WT SPs foresees a big opportunity for the 2WT especially in Bungoma region since land fragmentation index in the region is very high and continue to increase due to high population growth- this makes operation of 4WT (biggest competitor of 2WT SPs) in small land sizes uneconomical and also difficulty to maneuver in shrinking land sizes. Also another opportunity in the offing is the decreasing human and animal based labour leaving 2WT as the best option.

Positive impact: The FACASI program has brought a positive impact in increasing the level of awareness of 2WT mechanization E.g. through the successive case of the AgriHub in Laikipia. KENDAT with the support of FACASI project has been training farmers in Bungoma on the operating 2WTs.

Low awareness: The study found out relatively low awareness level among smallholder farmers on mechanization services available. In summary, the limited access to efficient and economically viable farm mechanization machinery and equipment, low level of investments in mechanization services, poor extension and technology adoption, weak institutional and legal framework, limited access to financial services to acquire the machines, inadequate knowledge of farm mechanization by many farmers as well as attitudinal mind-set has contributed to low level of use and adoption to mechanization by majority small scale rural farmer in Kenya.

Financing the BMS: The financial environment is conducive to the development of the sector but farmers and SPs need to earn enough income to enable them service the high interest rates charged on loans offered in the market. The business financing market in Kenya is well developed and very competitive, there are many commercial banks and micro finance institutions who have developed various financing models and products aimed for the agribusiness sector. However, affordability of such product is a key detriment for small sized BM and for small scale farmers whose income earnings from their farm activities is quite low and unable to service the high interest rates the loans attract.

10. RECOMMENDATIONS

For adoption and scaling up of 2WTs in Kenya, the best strategy is to target existing SPs who have good entrepreneurship skills, high improvisations skills and who have passion for mechanization who are then provided (at a subsidized rate) 2WTs and their accessories to provide services to small-scale farmers. Though Small-scale farmers might not afford to buy the 2WTs because of the high prices compared to the marginal returns farmers get from their farming activities, they should be able to hire them at affordable hiring charges from these SPs.

The best model for scaling up 2WT based mechanization would be small scale 'individual owner/operator model' that has SPs owning 2WTs exclusively for service provision. Caution must however be put in choosing such SPs to identify the most active and innovative ones who have a passion for agriculture mechanization and personally provide 2WT service like Vincent Sikuku and his son. The individual owner operation business model is a best choice because the SPs interact directly with farmers and are able to identify farmers' mechanization needs through their close interaction. Most importantly, these SPs operate 2WTs on a daily basis and are able to diagnose its performance and short comings and need for modifications. Through SP innovativeness, the study has shown that some SPs were able to successfully fabricate and improvise their 2WTs thereby providing quality services while others could not.

As much as corporate Led model would seems most suitable for scaling up 2WT mechanization technologies, it's most difficult one to implement. First, there are hardly any other AgriHub model in Kenya apart from KENDAT one. This limit greatly any scaling up effort. Second, setting up a hub is an extremely costly affair- e.g. the AgriHub capitation is more than USD 172,000 and still more equipment are needed without counting the daily operational expenses. For such a hub, the preference of equipment bought must be those which has the highest return on investment- to recoup the capital invested. For 2WTs and their current operational challenges, any Hub entrepreneur would highly likely to sideline it for more versatile profit-making technologies and equipment.

In improving 2WT business operations, majority interviewed said there is need for provision of technical training to owners and SPs to improve use and adoption of 2WTs. Experienced SPs can be used as trainer of trainers (TOTs) or even directly train farmers on operational of mechanization technologies in their own farms or established models farms.

The financial environment is conducive to the development of the sector but farmers and SPs need to earn enough income to enable them service the high interest rates charged on loans offered in the market.

Provision of government support in making sure affordable machinery is available is critical. Although the government is preparing a policy for mechanization, the current enabling environment is not conducive for private sector investment. There are no incentives for local manufacturers as they are double taxed on the importation of sheet metal and VAT for manufactured products. Such support like tax exemptions for importers, dealers and suppliers of machinery and accessories must be put in place in order to lower the prohibitive cost of acquisition of 2WTs and their spare parts that was considered by majority to be beyond reach for many small scale farmers.

For Group Based model where 2WT is owned by a group like Tuuti CBO, the best approach would be to employ a skilled operator-either from the group or outside the group who is charged with managing the tractor on behalf of the group. In that model, the operator would provide services to group members and nonmembers at the market rate fee. After planting seasons, the tractor could provide other services like transport and maize shelling. However, group based model was found to be most challenging to run and operate.

If the 2WTs are to be adopted, then manufacturers and dealers must integrate SPs advice on certain modifications to be carried out on 2WT to improve their effectiveness and functionalities. Most SPs suggested that 2WT mechanization business will never pick up as long as the 2WT supplied are not modified to suit the local conditions and must be manufactured based on suggested modification by local SPs in Kenya. Some SP also complained on the amount of body strength needed to ignite it using the manual ignition systems. The manufacturers need to modify the ignition and put automatic ones. The service provider reiterates that 2WT requires considerable amount of energy to operate it because of the way the engine is placed in the front - making it heavier than normal in the front than in the back. They suggested that to balance the 2WT, a weight should be placed near the handle so that it counteract the engine weight for easier maneuverability while ploughing.

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