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Challenges Encountered by County Agricultural Mechanization Service Operations in Kenya

Nasirembe, W. W.[1], Mutinda, B.[2], Cheboi, P.[3], Olduboi, K.[4], Saya, I. J.[1], Lang'at, W.K.[1], Kirui, K. K[1]. Maingi, S.[1], Wanjiku, B.[1], Odowa, F.[5], Andisi, F.[6]

[1]Kenya Agricultural and Livestock Research Organization, P. O. Box 57811-00100, Nairobi
[2]Department of Agriculture, Food Security and Cooperative Development. Mwatu Wa Ngoma Rd, P.O Box 40-90100. Machakos
[3]Kipchumba Cheboi, Bukura Agricultural Technology Development Centre, P.O Box 65-50105, Bukura.
[4]County Government of Nandi, Department of Agriculture and Co-operatives Development P.O Box 822 – 30300 KAPSABET
[5]Agriculture Technology Development Centre (ATDC) Siaya, P.O. Box 03. - 40600 Siaya
[6]Ministry of agriculture Trans Nzoia county P. O BOX 4211-30200 Kitale

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***Corresponding Author:** Nasirembe, W. W.

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Abstract **Original Research Article**

The fact that a well-managed tractor hire service contributes to food self-sufficiency and nutrition necessitated this study. The main objective was to establish the factors limiting the success of the County-operated Agricultural Mechanization Service (AMS) in Kenya to serve small-scale farmers efficiently. A conditional technique using SurveyNut with mixed question types was adopted to generate data from 37 out of 47 counties in Kenya. Data was analyzed using descriptive statistics where results indicated that the major limiting factors of having a functional Tractor Hire Service were the; labour force structure was skewed to plant operators at 55%, lack of service shop, 59%, 40% of the AMSs park their equipment during off-season periods, breakdowns cost 25% of the time, county administration interference 20%, supplies procedure delays 18% and late fuel deliveries take 16% of the time. Major services provided were ploughing, harrowing and transportation yet post-harvest handling is responsible for over 30% of the food losses. There was stiff competition from private tractor higher service schemes at 6%, promising to increase. Based on the findings, the paper recommended employing relevant qualified staff and conducting routine on-the-job training be made a priority, the AMSs should keep up with technology like having GPSs for estimating acreage, tractor tracker for real time location, mileage travelled while on the road, area ploughed and fuel consumption to be installed, Acquire models of tractors that have back-up/after-sales service within the locality of operation, should have an operational service shop, run the service professionally as a business and match the machine units to the projected workload for labour efficiency. Some county AMSs visited have their fleet photos listed, Plate 1 to Plate 28, Table 1.

Keywords: *Rent-seeking, Seedbed Preparation, GPS, Sources of tractor hiring, Workload.*

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INTRODUCTION

The Agricultural Mechanization Service was established in 1947 in Kenya. The service, initially known as Soil Conservation Services (SCS) involved the use of heavy earth-moving machinery (the Plant Hire Service (PHS)) to open up land for agricultural development in the former white highlands. Other functions included the construction of soil conservation and water harvesting structures, bush clearing and land leveling. Through this, more land was brought into agricultural production.

In 1965 the Government established the Tractor Hire Service (THS) whose broad objectives were to open new land for wheat production, introduce modern farming practices, stimulate and encourage private ownership of farm tractors and machinery and train the farming community on the general techniques for good seedbed preparation. The amalgamation of THS and PHS in 1981, resulted in the creation of Agricultural Mechanization Services (AMS).

In late 1970 and early 80's a rural technology promotion department was initiated under the Ministry of Agriculture responsible for the promotion of appropriate technologies in:

Agricultural implements, Rural energy, and Rural industry sectors. The department later grow to other four rural technology promotion Centres (AMS), Annex 4. The predominant opinion is that the Public Hire Schemes have not, in general, been successful. The objective of this study is to establish the likely causes of failure experienced in Public Hire Services through a collection of relevant data and as much information on such schemes as possible, summarize the findings and where possible, develop hypotheses for the successes and failures of these schemes and determine what lessons can be learnt. (1) Are Tractor Hire Schemes intrinsically doomed to failure; (2) Under what conditions do they have a chance of success and how appropriate are they to the agricultural problems faced by counties.

The objective of tractor hire services in Kenya was to help farmers access machinery and equipment that they can't afford to own and at a subsidized rate relative to market rates. Today, some County Governments operate Agricultural Mechanization Service (AMS) Stations offering services to farmers such as land preparation, drilling/planting, crop protection, harvesting, transportation, shelling/threshing and post-harvest handling processes. The services are categorized into two types, namely; Plant Hire Service (PHS) for crawlers and Tractor Hire Service (THS) for wheeled tractors.

Kenya has a wide agro-ecological amplitude. Various factors, including climate, altitude, soil patterns, and moisture supply, characterize the agro ecological zones (AEZs). Each zone is characterized by specific elevations, annual rainfall and vegetation types adapted to the prevailing climate. Additionally, important grass and legume species found in the respective zone can also vary, as they have evolved to thrive under the specific climatic conditions of each zone. Much of the variation is a result of agro-ecological differences. Farm operations occur at different times in different ecological zones, making it possible in theory to move machines to follow the work.

The scheme originated in the wheat growing area in the southern part of the Rift Valley where land is flat and large areas were available for cultivation. However, attempts were made to spread the benefits of mechanical cultivation to smallholder farmers in other parts of the country. Most recently the services have moved into the more arid regions, for example in Eastern Province, where the returns to arable farming are unlikely to make mechanization viable. Compounded by unpredictable rainfall and poor or no irrigation infrastructure, the viability of the venture becomes remote.

By the year 2012, a total of 78 plants and 115 farm tractors were available in 24 AMS stations countrywide and were supplied by the national government. At present, more plant and farm tractors with their equipment are being acquired by individual Counties following the conglomeration of the new constitution in 2010 which completely devolved agricultural services. The demand for farming system intensification and potential demand for mechanization started rising in Kenya in a few pockets of areas favorable for intensification.

It has been argued that an increasing population and greater food demand motivate an increase in effective mechanization, in particular with regard to draught animals in areas where tractors are not appropriate or have failed (O'Neill, 1989). Mechanization was more substantially stimulated by such farming intensification than by other factors. For example, the spread of the plough from settlers to smallholders had been a relatively minor channel of diffusion, because such transfers had often been inhibited by a number of discriminatory practices (Pingali, Bigot, and Binswanger 1987a).

By the mid-1980s, the use of mechanization (motorized transport) had spread gradually for various transport operations in areas including most of the highlands, Embu and Machakos districts as they were referred to then and areas around Nairobi; (Pingali, Bigot, and Binswanger 1987b). In these areas, the use of animal-drawn ploughs and ox-carts had also started spreading by the mid-1980s. Also by that time, private-sector contract-hire operations with tractors had also been observed in various locations within Kenya, including Nakuru and Narok districts (Pingali, Bigot, and Binswanger 1987c).

Large-scale farming, in contrast to small-scale farming, has seen higher levels of mechanization at all stages of production. For example, irrigation schemes for sugarcane production in Kenya similar to those in Sudan and Tanzania, have been highly mechanized. The major mechanized operations include land preparation, cane loading and cane transport to the factory (Krenzler, Ash burner, and Sims 2013). Another example is large-scale wheat farming in Kenya, which uses tractors for cultivation and planting, spraying equipment, combine harvesters and transportation. However, these types of farmers have remained small in terms of share in Kenya.

In the past decade, agricultural mechanization has returned to the development agenda in Africa. This change is reflected in major mechanization efforts in a range of African countries, e.g., Kenya, Nigeria, Tanzania, Mali, Uganda and Zimbabwe, (Diazo et al.2016). These programs (machinery imports, hire services and state farms) failed because of governance challenges such as rent seeking and lack of access to spare-parts, qualified operators and technicians. In addition, scholars argued that many of these programs were not based on a real need for mechanization (Daudi, C. K., et al. 2020) Countries with underutilized land resources but increasingly scarce labour, such as Ghana, Tanzania and Mali, are likely to take the avenue towards mechanization instead of focusing on Asian-style green revolution technologies (Feininger and Berlese 2011, Diazo et al., 2016). Rwanda where labour is abundant and land expansion is associated with high environmental costs (Jayne et al. 2014a).

As shown by (Binswanger, 1986), mechanization can lead to an expansion of agricultural area, output and even employment if land is available and the demand for agricultural products is elastic. The second condition (elastic demand) is more likely to apply in Africa now than it was in the past, due to improved market access and (urban) population growth, which has created a rising demand for agricultural products (Ash burner and Krenzler 2011). Farm structures have also changed, and the rise of medium-scale farmers, observed, e.g., by (Jayne et al. 2016). Moreover, there is evidence that both large and smallholder farmers demand mechanization because trends such as urbanization and change in farming systems have created critical labour bottlenecks, particularly during land preparation (Ash burner and Krenzler 2011); Young farmers demand mechanization services because manual work, which is

associated with drudgery and low productivity, makes agriculture unattractive compared with other occupations (Ash burner and Krenzler 2011).

METHODOLOGY

Conceptual Framework

Traveling around counties, it is astonishing to see dilapidated, relatively new models in a junkyard, on the ground, or hanging on stones. Most parts were cannibalized, notably the front ballast weights, electrical parts (battery, starter) and the list goes on and on. This is a venture that should help Kenya increase productivity more efficiently and reduce food deficiency or even excess for export. Kenya was a net exporter of wheat in the years 1944-1952, (Chadwick *et al.*, 2016). The population of Kenya in 1953 was 6,048,250, https://population.un.org/wpp. If 6m people could produce food for themselves and export, then today at 53m people should produce even more. Intensification of agriculture is generally driven by an increasing population, which requires communities to produce increasing amounts of food on a fixed land area (Boserup, 1965)

Sampling

Cluster sampling method was used where a County were clusters then individuals formed part of target population whose bias towards a pre-existing group; a county member or resident and a respondent should also be a stakeholder or interest in agricultural mechanization in their county of association.

Information was collected from 37 county hire schemes in Kenya. An interactive electronic questionnaire was developed, whose URL was shared with respondents to snowball it to peers in their neighborhood or any other County. Some of the counties were visited to take evidence while in others, it was done through proxies. On attaining a critical number of 16 counties, the activity was stopped. By the time of getting to the sixteenth county, they were already 37. Responses from the counties are listed in Appendix 1. There are three main survey data collection approaches were employed; telephone, Face-to-face and Online Surveys. They were ultimately converted to fit into a Survey-nut format, questionnaire appendix 2.

DATA ANALYSIS, RESULTS AND DISCUSSION

Number of counties that responded and existing AMS Centres

Thirty-seven out of forty-seven counties responded to the questionnaire, Annex 1, of which 68% had existing AMSs before the promulgation of the 2010 constitution that completely devolved the Ministry of Agriculture and related functions, Fig 1.

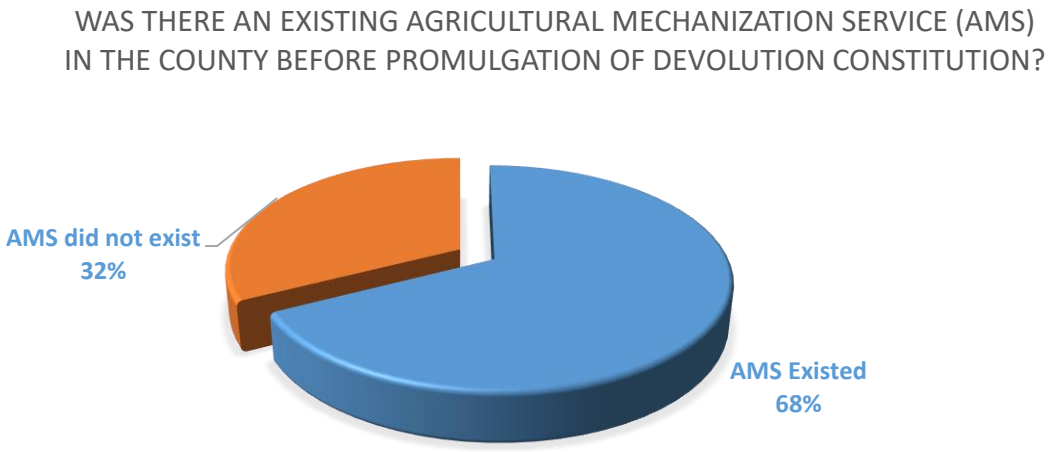

Figure 1: AMS situation before promulgation of the 2010

Establishment of AMS Centres

Thirty-two percentage of the 47 counties who had no AMS before promulgation of the 2010 constitution, 50% started the service during the first term, 17% during the second term, 8% the third term and 25% said they do not need the service, Fig 2. The counties that do not have an AMS were, Nairobi, Mombasa and Kirinyaga. The three counties are mainly urbanized except for one, Kirinyaga which has most land occupied with perennial crops. Kirinyaga which has most

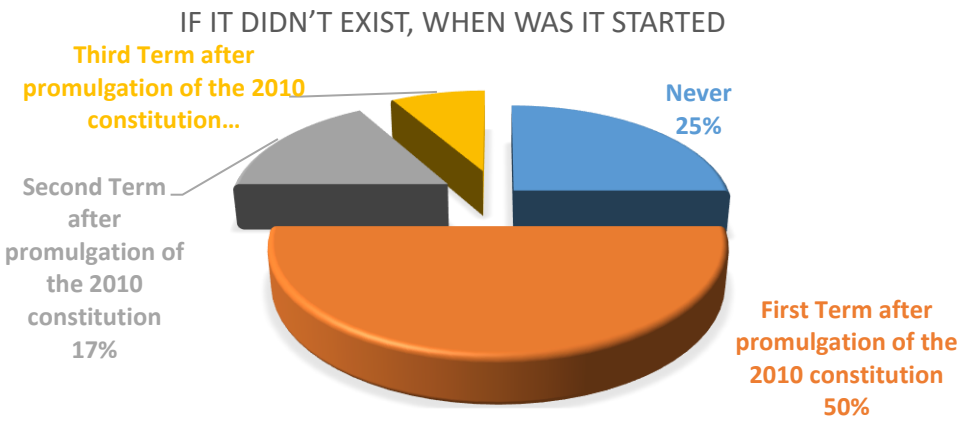

Figure 2: Show percentage of counties that started AMS after promulgation of the 2010 constitution

Land occupied with perennial crops. The private tractor hire service is also abundantly available in the Mwea Irrigation scheme where there are land preparation and baling wheel tractors and crawler combine harvesters making the county service unnecessary.

Tractor makes owned by the Number of counties that responded and the existing AMS Centres

The most common tractor makes that were found at the AMSs were Case International, Massey Ferguson, New Holland, John Deere, Kubota and others at 33, 26, 15, 11, 4% respectively and 11% were for unspecified models. Case International was found to be the most popular tractor acquired by the County Governments for their AMSs followed by Massey Ferguson in that order as depicted in their percentages. The reason for any popular equipment is a widespread after-sales service geographically, familiarity of the operators about the machine and affordable cost of spares. Kubota is the least common amongst the options, Fig 3. with the reason being, a lack of County-Wide after-sales service. Eventually, expected lifespan becomes a factor for choosing a tractor as they compare different makes bought at almost the same time.

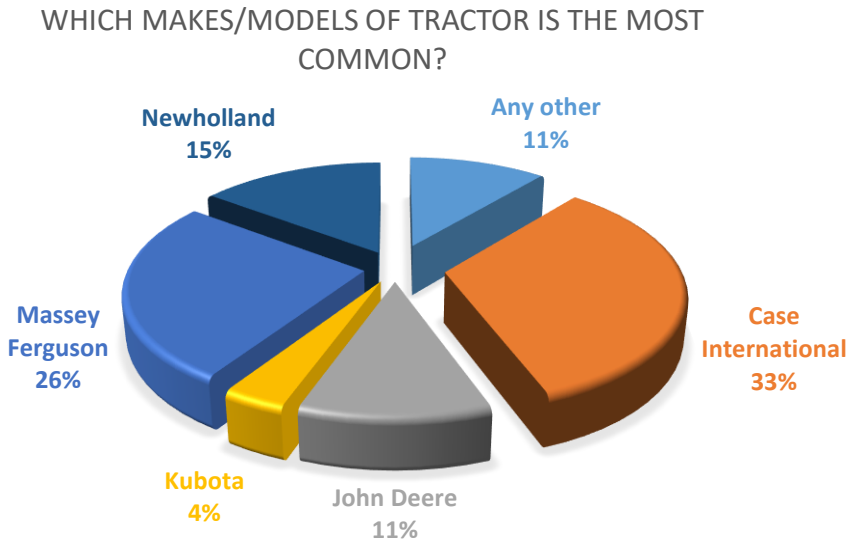

Figure 3: Common Tractor makes at County AMS centres

Age of tractors owned by County AMSs

The useful life of a tractor on a farm can vary, but with proper care and maintenance, a tractor can last anywhere from 8 to 15 years. As a tractor ages and accumulates hours of use, its performance can change. Here are some things to consider when deciding if it's time to have the tractor replaced. Tractors

may start having failures in hydraulic pumps, clutches, and injectors may and need attention. At 8 years old, the engine may need significant work. The age of tractors from all counties was appreciably within the operating span of less than 8 years. More than 50% had worked for less than 8 years, Fig 4.

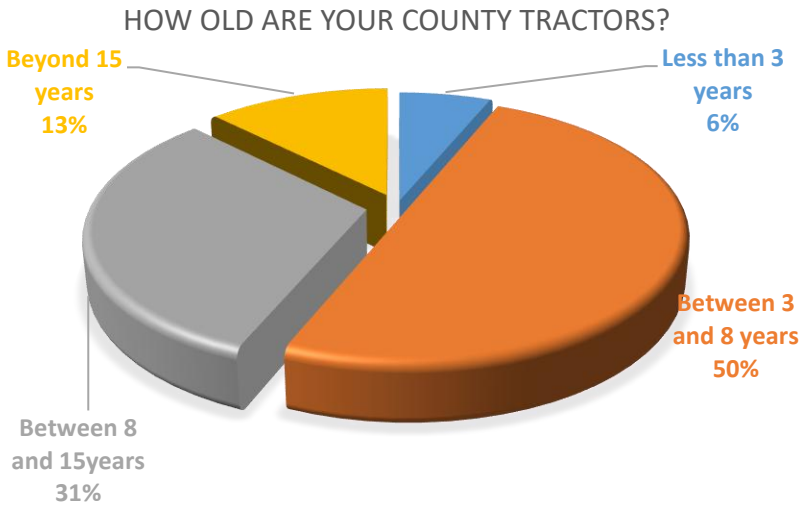

Figure 4: Average age of tractors in AMS county Schemes

The age of tractors at between 8 and 15 years formed 31%, fairly serviceable. From the knowledge that most of the year they idle for one reason or the other, they could have worked for less than 3 years in total.

Power ratings of tractors owned by County AMSs

Tractors have different horsepower ratings that are suitable for different tasks, 36-50 horsepower is a common range for utility tractors and can handle a variety of farm tasks, including baling, ploughing, planting/sowing, mowing, loading off-loading and transportation, 50-90 horsepower are used as utility tractors for ploughing fields, harrowing and weeding, 90-120 horsepower are suitable for construction, industrial use, forage harvesting and large-scale potato plantations among others. Choosing the of horse power of a tractor needs depends on several factors, including; farm size, cropping pattern, Soil type, Speed and depth: Faster speeds and deeper ploughing depths require more power. Respondents to the question about the tractor power rating was; 20% had less than 40hp tractors, 60% had between 40 and 60hp while 20% ha tractors of over 60hp rating, Fig 5.

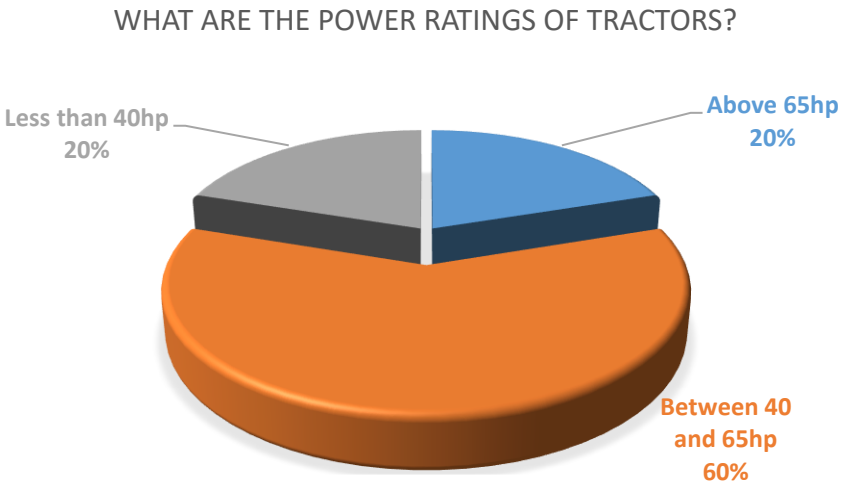

Figure 5: Tractor Power

Services offered by County AMSs

The most popular tractor-hire services in the counties are those devoted to land preparation, planting, spraying, threshing, shelling and transportation. Other services offered by tractor hire services include: drying, winnowing, cleaning, grading, chopping, milling and grinding. Respondents to types of services provided by the County AMSs indicated that seven types of services were targeted. The major service in focus was ploughing 32%, harrowing 23%, planting 11%, spraying 8%, Combine-harvesting 7%, stationary threshing 4% and Transportation 15%. Fig 6.

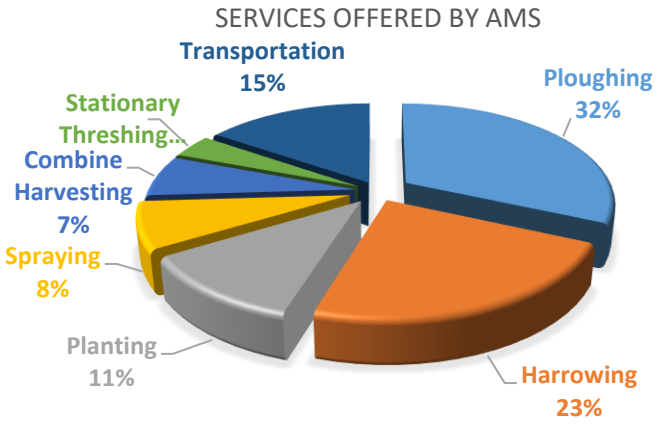

Figure 6: Services offered by County AMS

Depending on the County offering the specific service, priority for the most strenuous job will vary accordingly. Leading grain producers like Trans Nzoia, Uasin Gishu, Bungoma, Nandi, Nakuru, Narok and Kakamega do not have combine-harvesters except for Trans Nzoia, Uasin Gishu, Kajiado and Nakuru.

LABOUR FOR COUNTY AMSS

The labour capacity required for a tractor hire service provider depends on the field capacity of the tractors, which is calculated as follows:

$$The\ field\ capacity\ in\ ha/10\ hour\ day = Speed\ in\ km/h \times working\ width\ in\ m \times N,$$

where N is the Field Efficiency, which is measured as a decimal. The field efficiency factor allows for the time spent turning on the headlands, refueling the tractor, filling seed and fertilizer bins on a planter, etc. Some tables show average field efficiencies for a selection of different operations, Annex 3. The team for operating the County AMS project was found to be composed of 3% unskilled labour, 6% skilled casuals, 15% drivers, 21% Agricultural Engineers and 55% plant operators. In most Counties, the AMS are operating at below expected capacity of 75% which is equivalent to 5ha. per week or 20ha per month. The labour force engaged in executing activities of the AMS earns salaries to contribute to food and nutrition self-sufficiency and nutrition but ends up as a big loss through salaries and no production. Fig 7.

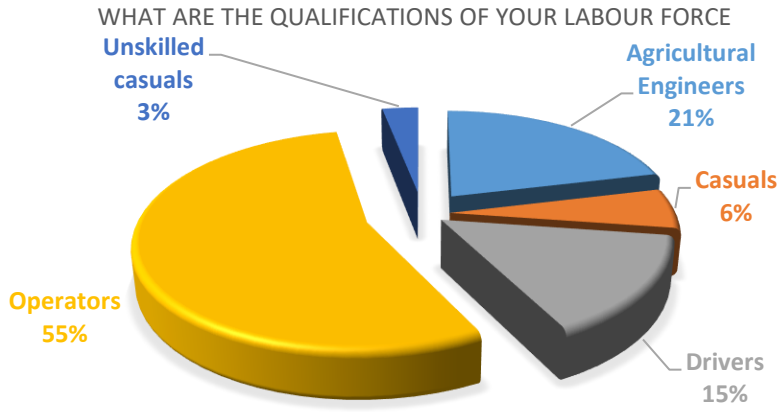

Figure 7: Qualification for workforce

Existence of a Service Shop

A service shop is important to an agricultural mechanization service shop because it provides a place to repair, maintain and store machinery, implements and structures. A service shop can also be used to store tools, supplies and spare parts and as a shelter for workers during bad weather. The importance of a service shop to an agriculture Mechanization service provider cannot be over-emphasized. Service shops are important to agricultural mechanization services because they help farmers access machinery and equipment for a defined period of need. The service shop will enable farm machines to improve yields, reduce dependence on food imports, Complete field preparation and harvesting on time, adopt new technologies through modifications, exploit economies of scale, create employment opportunities and upgrade rural life, Fig 8 below. By the period of conducting this study, 59% of the County AMSs had no service shop which impacts negatively on benefits of having one.

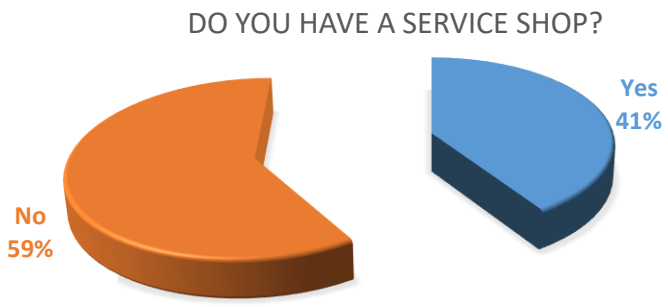

Figure 8: Service Shop

Off-Season Machine Activities

During the off-season, the tractor hire service equipment can be maintained and prepared for storage by changing fluids, engine oil, transmission fluid, and coolant to help keep the engine and components and keep them in good condition. This also prevents sludge formation and protects the engine from corrosion and wear. Emptying fuel tanks or using fuel stabilizers can prevent fuel tank degradation. The rain seasons in the country's regions are varied. Some areas have one season, and most have two but not all regions utilize both rain seasons while others have three.

In Fig. 9 below, 21% sort jobs outside their county's area of their jurisdiction, 40% parked all the farm equipment and waited for the next season while 39% serviced and secured the equipment until the next season.

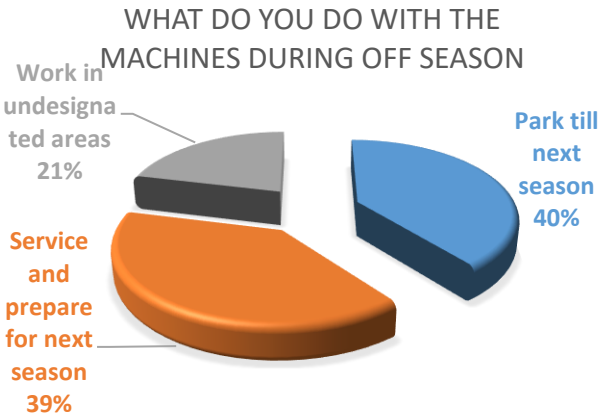

Figure 9: Utilization of off-season time for machines and labour

Average Acreage Done Per Day Per Tractor

A tractor can plough between 1 and 4ha per day, depending on the type of soil:

i. Light soils: A tractor can plough about 4ha per day in light soils.
ii. Heavy soils: A tractor can plough about 0.8ha per day in heavy soils.

The variation is too big and specific cases came from Narok East, Ntulele area where soils are light and well drained compared to Trans Nzoia Bikeke, Kiminini Sub-County where a tractor can do about 0.8ha a day in February before the onset of rains. The soil is very hard and can end up spending 50-60 litres for the job of 0.8 ha. According to the respondents, 59% managed less than 4 ha, 31% between 4 and 6 ha and 10% did over 6 ha, Fig. 10. Above.

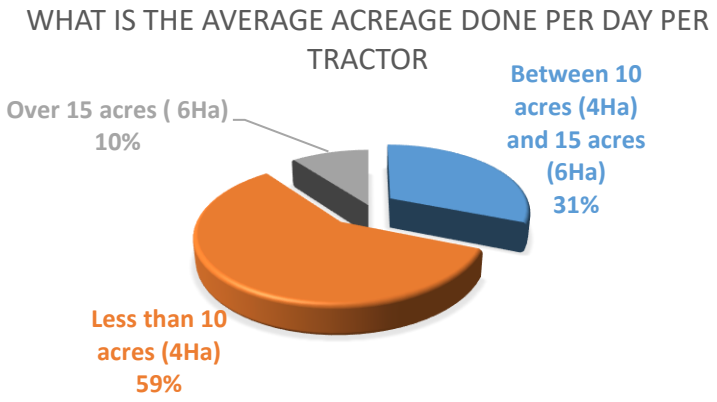

Figure 10:Acreage projection

Average number of farmers by AMS per year

Since not all tractors are created equal, it's a little hard to determine the power of a tractor without knowing its feature and accurate size. For example, John Deere riding tractors are quite powerful and can plough approximately 2.5-3.3 ha in a day which may not be the case with any low-power tractor. It also depends on many other factors as soil type, moisture content, terrain, time, land size, and driver's knowledge of the operation a tractor. On average, a tractor can plough 3 hectares a day depending on the power it has.

There is a group of respondents 40% who served 100 farmers, 20% served between 50 and 100 farmers and 40% served less than 50 farmers, Fig. 11 above.

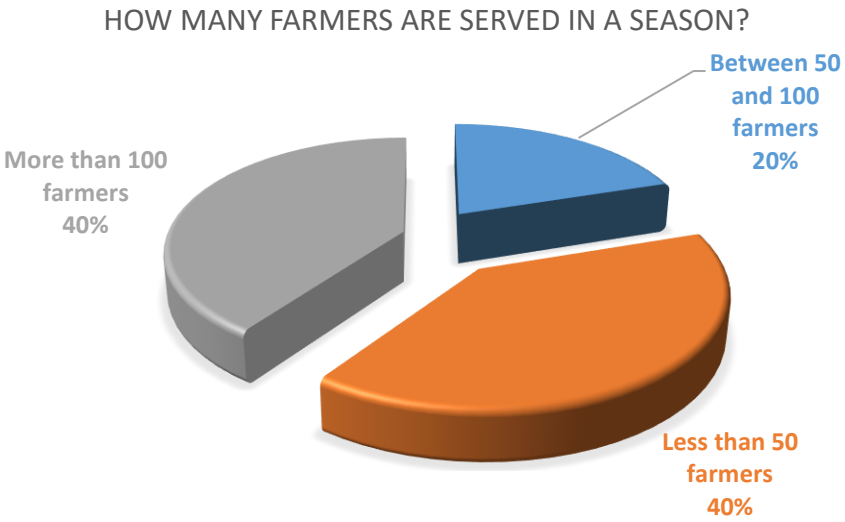

Figure 11: Farmers served per Season

Sources of County AMS Service Provision Challenges

AMS Centres providing Tractor Hire Services face several challenges, including:

i. The cost of maintenance and spare parts, as well as fuel prices, is high.
ii. There is a shortage of formerly trained and qualified tractor operators.
iii. Networking between service providers and end users of the service is still low and tracing each other is largely physical due to lack of a common platform on which the service providers and their clientele can interface.
iv. During peak farming season, there is segregation of land choice by service providers depending on land size, terrain and distance.
v. It may be difficult to hire a tractor with specific features or functionality if the hire is short-term.
vi. Operators increase the plough swath gaining on acreage covered per unit time at the expenses of the land owner because the process provides sections of unplowed land.
vii. Travel speed is another source of poor results where the tractor will consume more fuel and deliver a poor seedbed
viii. Farmers may want to ask questions and see the service conditions of the tractor to ensure they get services required, but mobile apps and SMS services may not provide this option.
ix. In some areas, farmers themselves provide tractor hire services to their local markets.
x. In other areas, specialized service providers are emerging.

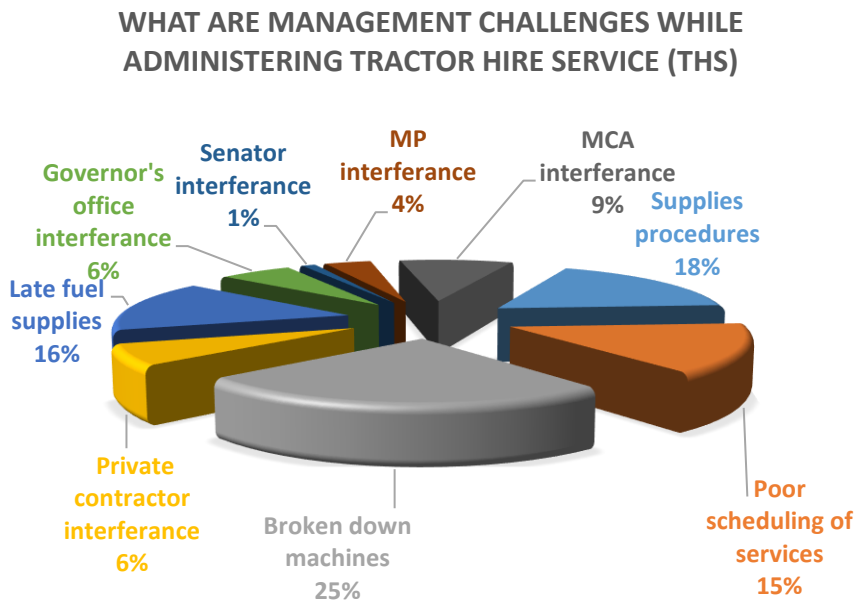

Figure 11: Management services while administering County AMS services

According to the respondents, the actual challenges in the Kenyan counties varied from the respondent to another, which included political interference of 1% from the local Senators, 4%, from Members of parliament, from the private investors who tied with the County Governors at 6%, 9%, from Members of the County Assembly, 15%, due to poor scheduling of service provision, 16%, due to late fuel delivery, 18% due to supplies procedures and finally, 25% from broken down machines, Fig.12.above

Emerging Equipment Lease Competition

Challenges that face county AMSs provide an opportunity for alternatives to emerge. Alternatives learn a lot from failures of AMS and enter the market well-oiled battery of agricultural equipment that provide serve at one stop focusing on efficiency and maximizing on efficiency.

Various innovative ideas have emerged from (1) Hello Tractor, (1) TingA, (3) e-Tinga, (4) Tinga rental, Tinga Rental Stores and many others that are localized within the area of operation. Some of the innovations are; provision of complete service accessed on call, hire service for tractor, equipment or both, reduced cost and professional operators create a turning for preference. The emerging innovation do not leave room for AMS competition. Capacity to mobilize say 10 tractors to do 40 ha in one day is much appreciated for it reduces management stress. Private non-registered service providers are stubborn;

they'll ask for you to fuel their tractor before the go to your field, the tractor will breakdown on a major component like a broken crankshaft which will take five days to repair at your cost and be reconciled later or you lose you fuel. The operator can decide to contract many customers and do bit of each taking a risk of working at night with poor results.

CONCLUSION

Despite having the potential to fundamentally change the face of Kenya's farming and rural areas, the effects of agricultural mechanization have not been given the seriousness they deserve except for a few counties. Drawing on qualitative evidence from 37 responding counties, this study is the first to take a holistic view of the effects of mechanization. The results suggest that mechanization has more far-reaching agronomic, environmental and socioeconomic consequences than commonly assumed. The results suggest that most of the County AMS schemes are not operational regardless of the existing staff and equipment on site. Most of the equipment is broken down before their expected life span and vandalized beyond repair. The idea is noble but requires a more professional modernized digitized business approach to realize the intended objective. However, some can be negative in the absence of complementary research efforts and policy measures though each County has its own unique characteristic that should be studied independently. As highlighted by the FAO (2013), agricultural mechanization strategies are therefore needed for each African country, county in the case of Kenya, that provide "a framework for making decisions on how to allocate resources, how to address current challenges, and how to take advantage of opportunities that arise". As noted by the FAO and emphasized by the findings from this study, such mechanization strategies have to consider all issues as articulated in the findings for sustainability. This will help ensure that mechanization contributes to a sustainable County agricultural transformation from a social, economic and environmental perspective. Each county should formulate its own agricultural mechanization service policy for there are no two counties with similar historical land characteristics; after all, the agriculture ministry is completely devolved. Plan for acquiring equipment through professional advice and the equipment should match the workload when using it. There should be no season known as "offseason" for an agricultural tractor since there is a farm activity every of the year. Remember, hiring service may be better than owning a tractor if your calculations do not add up.

RECOMMENDATIONS

1. Employ relevant qualified staff and conduct routine on-the-job training.
2. Match the units to the projected workload for labour efficiency
3. Develop profitable models of operation
4. Register all farmers on a communication platform for ease of access
5. Employing relevant qualified staff and conducting routine on-the-job training be made a priority
6. Should keep up with technology like having a GPS for estimating acreage, tractor tracker, mileage area ploughed and fuel consumption to be installed
7. Acquire models of tractors that have back-up/after-sales service within the locality of operation
8. Should have an operational service shop to undertake non-specialized repair jobs
9. Run the service professionally as a business
10. Dispose of tractors after 8 years of service

Table 1: Pictures

Plate 1 Bungoma

Plate 2 Bungoma

Plate 3:Bungoma

Plate 4

Plate 5:Bungoma

Plate 6: Busia

Plate 7: Busia

Plate 8:Homa Bay

Plate 9: Kakamega

Plate 10: Kakamega

Plate 11:Kilifi

Plate 12:Kilifi

Plate 13 Kitui

Plate 14: Kakamega

Plate 15: Kitui

Plate 16: Machakos

Plate 17: Machakos

Plate 18: Machakos

Plate 19: Machakos

Plate 20: Migori

Plate 21:Migori

Plate 22: Siaya

Plate 23: Migori

Plate 24:Migori

Plate 25:Siaya

Plate 26: Siaya

Annex 1:Responding Counties

Trans Nzoia	W/Pokot	Nakuru
Baringo	Kirinyaga	Nandi
Bomet	Kisii	Narok
Bungoma	Kisumu	Nyamira
Busia	Kitui	Nyandarua
Elgeyo Marakwet	Kwale	Nyeri
Embu	Laikipia	Samburu
Garrisa	Lamu	Siaya
Homa Bay	Machakos	Taita Taveta
Isiolo	Makueni	Tana River
Kajiado	Mandera	Tharaka Nithi
Kakamega	Marsabit	Turkana
Kericho	Migori	Uasin Gishu
Kiambu	Mombasa	Vihiga
Kilifi	Murang'a	
Wajir	Nairobi	

Annex 2: Questionnaire

What is your county?
Sampled counties
Was there an existing Agricultural Mechanization Service (AMS) in the county before devolution?
Status of Agricultural Mechanization Service (AMS) in the county before devolution?
If it didn't exist, when was it started
When it started
Which makes/Models of machines do you have
Tractor models
What is the age of county tractors?
Tractor age
Which type of services does tractor hire service provide?
Type of THS offered
What are the qualifications of your labour force?
Choice of operating team
Do you have a service shop?
Service Shop back-up
What do you do with the machines during off season?
Machine activity during off Season
What is the average acreage done per day per tractor?
Tractor output
How many farmers are served in a season?
Number of farmers served
What are management challenges while administering Tractor Hire Service (THS)
Challenges
Internal
Qualification of service crew
Specialized preventive maintenance and repair
Broken down machines
Poor scheduling of service

Annex 3:Typical field efficiencies for various tractor-powered operations

Operation	Field Efficiency%
Moldboard or disc plough	75-85

Disk harrow	77-90
Field cultivator	75-85
Spring-tooth or spike-tooth harrow	65-80
Seeding and planting	
Maize planter only	60-75
Maize planter with fertilizer attachment	45-65
Grain drill	65-80
Harvesting	
Combine harvester	60-75
Mower? Reaper	75-85
Baler	65-80
Forage harvester	50-70
Crop care	
Sprayer	55-65

Source: Sims, Brian, and Jennifer Heney, *Agriculture* 7.8 (2017): 64.

Annex 4: AMS Stations that existed before devolution

AMS STATION	County
1. Bumala	Busia
2. Eldoret	Uasin Gishu
3. Garissa	Garissa
4. Garzen	Tana River
5. Kajiado	Kajiado
6. Kipkelion	Kericho
7. Kitale	Trans Nzoia
8. Lamu	Lamu
9. Machang'a	Embu
10. Makueni	Makueni
11. Maralal	Samburu
12. Mariakani	Kilifi
13. Marigat	Baringo
14. Marsabit	Marsabit
15. Migori	Migori
16. Mitunguu	Meru
17. Nakuru	Nakuru
18. Naro Moru	Laikipia
19. Narok	Narok
20. Nyahururu	Nyandarua
21. Ruiru	Kiambu
22. Siaya	Siaya
23. Rabuor	Kisumu

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