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ZINC ROOF OR MANGO TREE? TRACTORS, MODERNISATION AND AGRARIAN TRANSFORMATION IN MOZAMBIQUE

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ACRONYMS

2WT	Two-wheel tractor
4WD	Four-wheel drive
ADB	African Development Bank
ADVZ	Agência de Desenvolvimento do Vale do Zambeze [Zambezi Valley Development Agency]
APRA	Agricultural Policy Research in Africa
AU	African Union
CA	conservation agriculture
CAADP	Comprehensive Africa Agriculture Development Programme
CAIC	Complexo Agroindustrial do Chókwè [Chókwè Agro-Industrial Complex]
CGAP	Consultative Group to Assist the Poor
CSAs	Centros de Serviços Agrários [Agrarian Service Centres]
DSA	Development Studies Association
FAO	Food and Agriculture Organization of the United Nations
FDA	Fundo Desenvolvimento Agrário [Agrarian Development Fund]
FONPA	National Forum of Cotton Producers
GoM	Government of Mozambique
GRAIN	Genetic Resources Action International
GSSP	Ghana Strategy Support Programme
HICEP	Hidráulica do Chókwè Empresa Pública [Chókwè Hydraulic Company]
HP	horse power
IAPAR	Institute Agronômico do Paraná [Agronomic Institute of Paraná]
IESE	Institute of Social and Economic Studies
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IIAM	Agricultural Research Institute of Mozambique

INCRA	Instituto Nacional de Colonização e Reforma Agrária [National Institute of Colonisation and Agrarian Reform]
INE	Instituto Nacional de Estatística [Mozambican National Statistics Institute]
MASA	Ministério da Agricultura e Segurança Alimentar [Mozambican Ministry of Agriculture and Food Security]
MDA	Ministério do Desenvolvimento Agrário [Brazilian Ministry of Agrarian Development]
MFI	More Food International
MINAG	Ministry of Agriculture
MZN	Mozambican meticals
NGO	non-governmental organisation
OMR	Observatório do Meio Rural [Rural Environment Observatory]
PEDSA	Plano Estratégico de Desenvolvimento do Setor Agrário [Strategic Plan for the Development of the Agrarian Sector]
PNMA	Programa Nacional de Mecanização Agrária [National Agricultural Mechanisation Programme]
PPP	public-private partnership
PROSUL	Pro-poor Value Chain Development Project
RENAMO	Resistência Nacional Moçambicana [Mozambican National Resistance]
SDAE	Serviços Distritais de Administração Económica [District Services for Economic Administration]
SSA	sub-Saharan Africa
ToR	Terms of Reference
UNAC	União Nacional de Camponeses [National Union of Peasants]
UNECA	United Nations Economic Commission for Africa

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SUMMARY



In 2015, the Mozambican Ministry of Agriculture and Food Security (MASA) launched the National Agriculture Mechanisation Programme, as part of a strategy to increase production and productivity and transform peasant farming into commercial agriculture. By 2018, the programme had established 96 Agrarian Service Centres across the country for the provision of mechanisation services and, eventually, a range of complementary services to farmers. The new machinery that equipped these centres, mainly tractors and tillage implements, had been procured by the government with support from a Brazilian concessional loan. The majority of the service centres were run by private operators, who purchased farming machinery from the government, at a subsidised price and under a leasing contract, and who were expected to provide mechanisation services to the population on a fee-for-service basis.

Mozambique's predominantly small-scale peasant farmers, or the 'family sector', as it is often called, rely on short-handed hoes for ploughing and cannot afford to buy seed or fertiliser, let alone machinery. The programme pledged to target mainly these farmers and

address national food security objectives by offering services through privately managed centres. This paper analyses the design and initial implementation of this mechanisation policy, looking at the models devised for service provision, actors involved, their motivations and expectations, and access to machinery by the small-scale family sector. It also discusses the role played by mechanisation in processes of agrarian change and social differentiation in rural Mozambique and, specifically, its part in efforts by the state to nurture a modern agribusiness entrepreneur.

Peasant farmers are largely disconnected from the policy in place and, despite being repeatedly proclaimed by policymakers as the chief beneficiaries of their policies, they remain on the edges of the type of modernisation envisaged by the government. Yet, the Brazilian tractors are also nurturing accumulation from below, the scale and implications of which deserve further exploration. The latter is more progressive because of its broad-based character and its greater dynamism in developing the productivity of farming, as well as its implications for democracy.

1. INTRODUCTION

In 2015, the Mozambican Ministry of Agriculture and Food Security (MASA) launched the National Agriculture Mechanisation Programme with the aim to increase agricultural production and productivity, in line with the government's agricultural development strategy. By 2018, the programme had established 96 Agrarian Service Centres (*Centros de Serviços Agrários*, CSAs) across the country for the provision of mechanisation services to farmers. Of this total, 27 CSAs were managed by public sector institutions of varied nature and 69 by private operators with established farming activity, which had been contracted through a competitive bidding process.

The CSAs were equipped with newly imported machinery, mainly tractors and tractor implements for ploughing, which had been bought in Brazil with a concessional loan provided by the Brazilian government. This loan was part of More Food Africa or More Food International (MFI), a Brazilian cooperation programme implemented in five countries in sub-Saharan Africa (SSA), including Mozambique, Ghana, Kenya, Senegal, and Zimbabwe, and focused on improving food security through the increased mechanisation of small-scale farms.

The loan was tied to Brazilian machinery, which made it, in effect, an export credit aimed at stimulating the Brazilian manufacturing industry, and assisting its penetration into the African market. Non-commercial motives also drove the programme on the Brazilian side, specifically strengthening a policy agenda centred on family farmers, which was pushed by a coalition of interests seeking projection and influence in the international and domestic spheres, as discussed by Cabral et al. (2016).

This paper analyses the Mozambican government's mechanisation programme that emerged out of the Brazilian cooperation initiative. It reviews the design and initial implementation of the mechanisation policy, looking at actors involved, machinery allocations, modalities for service delivery, experiences with service delivery and machinery use, perceived aims of mechanisation and roles of private service providers, and access to mechanisation services by the average

small-scale peasant farmer. It also discusses the role played by mechanisation in processes of accumulation and agrarian change and, specifically, in the rise and consolidation of middle farmers and agribusiness entrepreneurs.

Questions guiding the research include the following:

- What are the drivers for state intervention with regard to mechanisation, and for the particular policy instruments chosen (e.g. public-private service centres)?
- What models for agricultural development are envisaged by the government's mechanisation policy?
- To what extent is government-sponsored mechanisation reaching out to small-scale farmers?
- What are the challenges faced by small-scale farmers in accessing mechanisation services?
- How is mechanisation contributing to accumulation and changes in agrarian structures and social relations in rural areas?

The analysis in this paper draws on data collected between March 2017 and July 2018 in Mozambique. Fieldwork was undertaken in several locations where CSAs have been established. These sites were chosen for their agricultural potential, and hence focus of mechanisation policy, but also for the occurrence of conflict over land access and over models of agricultural development. One of the study sites is Chókwe District, situated in the southern province of Gaza and well known for its irrigation infrastructure erected during colonial times, which spreads over an area of 30,000 hectares and irrigates fields of rice and horticultures. The other region is the Nacala Corridor, in the north of the country, a vast territory spanning across five provinces and 19 districts (ProSAVANA 2013; MASA 2015). Compared to the Brazilian

Cerrado in agricultural potential (Embrapa 2010), this region has attracted some large-scale and export-oriented farming investments, which have been fiercely contested by civil society organisations and farmers' movements (Shankland and Gonçalves 2016; UNAC and GRAIN 2015). Fieldwork in the Nacala Corridor was conducted specifically in four districts of Nampula Province: Malema, Meconta, Monapo, and Ribáuè.

Fieldwork comprised semi-structured interviews with CSA managers (public and private) and individual farmers who leased machinery through the government-sponsored programme. Other respondents included government officials at local District Services for Economic Administration (SDAEs), private sector operators, small-scale farmer association representatives and their members and SOTEMA, the company responsible for distributing and servicing the machinery. Fieldwork also included field observation, including guided visits to CSA infrastructures and to farming areas while mechanising ploughing and harrowing services were ongoing. For a broader perspective on policy design and the market for mechanisation, the relevant national government authorities were interviewed, including MASA and its provincial and district representations, the Agrarian Development Fund (FDA), the agency responsible for managing the loan and implementing the programme, and private sector actors operating in the field. The study also drew on the data from a 2017 baseline survey conducted by the Observatório do Meio Rural (OMR), which covered the service centres

located in the districts of Buzi, Lichinga, and Malema (Dada, Nova and Carlos 2017).

After this introduction, the paper gives an overview of agricultural mechanisation in Mozambique, including its historical trends. It then looks into the government-led mechanisation programme and the process of setting up the CSAs, situating this in the context of other ongoing mechanisation initiatives and their concurrent models for service delivery. The paper then considers three features of the government's CSA programme: (1) the involvement of the private sector through public-private partnerships; (2) the emphasis on tillage and the predominance of tractors and ploughs in the machinery package ordered from Brazil and in the mechanisation services promoted and requested; and (3) access to the programme by the proclaimed primary target group of small-scale farmers.

The paper distinguishes between two models of mechanisation service delivery emerging out of the government policy, which represent concurrent patterns of accumulation from above and from below. The CSA model of business management, much advertised by the government as the policy novelty (referred to later as the 'zinc-roof model'), is contrasted with peer-to-peer rental services by emerging small- to medium-scale farmers (the 'mango tree model'). Further research on how these two models unfold and their implications for agrarian structures and class differentiation should be the focus of follow-up research.

2. OVERVIEW OF AGRICULTURAL MECHANISATION IN MOZAMBIQUE

2.1 Low levels of mechanisation

The short hand hoe (*enxada de cabo curto*, in Portuguese) remains the main tool used by Mozambique's predominantly small-scale and subsistence agriculture. About 97 per cent of agricultural production comes from farmers practising rain-fed farming in areas with an average farm size of 1.2 hectares, with minimum input use and virtually no mechanisation (CGAP 2016; MASA 2016). According to the 2009-10 National Agricultural Census, only 1.6 per cent of farmers in Mozambique used tractors and less than 0.5 per cent had access to trailers or motorised water pumps (Table 1). Animal traction is also generally low in the country (under 10 per cent), except in areas not affected by trypanosomiasis (animal sleeping sickness), such as in Gaza, Inhambane, Manica, and Tete provinces (MASA 2016).

Although official data on machinery stocks or tractors in use are not readily available for Mozambique, one estimate puts the current stock of tractors at 1,500 to 2,000 (under 100 hp), which are used not only in agriculture but also in road maintenance and rubbish collection.² Historical records for tractor imports give an indication of Mozambique's low levels of mechanisation in relation to other African countries in the post-colonial period (Figure 1).³

2.1.1 Brief overview of Mozambique's mechanisation history

Before independence, Portuguese plantation farms in Mozambique were largely mechanised. After independence, these farms were nationalised and turned into state companies that inherited colonial machinery stocks. New machinery imports declined sharply in those early years but gradually picked up in the late 1970s (Figure 2).

In 1977, the first public tender for mechanisation (Concurso Público Número 1) of independent Mozambique was launched with support from Italy, Sweden, and other international development partners. This first batch of machinery originated mainly from Western countries and included brands such as Massey Ferguson and Fiat. More machinery arrived in the early 1980s, this time funded by Eastern partners, such as the Soviet Union and the German Democratic Republic, who provided their own brands. The newly constituted state farms were the main destination for this machinery.⁵

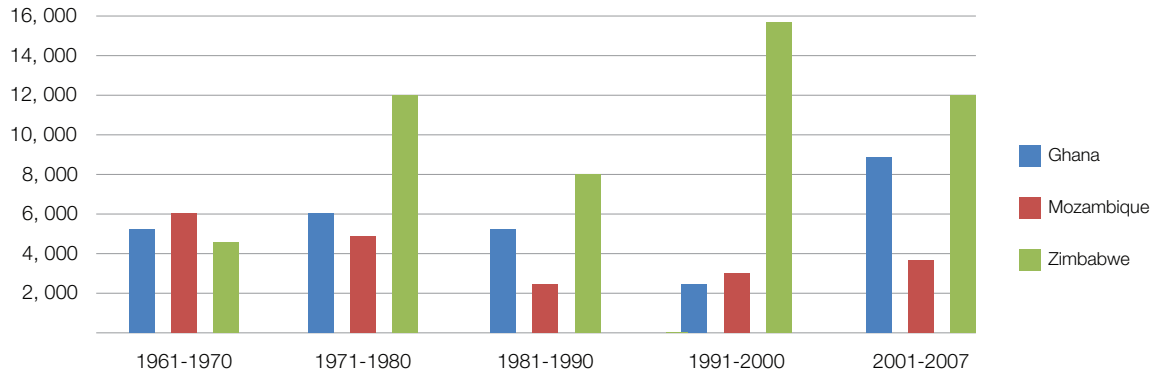
A state company was established at the time to support agricultural mechanisation. It was called MECANAGRO E.E. and it became responsible for overseeing the

Table 1 Percentage of farming units that have had access to tractors, water pumps, and means of transportation, 2009–2010

Province	Tractor	Motorised water pumps	Trailers	Bicycles
Niassa	0.4%	0.1%	0.2%	59.5%
Cabo Delgado	0.3%	0.1%	0.1%	32.9%
Nampula	0.2%	0.1%	0.1%	21.5%
Zambézia	0.3%	0.0%	0.0%	44.7%
Tete	0.5%	0.3%	0.4%	43.9%
Manica	1.8%	0.3%	1.1%	42.9%
Sofala	2.4%	0.3%	0.5%	43.7%
Inhambane	0.1%	0.0%	0.3%	3.3%
Gaza	6.2%	0.9%	0.9%	7.5%
Maputo	12.9%	0.6%	1.2%	7.0%
National average	1.6%	0.2%	0.3%	32.2%

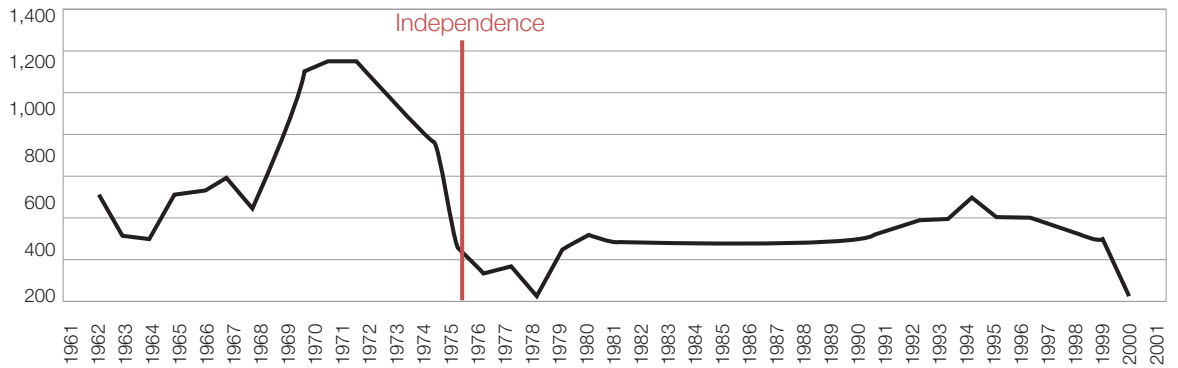
Source: Author's own, based on data from the National Agricultural Census 2009–10 (MASA 2011).

Figure 1 Tractor imports in Ghana, Mozambique, and Zimbabwe, 1961–2007 (quantity)



Source: Author's own based on data produced by the FAO (FAOSTAT).⁴

Figure 2 Tractor imports in Mozambique, 1961–2001 (quantity)



Source: Author's own based on data produced by the FAO (FAOSTAT). The series stops in 2001 for Mozambique and the FAO series for mechanisation stopped being compiled altogether in 2008, reflecting, as argued by Biggs and Justice (2015), the reduced interest in the topic since the mid-1990s.

mechanisation process, including importing new machinery, managing stocks, and providing services to state farms (Mosca 2011). MECANAGRO operated machinery parks throughout the country and sold services to state companies and to the few private agricultural companies that remained under private management after independence, particularly in the sugar sector. Chókwè became the country's most mechanised district at the time and the place where the larger machinery items could be found (with tractors as big as 300 horse power, or HP). By 1982, there were reportedly a total of 5,000 tractors in the country.

The option for mechanisation was not uncontested. A news-piece published by the *Washington Post* in 1978 describes cleavages inside the Frelimo-led socialist government (Ottaway 1978). The dispute was between Soviet-leaning bureaucrats, favouring mechanisation for the large-scale state farms, and China-influenced

bureaucrats, preferring a model centred on labour force, or 'people's power'. A paper by the economist Marc Wuyts (1981) also criticised the option for machinery as being driven by political considerations while failing to address Mozambique's material conditions, whereby rural labour was abundant and labour-intensive farming was the most suitable option, until industrialisation started absorbing it and raising rural wages. Analysing the Mozambican government's mechanisation strategy at the time, Wuyts wrote:

The concrete conditions of the present phase, however, are not constituted by the necessity to release labour from agriculture so as to enable industrialization, but rather to cope with a severe crisis of the colonial economic structures which manifests itself in the disintegration of the peasant economy, either through breakdown of commercialization networks, or through the crisis

of the worker-peasant, or both. The question today is not to 'release' labour but to 'absorb' it within agriculture so as to prevent the deepening of the crisis of the peasantry. (1981: 14)

The crisis in the rural areas deepened as the circumstances of Mozambique's state-run agricultural sector worsened throughout the 1980s. Poor management of MECANAGRO and the widespread collapse of state companies at a time of war⁶ led to the end of the mechanisation company and the abandonment of the mechanisation strategy, alongside the extensive withdrawal of the state from agriculture. This process was accelerated by the Structural Adjustment Programme, overseen by the Bretton Woods institutions, which sought to dismantle inefficient state interference in the sector and make way for a private sector-led transformation. Yet, lack of capital and entrepreneurial capacity meant that there was no substantive private sector to take up the state's place in Mozambique. The consequence was a vacuum in the countryside where peasant farmers were largely left without mechanisation services or indeed other services or organised markets for their produce. The international aid sector eventually filled some of the gaps, particularly with extension, input supply, and market support initiatives operationalised by non-governmental organisations, but mechanisation remained off the radar for many years.

2.1.2 The recent revival of mechanisation

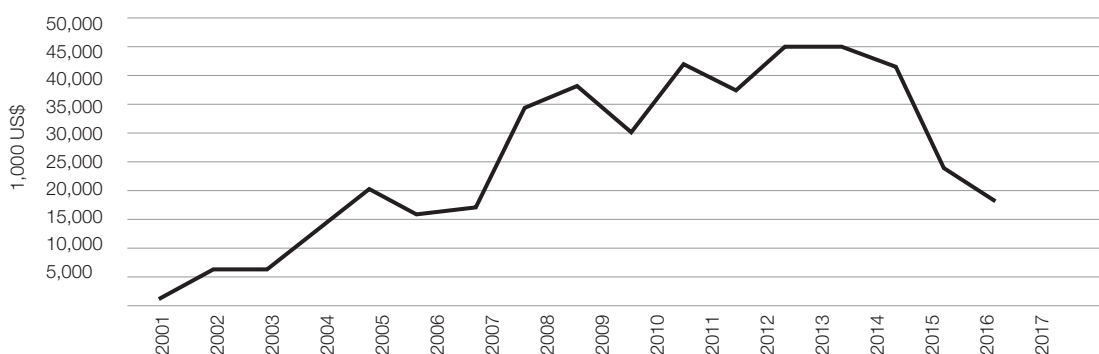
This is now set to change with mechanisation re-emerging as a salient policy issue. This is happening not only in Mozambique but also in other African countries and at the continental level. Organisations such as

the African Union (AU), the African Development Bank (ADB), the United Nations Economic Commission for Africa (UNECA), and the Food and Agriculture Organisation (FAO) have explicitly renewed their commitment towards mechanisation as part of their support to Africa's agricultural transformation (ADB 2016; Ahmed 2015). The Sub-Regional Coordinator and FAO Representative to the AU and UNECA noted that 'the dream to have a hunger-free Africa by 2025 would remain a mirage without mechanization' (FAO Regional Office for Africa 2016: 6).

In Mozambique, the rise in agricultural machinery imports is noticeable in recent years (Figure 3).⁷ Countries such as South Africa, China, the United Kingdom, the United States, Japan, and Brazil are amongst the main sources of imports of agricultural machinery, according to records from the Mozambican National Statistics Institute (INE). Turkey, India, and South Korea have also reportedly approached the government for mechanisation-focused aid and trade agreements.⁸

The upward trend in machinery imports is happening in tandem with a renewed emphasis on agricultural modernisation by the Mozambican government. Following the endorsement of the Comprehensive Africa Agriculture Development Programme (CAADP) by African heads of state in 2003, the government has pledged to increase spending in agriculture and help raise production and productivity levels. Mechanisation is part of a strategy to modernise agriculture and transform the predominant peasantry into modern commercial farmers (MINAG 2011). The National Policy for Agricultural Mechanisation announced in 2015 is one component of such a strategy (MASA 2017).

Figure 3 Imports of tractors and other farming machinery and equipment, 2001–2017 (value in 1,000 US\$)



Source: INE, Mozambique. Author's own, based on data provided to the author by the Instituto Nacional de Estatística de Moçambique. Data for 2017 is preliminary. Other machinery and equipment includes ploughs, seeders, fertiliser distributors, combine harvesters, threshers, and milking machines, amongst others.

Other key elements include the prioritisation of public investments (in mechanisation, storage facilities, and input supply) in high-potential farming areas, particularly along growth corridors connecting the hinterland with seaports, and partnerships with the private sector for the management of these public infrastructures.

The government's assumption is that, in contrast with the past, when state-run services failed to become financially sustainable, the private sector can make state-led mechanisation work and thereby assist the structural transformation of the sector and raise the production, productivity, and competitiveness of Mozambican agricultural commodities in international markets.

3. AGRARIAN SERVICE CENTRES AS THE GOVERNMENT'S NEW MECHANISATION STRATEGY

3.1 Brazilian machinery and family-farming experience as initial policy drivers

The launch of the mechanisation policy in 2015 was prompted by the arrival of farming machinery from Brazil, funded by the Brazilian cooperation programme known as More Food International (MFI). This has been one of the largest agriculture mechanisation initiatives in Mozambique in recent years. When the programme was formally approved in 2010, it comprised two components: (1) farming machinery, which would be imported from Brazil with a concessional loan of about US\$98 million; and (2) in-kind technical cooperation and so-called 'policy dialogue'-focused food production and family-farming policies led by the Brazilian Ministry of Agrarian Development (MDA) (Cabral et al. 2016).

The Brazilian left-wing government led by President Lula da Silva had, over the period of 2003–10, significantly increased support to the family-farming sector in Brazil (MDA 2010). A number of public policies targeting this group of officially registered family farmers had been put in place during Lula's government (Grisa and Schneider 2015). These included credit provision to enable the mechanisation of family farms, which was part of a government programme in Brazil called More Food (MDA 2013; Patriota and Pierri 2013). MDA was in charge of these policies and programmes and, as it became involved in international development cooperation from 2010, was keen to promote this experience internationally (INCRA 2010).

MFI emerged from an alliance of interests between the Brazilian industry, seeking to promote machinery exports to Africa, and the MDA, aiming to project its family-farming-centred policy abroad, both as part of a South–South solidarity agenda and to strengthen the family-farming agenda domestically *vis-à-vis* the dominant large-scale agribusiness model (Cabral et al. 2016). Technical cooperation and policy dialogue involving the MDA directly served these later objectives. Yet, this component never took off meaningfully, in part due to political changes in Brazil (not least the dismantling of the MDA as a ministry by the ensuing centre-right government) and cuts in the technical

cooperation budget. Instead, the first of three loan tranches to fund the procurement of machinery by the Government of Mozambique (GoM) was ready at the end of 2013, and by early 2015, the first (and so far only) consignment of machinery finally arrived in Mozambique (MDA 2015).

The machinery package was supplied by three leading companies in Brazil: LS Mtron (a South Korean brand with a factory in Brazil) supplied 513 tractors, model LS Plus 80 (Figure 4); and Tatu Marchesan and Triton supplied a range of tractor implements and other equipment (2,623 items in total) (Table 2). These brands were new to Mozambique and hence there were no local brand representations. Local machinery importers had not been called into the programme. This would, unsurprisingly, prove to be a challenge for timely and affordable access to spare parts and availability of suitable technical assistance.

3.1.1 The CSA model with three types of service providers

A model for allocating the newly arrived machinery was then devised (ex-post) by the FDA, the government's implementing agency for the programme. Its core idea involved establishing agrarian service centres (CSAs) that would provide services to farmers against a service fee. Three types of service providers were envisaged: (1) CSA-public, managed by public sector entities, including state-owned enterprises, agronomic research stations, and penitentiaries; (2) CSA-private, whereby privately managed service centres would be established by agribusinesses and farmers' associations and provide services to local farmers on a fee-for-service basis; and (3) individual farmers seeking to buy subsidised machinery for their own farms. The latter were also expected to rent out this machinery to other farmers and thereby ensure the full utilisation of the acquired machinery and investment repayment.

The advertised novelty of the programme concerned the privately managed fee-for-service modality and the provision of a range of services, which, besides mechanised farming operations, would eventually include the selling of agricultural inputs, storage and

Figure 4 LS Plus tractors parked at the Sonil CSA in Malema, Nampula Province



Source: Photo taken by the author in July 2018.

Table 2 Machinery and equipment purchased with the first MFI loan tranche in 2015)

Item		Brand
(English designation)	(Portuguese designation)	
Tractor LS Plus 80 (75hp)	<i>Tractor</i>	LS Mtron
Trailed disc plough (3 discs)	<i>Arado de disco fixo</i>	Tatu Marchesan
Trailed chisel plough	<i>Arado subsolador ou escarificador</i>	Tatu Marchesan
Trailed disc harrow (14 discs) or heavy harrow	<i>Grade aradora de arrasto or grade pesada</i>	Tatu Marchesan
Trailed disc harrow (28 discs)	<i>Grade niveladora de arrasto</i>	Tatu Marchesan
Trailed weeder	<i>Capinadeira</i>	Tatu Marchesan
Inorganic fertiliser spreader	<i>Distribuidor de adubo inorgânico</i>	Triton
Lime and organic fertiliser spreader	<i>Distribuidor de calcário e adubo orgânico</i>	Tatu Marchesan
Backpack sprayers	<i>Atomizador de dorso</i>	n.a.
Trailed boom sprayer	<i>Pulverizador mecânico rebocado</i>	n.a.
Seed planter	<i>Semeador e adubadeira de grãos</i>	Triton
Tilting trailer (5 tonnes)	<i>Atrelado basculante</i>	Triton

Source: Author's own, based on interviews with the FDA, March 2018.

agro-processing facilities, extension services, and market information for farmers. Once fully developed, the centres would cover the entire range of agricultural inputs and services required for farming, post-harvest storage, processing, and commercialisation. Mozambique's high-potential farming areas were selected as main destinations for the new machinery – these were located in the six agricultural development corridors: Maputo, Limpopo, Beira, Zambeze, Nacala, and Pemba-Lichinga. Within these, the centres would provide mechanisation services to small- and medium-

scale farmers without their own machinery but with the financial capacity to pay for services. The aim of the programme was to assist the structural transformation of agriculture while increasing food production. Incidentally, food production by family farmers had been the Brazilian government's leading motto for the MFI programme, as well as its domestic equivalent in Brazil.

The Mozambican government issued two calls for proposals for setting up and managing the CSAs in early 2015 and 2016. As indicated in the calls, these

were addressed specifically to young entrepreneurs with agricultural training, business entrepreneurs, private societies, farmers' associations, and private agricultural service providers, with preference given to those already established in the place where the prospective centres would be located (FDA 2015b). They would set up business units to manage, in the first instance, machinery parks (*parques de máquinas*) that would eventually expand to comprise a range of agribusiness services.

The first call for proposals envisaged three types of parks, according to their size: (1) large, with capacity to have more than 30 tractors and corresponding farming implements, (2) medium, with capacity for 10 to 30 tractors and implements; and (3) small, with less than 10 tractors (*ibid.*). The machinery parks, and aspiring agribusiness service centres, would be equipped with tractors and a selection of implements available for purchase at subsidised prices, as specified in the call's Terms of Reference (Table 3), and would have some weather-proof infrastructure to store the machinery.

country (Table 4). In addition to these, public centres were also designated as programme beneficiaries. A total of 27 public institutions, comprising state companies, research institutes, and state services (such as penitentiaries and research stations) were covered by the programme.

Furthermore, according to FDA records, 95 individual farmers accessed the credit facility and bought tractors and implements for their own farms. For these farmers, upfront payment was 50 per cent of the price, with a leasing contract with the government for full repayment over a five-year period and 10 per cent interest. Each individual farmer bought at least one tractor and one plough. Some also bought one disc harrow.

The number of tractors and equipment distributed to each CSA and to individual farmers varied somewhat. Although the initial intention was to have centres of medium- and large-size, no privately managed centre ended up leasing more than eight tractors. This allowed the GoM to distribute the first consignment as widely

Table 3 Price for tractors and equipment for service centres, as stipulated by the GoM

Item	Unit price (US\$)
Tractor	36,462
Trailed plough	3,525
Trailed chisel plough	1,918
Trailed heavy disc harrow	3,982
Trailed disc harrow	8,838
Trailed weeder	4,257
Inorganic fertiliser spreader	2,432
Lime and organic fertiliser spreader	9,122
Backpack sprayers	983
Trailed boom sprayer	5,180
Seed planter	8,384
Tilting trailer	3,019

Source: Author's own, based on data from FDA (2015c).

The call also indicated a number of criteria to be observed by bidders, including: having Mozambican nationality; ongoing agricultural activity in the area where the centre would be implanted; available space for physically establishing the centre, including lodging the machinery; and financial capacity to pay upfront 5 per cent of the price of the machinery package. Successful applicants would then sign a leasing contract with the government for ten years and pay annual interest of 10 per cent.

By 2018, 69 of these privately managed CSAs with zinc-roofed warehouses had been set up across the

as possible across the country. The delay in releasing the two additional loan tranches (which would have provided additional machinery) has also prevented the expansion of the established centres. In this study's fieldwork sites, privately managed CSAs had bought three to eight tractors as part of the FDA programme, publicly managed centres had bought three to five, and single applicants had bought one or two tractors. Some of the centres had the infrastructures and, reportedly, financial capacity to allow for an extension of their machinery stocks. The release of the outstanding tranches, or complementary programmes, may offer this opportunity.

Table 4 Service centres and individual farmers covered by the programme in 2018

Type of service provider	2018
CSA-private	69
CSA-public	27
Individual farmers	95

Source: Author's own, based on data collected by interview with the FDA, 6 March 2018.

Table 5 Machinery package for CSA-private in Malema District, Nampula

Item	Unit
Tractor	8
Trailed disc plough	8
Trailed chisel plough	2
Trailed heavy disc harrow	8
Trailed disc harrow	8
Trailed weeder	3
Inorganic fertiliser spreader	4
Lime and organic fertiliser spreader	4
Trailed boom sprayer	2
Seed planter	8
Tilting five-tonne trailer	8

Source: Author's own, based on interview with Sonil.

Some centres and individual farmers already had machinery of their own. For example, Sonil, a private tobacco processing company in Malema District, had 13 other tractors and implements that it used to provide services to small-scale tobacco producers operating under contract farming. It then bought an additional eight tractors and implements under the FDA programme.

The selection of machinery in the package was uniform across the entire country and the various centres. Tractors, ploughs, harrows, and other equipment had exactly the same characteristics in terms of dimension, power, or capacity. These had been selected centrally by the FDA before a working model for the centres had been devised, and local partners and service providers had been identified. Whereas individual farmers and farmers' associations with limited financial capital typically bought only tractors, disc ploughs, and heavy disc harrows (most often one of each item), private CSA managers were encouraged to acquire the entire package, which also included chisel ploughs, lime and fertiliser spreaders, weeders, trailers, trailed boom sprayers, and trailed seed planters. The typical machinery package found for the privately managed CSAs is indicated in Table 5.

The distribution of machinery and training of tractor drivers and operators was carried out by SOTEMA, a Maputo-based service company specialised in farming machinery and contracted by the FDA to assist the overall programme from Maputo. The machinery had a one-year guarantee for technical assistance and since then SOTEMA has operated as a monopolistic supplier of technical assistance and spare parts, covering the entire country from its Maputo headquarters. The newness of the Brazilian brands included in the programme prevented other service providers stepping in, although local mechanics were reported to have occasionally helped with simple repair and maintenance services as well as some artisanal fabrication of some parts, such as top links (*esticadores*), which were, reportedly, very prone to damage.

3.1.2 Distribution of CSAs across the country and allocation of machinery across centres

The agricultural potential of a district was one of the criteria for selecting the location of the centres. Table 6 indicates the distribution of CSAs across Mozambique's ten provinces, as well as the number of small- and medium-scale farming units per centre in each province. Although the latter is only a rough approximation of

potential service coverage, it gives an indication of where the most significant gaps in service delivery to farmers are likely to be found – for example, Inhambane, where only two private centres have been established (unsurprising, as it is not considered a high-potential farming area), or the densely populated Nampula and Zambézia provinces. On the other hand, provinces like Gaza seem to be relatively ‘better’ served – the district of Chókwè alone has five privately managed and three publicly managed centres, and this certainly reflects the established capacity, infrastructures, and agricultural entrepreneurship in an area of high agricultural potential, a consolidated farming tradition, and a flat landscape particularly suitable for tractor use.

agricultural potential and attract private investment. The agency set up service centres in the provinces of Sofala, Tete, and Zambézia, spanning the Zambezi Valley and the Beira Corridor. In two years, the ADVZ established about 39 centres. Similarly to the CSA-private model, these started off as privately managed machinery parks where private operators entered leasing contracts with the ADVZ for the machinery to be managed by their centres. These parks were also expected to develop into more holistic service units.

Yet, ADVZ centres differ from the FDA’s CSA-private model in several ways. For example, ADVZ centres are located in state land that was given in concession to

Table 6 Provincial distribution of private and public CSAs and number of farming units per centre

Province	Private CSAs (a)	Public CSAs (b)	CSAs total (c)	Small- and medium-scale farming units (d)	Small- and medium-scale farming units per total CSAs (d/c)
Niassa	5	2	7	169,267	24,181
Cabo Delgado	6	1	7	418,465	59,781
Nampula	6	3	9	742,679	82,520
Zambézia	10	1	11	689,891	62,717
Tete	4	2	6	366,730	61,122
Manica	8	3	11	197,865	17,988
Sofala	11	1	12	232,096	19,341
Inhambane	2	0	2	212,957	106,479
Gaza	11	9	20	204,737	10,237
Maputo	6	5	11	779,259	70,842
Total	69	27	96	4,013,946	41,812

Sources: Author’s own based on data from MASA (2016) and the FDA (pers. comm.).

A rigorous assessment of the distribution of centres and coverage of mechanisation services would have required taking into account other mechanisation service delivery channels and the actual numbers of machinery operational to deliver services. Unfortunately, this information was not readily available for this study.

3.1.3 Other mechanisation service centre models in operation or under development⁹

Besides the new CSAs, other mechanisation service delivery models were found to be in operation or under development in Mozambique. The service centres of the Zambezi Valley Development Agency (Agência de Desenvolvimento do Vale do Zambeze, ADVZ) are a case in point. The ADVZ is a state agency with the mandate to promote the development of the Zambezi Valley and, in particular, to stimulate the region’s

private managers on the basis of performance. Poor performance by some centre managers has already seen the revocation of their contracts and the return of the machinery and the centre’s infrastructure to the ADVZ (MundiServiços 2015¹⁰). Another significant difference is that the machinery brands imported by the ADVZ for the programme (e.g. Massey Ferguson and John Deere) have long-standing representations in Mozambique, and therefore more ready access to spare parts and technical assistance. And finally, ADVZ centre managers were directly involved in selecting the types of machinery allocated to their centres, to ensure the suitability of machinery to local farming conditions and needs.

Another service centre model has been devised by PROSUL, a government-led agricultural programme (2012–19) supported by the International Fund

for Agricultural Development (IFAD) (with a loan of US\$45 million) and focused on pro-poor value chain development in the Maputo and Limpopo corridors in southern Mozambique. The specific attribute of the envisaged PROSUL service centres is their focus on assisting selected value chains (the programme targets horticultures, cassava, and red meat) and the more elaborate management mechanisms underpinning the business model (MundiServiços 2015).

There is also a private sector-led initiative worthy of note. Casa do Agricultor is a private company selling agricultural inputs, machinery, and technical assistance. It has its headquarters in Maputo and it has three additional large stores in three cities (Nampula, Beira, and Chimoio). The company is also working with an

expanding network of local agents, or agri-dealers (there are now 60), who sell its products and equipment locally. The company aims to create a widespread input supply and service provision network.

As these concurrent models develop and experience with their implementation accumulates, their performance and impact should be comparatively assessed. This is not, however, the purpose of this study, which focuses instead on the process of establishing CSAs through public-private partnerships and exploring what this process reveals about the government's agricultural development strategy, its inclusiveness, and implications for agrarian structures and relations in the countryside. The sections that follow address these issues.

4. CSA MANAGERS AND THE PUBLIC–PRIVATE PARTNERSHIP

4.1 CSAs and tractor-owning farmers

This study conducted fieldwork at ten service centres. These included eight private and two public CSAs (Table 7). In addition to these centres, this study also looked into the experiences of three individual farmers who had bought machinery under the programme and provided mechanisation services to other farmers.

4.1.1 Who are the CSA managers?

The private CSA managers covered by the study can be grouped into three categories: (1) locally established private companies operating in either agricultural production, processing or services, or a combination of these; (2) medium- to large-scale farmers and agricultural entrepreneurs, some of them new to farming; and (3) farmers' associations. For example, the Maputo-based agricultural services company Agri-arena, which operated one centre in Chókwè, and the tobacco processing company Sonil, based in Malema, fit in the first category. Managers in the second category were typically middle-aged Mozambican men, native to the district where the centre was located. Exceptions to this included: a young manager in his early thirties (CSA in Monapo, Nampula) and a Brazilian national (CSA in Ribáuè, Nampula). In the sites covered, this study encountered one farmers' association union (União de Cooperativas Agrárias do Chókwè) acting as a service centre. This union provided services to members as well as other farmers in the area. The membership of the union covered an area of 700 hectares. As with the other private CSAs, mechanisation services were provided against a fee, which was slightly lower for union members.

With the exception of the farmers' union, where the president was a woman, this study found no accounts of women acting as centre managers, although some women reportedly purchased machinery as individual farmers.

In addition to these private CSAs, the study also looked into two public CSAs. These were state companies managing the large irrigation systems in Chókwè and Xai-Xai, Gaza Province. In addition to maintaining the infrastructure, these companies supply inputs and

services to farmers operating inside the irrigated area. The new machinery added to the fleet they already had to provide services to their target population. For example, the company managing the Chókwè irrigation system, HICEP (Hidráulica do Chókwè Empresa Pública), added five tractors and corresponding implements to its fleet of tractors and thereby expanded their capacity to service local farmers.

Although running agricultural mechanisation service centres was a new activity, all private managers had financial capacity (to purchase the equipment and offer guarantees) and access to an area where they could physically establish the centre. The centre in Ribáuè was the only one that was newly and purposely erected. The centre in Monapo, by contrast, was incorporated in an existing machinery rental business owned by the manager, which included construction and transport machinery. The centre in Namialo, Meconta District, was set in the local infrastructures of the National Forum of Cotton Producers (FONPA), presided over by the manager of the centre, which had capacity to lodge the machinery and equipment and sell inputs. The centre managed by the agribusiness company Agri-arena in Chókwè was located inside the new and large industrial complex of the state company Complexo Agroindustrial do Chókwè (CAIC).¹¹ The centre managed by Sonil was located in the compound of the company's tobacco processing plant. The farmers' union was the only case where a warehouse for storing the machinery was not available.

Managers in the second category indicated above had land holdings of various sizes¹² and, besides providing mechanisation services, all intended to scale up their farming activity. One of these had ambitious plans. He had obtained a number of land concessions adding to a total of 1,000 hectares, and was reportedly in the process of securing an additional 10,000 hectares for maize and soybean production, which is significant for a part of the country (the Nacala Corridor) where land disputes had been quite contentious (Funada Classen 2013; UNAC 2012; UNAC and GRAIN 2015). This centre was one of the largest of them all in terms of infrastructure and its business plan was considered by government officials to be a model for the whole country. In addition to newly built warehouses, plans

Table 7 CSAs visited by the study (September 2017–July 2018)

CSA type	Company	Core business	Location (district/ province)	Tractors	For private CSAs	
					Farming area (own or assisted)	Main crops in own operations
CSA-private#1	FONPA	Mechanisation services	Meconta/ Nampula	8	Own: 200 ha	Horticultures
CSA-private#2	Nelson Semedo	Machinery rental (farming and other)	Monapo/ Nampula	5	Own: 220 ha	Maize, beans, horticultures, and banana
CSA-private#3	Agribusiness	Agricultural production and services	Ribáuè/ Nampula	8	Own: 1,000 ha	Maize and soybean
CSA-private#4	Sonil	Tobacco processing	Malema/ Nampula	8	Contract farming: 15,000 producers over 4,000 ha	Tobacco
CSA-private#5	Agri-arena	Agribusiness services	Chókwè/ Gaza	8	Own: 12ha Service provision planned for 3,000–4,000 ha (but target never achieved)	Rice and other cereals
CSA-private#6	Associação Josina Machel	Agricultural production cooperative	Chókwè/ Gaza	3	Own: 100 ha	Rice and horticultures
CSA-private#7	Musafrica	Agricultural production	Chókwè/ Gaza	6	Own: 50 ha	Rice
CSA-private#8	Carlos Tamele	Agricultural production	Chókwè/ Gaza	5	Own: 40 ha	Rice
CSA-public#1	HICEP	Irrigation system management, support to production	Chókwè/ Gaza	5	Service provision across 16,000 ha (of a total area of 30,000 ha)	Rice and horticultures
CSA-public#2	RBL	Irrigation system management, support to production	Xai-Xai/Gaza	5	Service provision across 17,000 ha)	Rice and horticultures

Source: Author's own.

for the centre included two grain silos, training and accommodation facilities, and a desk to supply a range of agricultural inputs and services.

Not all these CSA managers were established farmers. But those who were new to the farming business reported a professional trajectory linked to agriculture, either through work in government, in aid-funded

projects or by being involved in different aspects of agribusiness. Besides presiding over FONPA, the manager of the centre in Namialo had worked as a civil servant in the Ministry of Agriculture and as a project manager for an international non-governmental organisation (NGO). In fact, one of these projects funded the infrastructure where the CSA was located and, at the time of our interview, a large sign identifying

the project – Development Assistance for Private Sector Agriculture Initiative, funded by the Danish aid programme – was displayed visibly on one of the walls. The private managers in Chókwè also had a history of connections to government and aid projects, which is unsurprising in a district that has over the years been an important destination for public funding and investments for agriculture. Also, the foreign manager of the Ribáuè centre worked previously for the South African seed company PANNAR, and aimed to have the company as an input supplier at his CSA.

4.1.2 What are their drivers and ambitions?

Managers were reportedly driven by the prospect of making a profit from the machinery rental business. The subsidised cost of the machinery and attractive leasing conditions, coupled with the need for machinery for their own farming activities, made this a relatively low-risk investment. The fact that managers seemed embedded into local social networks, developed through their previous professional trajectories, also ensured a secure clientele for their businesses.

But ambitions varied somewhat amongst the managers interviewed. For the manager of the CSA in Monapo, participation in the subsidised machinery programme only meant an extension of his fleet and of his established machinery rental business. For two of the private managers in Chókwè, the machinery was essential for their own farming development plans and their agribusiness advisory services to other medium-scale farmers in the area. For the manager in Ribáuè, the centre seemed to be a parallel initiative to the setting up of his core business, which would eventually be centred on large-scale soybean and maize production for export markets. For his own farmland, he had bought two bulldozers to prepare the terrain and start production in 600ha of the overall area in the 2017/18 season. As for the CSA, this was expected to ensure stable access to inputs at competitive prices (as the centre would stock for the district) and eventually become a source of income, as the plan was to rent out the centre's infrastructures for a number of years and then eventually sell it off.

In some cases, original expectations had already failed to be met in this early stage of the programme. For example, the centre managed by Agri-arena in Chókwè had been established with the intention of serving an area of 4,000 hectares inside the irrigation system. Agri-arena's business plan had assumed its clients would be small- to medium-scale farmers operating inside the irrigation infrastructure and involved in contract farming arrangements with CAIC. This would secure a stable

and reliable clientele. Yet, CAIC went bust and stopped operating less than a year after its inauguration and Agri-arena's initial plans never came to fruition. The company just about managed to keep the machinery busy, and in the previous 2016/17 campaign they had ploughed an area of 500 hectares.

The motivations of Sonil in relation to the machinery were less straightforward, as reportedly the machinery procured under the FDA programme could not be used to service its network of tobacco contract farmers. For the duration of the lease, the machinery was authorised to operate for food crops only. This may partly explain failure to reach annual targets for mechanised areas for the newly acquired machinery: 480 of 700 hectares in 2016/17 and 272 of 1,200 hectares in 2017/18. According to our respondent, the company expected that the GoM would eventually wave the rule that stipulated that FDA machinery could only be used in food crops farms. This would allow the company to use the newly procured fleet to service the 4,000 hectares of its 15,000 outgrowers. Perhaps this expectation was what had driven the company to enter the lease contract and take on the CSA business in the first place.

4.2 What does the public-private partnership entail and how it is interpreted by different actors?

The terms of the public-private partnership (PPP) for this mechanisation programme are signalled in the Terms of Reference (ToR) for CSA managers. The state ceded the machinery under a leasing contract (and with a subsidised price for the machinery) and provided one year of technical assistance as well as training on machinery handling and maintenance for drivers and operators. CSA managers run mechanisation services as a private business and repaid the lease obligation to the state until repayment had been made in full, taking ownership of the equipment at the end of the lease period. In practice, however, the real terms of this partnership involved unwritten expectations and transactions.

Whereas private CSAs were assumed to run independently as profit-oriented fee-for-service businesses, there was an expectation by government officials and the farming clientele that they would contribute to the government's policy objectives, including serving the small-scale sector and increasing national food production. Government officials working in district offices (SDAEs) were responsible for monitoring whether the centres were serving the predominant peasant farming population and hence contributing to the overall aims of the policy. Our research confirmed that they encouraged CSAs to provide services widely

to small-scale peasant farmers and to focus exclusively on food crops.

There is a tension, however, between the objective of reaching a large number of small farmers and ensuring that CSAs remained profitable and financially sustainable. Managers commonly complained that the peasant family sector farmed in areas that were unprepared for tractor ploughing because of their unevenness or because they were often covered with tree stumps (*cepos*), hard roots, and rocks, which made tractor implements break easily and tyres burst. Another common complaint was that fuel costs created obstacles, and made work on very small, scattered, and often inaccessible plots not cost-effective. Sonil in particular expressed frustration that the machinery leased by the FDA could not be used to service its geographically clustered tobacco farmers.

From the point of view of the presumed clients (small-scale peasant farmers), private CSAs were often regarded as an extension of the state and were therefore expected to assume the same provider function that the government was understood to have *vis-à-vis* the peasant population. That people had this understanding of the relationship to the state is unsurprising, given that government officials had toured around the countryside announcing the mechanisation policy for food production. Farmers had been asked to contribute to government-defined food production goals and naturally presumed that they would get support from the government in return.

Also, according to peasant farmer representatives, district officials had announced the FDA mechanisation programme as an initiative directed towards peasant farmers and its associations and therefore expected that tractors and equipment would become accessible to them. Many of the farmers interviewed did not seem able to (or want to) grasp the implications of having a privately run fee-for-service modality of service delivery. After all, the programme had been introduced to them as a state-led initiative directed to the peasant population. As one of the respondents explained, government policy always invokes peasants as the target population and yet 'the invoked continues to wear flip-flops' (farmers' association representative, Malema, July 2018) and it is not serviced by the private centres.

As for the government, its narrative on the programme was ambiguous and reflected some inherent tensions in the PPP. Hence, although it was highlighted that CSAs were privately managed and it was up to CSA managers to ensure that their machinery renting business was financially viable and profitable, these managers were often reminded about their obligations towards the

peasant population and *vis-à-vis* food production goals for the district where they were located. This passage from an interview with a district government official is illustrative:

The government cannot interfere in the business plan of the centre. (...) But there are contractual directives that require managers to provide services to peasant farmers. Regardless of how much the CSA manager increases its own production area, it has to have at least 1 or 2 tractors available for the population. (Government official, July 2018, author's translation)

The leasing contract does not include any concrete specifications about obligations towards a particular target group, and yet government officials interpret the partnership in this manner and their role as one of supervising and guiding businesses.

The following anecdote by one of the study's respondents provides a further illustration of these misunderstandings and contradictions. At the start of the 2016/17 farming season, a government minister visited the district and upon hearing a local farmer complaining that he had not had access to the newly arrived machinery, he publicly instructed the local CSA manager to service the farm of the complainer. The company swiftly executed the minister's instruction. However, until the day of our interview, the farmer had yet to pay for the service provided by the company on his farm. This very same farmer had, reportedly, been selected in the meantime as a beneficiary for a new aid-funded programme targeting medium-scale (or emergent) farmers and had bought his own tractor through this programme.

As for the CSA managers, their interpretation of the partnership also extended beyond the leasing contract. For example, securing access to land for expanding production depended on maintaining a good relationship with local communities and authorities. The performance of a public service-like function towards the community played this role. For established companies, the provision of a corporate social responsibility type of function to the community was a temporary commitment, often performed half-heartily. Once the lease was paid (if not earlier), the companies would be free to use the machinery and equipment where they wanted and it would no longer be restricted by the unwritten rule of servicing food-growing small-scale farmers, to whom providing tractor-drawn mechanisation was not cost-efficient.

5. MECHANISATION AS TILLAGE

5.1 Tractors and one-size-fits-all approach

Back in 2013, the FAO's guidelines for an agricultural mechanisation strategy for SSA warned against the 'rush towards mechanisation' and suggested that some projects across the region approved the import of tractors without adequate consideration of their suitability or appropriateness to local farming conditions (Houmy et al. 2013: 25). And yet tractors have not only dominated headlines on the Brazilian cooperation programme (MDA 2015; Notícias Online 2015) but have also become the primary symbol of the Mozambican government's agricultural mechanisation strategy, much like what happened in the past (Mosca 2011) as well as in other parts of Africa (Anthony 1988; Houmy et al. 2013).

What is also worth noting about the Brazil-sponsored mechanisation programme in Mozambique is the lack of variety of machinery options in the package. The three Brazilian brands selected for the programme (LS Mtron, Tatu Marchesan, and Triton) – all new to the Mozambican market – provided one single specification for each item of machinery and equipment (cf. Table 2). So all 513 tractors¹³ sent across the country had exactly the same characteristics (LS Plus 80, 4WD, 75hp) and the same for implements. One single package was distributed across Mozambique's ten agro-ecological zones and diverse farming systems without a prior needs assessment. For the centres visited for this study, this package typically included tractors, plough, harrows, seed planters, fertiliser distributors, and trailers. But as this study found, not all items in the package were adequate for local needs.

Such a one-size-fits-all approach provides somewhat of a contrast to the programme's implementation in Ghana, where a greater variety of brands and sizes is noticeable for the first tranche of the same Brazilian cooperation programme – three brands of tractors with distinct specifications were purchased to accommodate not only different needs but also different brand preferences. These were: Massey Ferguson (4WD, 65hp), Valtra (4WD, 75hp)¹⁴ and New Holland (4WD, 75hp). For the second tranche, the Ghanaian

government planned to add new items, such as two-wheel tractors for small-scale farmers and to service particular regions where the soil was adequate for this type of engine.¹⁵

5.1.1 Emphasis on tillage

Land preparation has been the dominant if not exclusive set of mechanised operations that the programme has covered in Mozambique, at least in its early stage considered in this study. In fact, the term mechanisation was found to be often used interchangeably with that of land preparation. Other items in the package, including trailers for transportation, laid idle in the centres, and some equipment, such as trailed seeders, lime, and fertiliser distributors or row seed planters, had yet to be tested after more than one year on site (Figure 5). Government officials and centre managers acknowledged that mechanisation was still in an early stage, and the priority was to prepare the soil and get farmers accustomed to the services available and the new business model for service delivery.

Land preparation typically comprised two operations – ploughing (*lavoura*) and harrowing (*gradagem*). In Chókwè, and for rice cultivation specifically, furrowing (*marrachamento*) was also a key part of land preparation, although there was no specific equipment

Figure 5 New seed planter wrapped in overgrown cassava leaves



Source: Photo taken by the author in September 2017, Monapo, Nampula.

for this operation in the Brazilian package. For ploughing and harrowing, the basic package included a 3-disc plough, a 14-disc harrow (*grade aradora*), also known as heavy harrow, and a 24-disc harrow (*grade niveladora*). For private CSAs, there were also chisel ploughs and weeders, but these were reportedly never used in service delivery. Two years on from their arrival, some of this equipment was yet to be taken out of their boxes and assembled, as explained by one manager (CSA respondent, July 2018).

The prices advertised by one of the CSAs in the local SDAE office only announced four mechanised operations: fixed-disc ploughing, chisel ploughing, harrowing, and planting. This company's service delivery records confirmed the predominance of tillage – of the total area serviced in 2016/17, 54 per cent corresponded to fixed-disc ploughing, 38 per cent to harrowing, and only 8 per cent to planting.

5.1.2 Limited solutions for soil conservation and peasant farming

The issue of soil conservation and how tillage may compromise the quality of soils in the longer term were not concerns amongst those interviewed for this study. Many shared the view that getting the plough sufficiently deep would allow moisture to be captured while reducing drudgery and improving the timeliness of planting, thereby positively impacting on production. The preference was therefore for the fixed-disc plough and the heavy disc harrow. The chisel plough, which offered a low-soil compact alternative for land preparation,¹⁶ was not in demand or indeed included in the service package provided to farmers.

The absence of considerations about soil conservation in mechanisation policy across Africa have been noted. The FAO in particular has advocated for a sustainable agricultural mechanisation approach focused on zero or low tillage solutions (FAO 2017) and has produced a database of mechanisation solutions compatible with conservation agriculture (CA) principles (FAO n.d.). Incidentally, a large proportion of the equipment featured in this database is produced in Brazil, a country that is well known for its advances with zero tillage farming (Casão, Araújo and Llanillo 2012). This has not been included in the MFI package for Mozambique, where conservation agriculture remains a niche topic with limited appeal to the average farmer. This is partly because of the lack of easy and affordable access to the required inputs (such as compost and fertiliser) and because of the insecurity of tenure, which discourages investments in soil quality over the long term (Grabowski et al. 2013; Grabowski and Kerr 2014). And yet, FAO has been implementing conservation agriculture projects in Mozambique and

has sponsored training and field visits to Brazil.¹⁷

Small-scale machinery tailored to the particular needs of peasant farming and staple crops in particular (such as cassava) were not adequately represented in the package either. Indeed, Tatu Marchesan, the company supplying most of the tractor implements, specialises in equipment for medium- and large-scale farming.¹⁸ The absence of solutions for small-scale agriculture is perhaps more surprising than the lack of CA options, given the leadership of the Brazilian family farming ministry (the MDA) in the original design of the programme. The MDA expected that the programme would offer a domestic food security-focused alternative to a model geared towards larger-scale grain production for export, which had until then dominated Brazilian cooperation initiatives (Cabral et al. 2016). Instead, as confirmed by government respondents and some service centre managers, the mechanisation programme targeted especially maize, rice, and horticultures, crops that do not generate sufficient income for the average peasant farmer to allow her to pay for mechanisation fees (see Section 6).

A study for PROSUL on the cassava value chain, as a major food crop in Mozambique, had already noted the absence of solutions for peasant farmers:

All PROSUL districts in the cassava value chain lack mechanisation services for land preparation. According to the SDAEs, there had been private operators providing services in these districts but they did not survive because of lack of demand. As for producers, they stated they needed mechanisation services but production did not pay for costs because of low productivity and lack of capacity to pay for mechanised operations. For them, the solution had to entail the development of a market for cassava and the availability of small machines (such as power tillers) that were more affordable. (MundiServiços 2015: 21, translation from the Portuguese)

The Asian experience with small-scale mechanisation has been increasingly emphasised in the literature as a potential model for Africa (Biggs and Justice 2015; Biggs, Justice and Lewis 2011). Power tillers or two-wheel tractors (2WTs) are thought to offer inexpensive and versatile power sources for resource-constrained farmers (Baudron et al. 2015). In Bangladesh, for example, where 80 to 90 per cent of cropland is prepared mechanically, one in thirty farmers owns a 2WT and nearly all 2WT owners are service providers (ibid.).

Two-wheel tractors were included in MFI packages for other African countries (e.g. Senegal) but not for

Mozambique, where big tractors remain the preferred option (Hanlon 2015). In Mozambique, 2WT tractors have been funded by other aid projects (e.g. recently by Japan in Chókwè) but with limited uptake by farmers.¹⁹ Some of the study's government respondents explained that for most of the country, soils are too hard and two-wheel tractors break easily, and that farmers look down on this option. Also, the size of the country, scattered population distribution (Mozambique's population density is 37 inhabitants per square kilometre of land, which compares with 1,252 in Bangladesh) and high fuel and transportation costs pose challenges to the development of a rental market for such small-scale machinery. Yet, one respondent²⁰ recognised that power tillers are more affordable, costing half the price of replacing an average four-wheel tractor tyre. And another one²¹ noted that they typically have better acceptance amongst farmers used to animal traction.

Baudron et al. (2015: 890) acknowledge that 2WTs 'do not have the tractive ability to plough under rain-fed conditions with most soils' but they claim they are

suitable for conservation agriculture. Yet, the conditions under which they recommend 2WTs are quite specific, including: existence of repair services, available and affordable fuel, commercially-oriented agriculture, labour shortages, and deep and stone-free soils; to which one could add all the rest that is necessary to make conservation agriculture viable (Grabowski and Kerr 2014).

Although 2WTs may not be viable in many parts of Mozambique, other small-scale engines, such as agro-processing, storage, and irrigation equipment might be. Small-scale irrigation, for example, is regarded as having a major role in improving rural livelihoods and reducing poverty in SSA (Kay 2001). In Mozambique, small-scale farmer-led irrigation systems have been cropping up, while large-scale state-run schemes have generally failed (Woodhouse et al. 2017). But these remain under the radar of the Mozambique government (Woodhouse 2018) and also, it seems, of its mechanisation policy which remains centrally focused on tillage.

6. THE INCLUSIVENESS OF MECHANISATION SERVICES

6.1 Proclaimed beneficiaries

Agricultural policy statements in Mozambique typically identify the predominant small-scale family sector (*sector familiar*) as their chief target group (MINAG 2011). The new mechanisation programme is no exception. When launched in 2014, the president of the FDA explained that the new mechanisation programme would help these farmers drop rudimentary farming practices and equip them with the modern means to reduce drudgery and time spent on land preparation (FDA 2014). Crucially, the programme would directly assist the transformation of subsistence family farmers into commercial farmers (*ibid.*).

In reality, the primary CSA beneficiaries are not from the family sector, but the better-off market-connected farmers, whose endowments – not least, size and characteristics of land and ability to pay for the service upfront – allow them to actually access the services. For the average peasant farmer, access is difficult. Most are unable to pay for the service and the lands they cultivate are unprepared for the available mechanisation solutions. Also, they are small and dispersed, raising the cost of transporting the machinery to the sites. Under such circumstances, CSA-private managers face the dilemma of running a profitable rental business while responding to pressure from the local population to whom government policy statements give legitimacy to demand for services – they are, after all, the invoked target group for the government’s mechanisation policy. And yet, as the farmer representative expressed, they remain virtually barefoot, at the margins of the modernisation process.

6.1.1 Land suitable for mechanisation

The typical farmer in the family sector farms in marginal land with machambas of under one hectare which will often be uneven and will have stones, roots, stumps, and anthills scattered in the field. Getting a tractor and plough to operate in such a terrain is challenging as there is a high risk of damaging the equipment and the tractor itself, which is particularly problematic as spare parts and repair services are centralised by SOTEMA in the capital city, Maputo. The tyres that came with LS

tractors were criticised for being particularly vulnerable to stumps, and during fieldwork, we encountered several LS tractors that were non-operational due to tyres that had blown out. One of the managers explained that he sometimes sent someone ahead to check the plot and if the land was not sufficiently cleaned, he would ask the farmer to remove stones and tree stumps before driving the tractor into the field to do the job. He conceded that he prioritised clients that he knew had clear and ready-to-plough land that was easy to access – this would normally be farmers cultivating lands which had been previously cleared, such as former colonial plantations turned into state farms during the socialist period. Another manager said that the company had stopped sending someone to check the fields in advance as the service fee was too low to justify the additional cost, so equipment getting damaged became unavoidable.

Besides the challenging topography, another commonly reported challenge to servicing the average small-scale farmer concerned the dispersion of plots. The maximum distance of travel reported by managers was 15 to 20km. One manager²² noted, however, that he had refused to move his machinery 15km to plough only one hectare, as the service would have been too small to cover the cost of transporting the machinery (fuel costs were in all but one case included in the service price) and paying for the tractor operator while ensuring a profit margin. Another manager²³ explained how he would often encourage farmers to form groups amongst neighbours so as to minimise dislocation costs for machinery and driver. In such cases, larger distances of 30 to 40 km would be travelled to service a cluster of farmers.

Having understood the challenges of servicing the average small and dispersed farmer, district government officials had been encouraging the population to move out from their areas of traditional cultivation and set up block farms. As for CSA managers, in the Nacala Corridor specifically, they expected that larger farmers would eventually arrive in the district and guarantee the right clientele to make the mechanisation service provision business profitable. In the meantime, service provision to medium-sized farmers with more than ten hectares and locally established agricultural companies

(such as the international agribusiness Olam, that manages a large outgrower scheme for cotton in Nampula Province) was taking place and condemned by underserved small farmers, who were serviced late or not at all.

6.1.2 Fees, costs, and payment conditions

The GoM recommended minimum and ideal fees for mechanisation services. These are higher in the northern provinces compared to the centre and south of the country (FDA 2015a). Fees are set per hour of service or per hectare, based on the assumption that it takes about three hours to plough one hectare, two hours for the first harrow and one hour for the second harrow. Minimum service fees were calculated to cover for service costs (driver and other employed staff, fuel, and maintenance) and loan repayment, whereas the ideal fee also included a profit margin for the service provider. So, for example, for the northern region, the minimum fee for ploughing one hectare is set at US\$ 69 (MZN 4,126) and the ideal fee is US\$77 (MZN 4,612), comprising a US\$8 profit margin.

Fees reported by this study's respondents varied slightly from the recommended fee, but no substantial difference was found between fees practised in Nampula (northern region) and prices in Gaza (south region). In both regions, reported fees per hectare varied between US\$50 and 58 (MZN 3,000–3,500), for ploughing with the fixed-disc plough, and US\$30–41 (MZN 1,750–2,500), for harrowing.

Service costs comprise fuel, the salary of the tractor driver/operator, spare parts, and maintenance. Fuel represented over half of the costs – one tractor requires around 30 litres of diesel per hectare for ploughing, which costs approximately US\$28 (MZN 1,700). A common complaint heard from CSA managers was that rises in fuel prices had squeezed profit margins, making long distances for small plots prohibitive. Sonil had already adjusted to this rise by excluding fuel from the service fee and asking clients to provide for fuel themselves, while charging lower fees for the actual service (MZN 1,900 for ploughing and MZN 1,400 for harrowing). This procedure also aimed to address the problem of misreporting of distances to the farm and size of plots by clients at the time of service request, which meant that CSAs would end up paying for the extra costs.

As for farmers, the inability to pay for mechanisation services was a commonly reported problem. This is unsurprising given the low income of the average Mozambican family in the countryside – one estimate

puts the mean annual family income for a family of five at US\$115 (Mozambique Integrated Agricultural Survey cited in Smart and Hanlon 2014). Some farmers are able to pay this level of fee after harvest time and, in the first year of the programme, some CSA managers agreed for the service to be paid then. Yet, payment defaults in the first year led to the abandonment of this practice by some privately managed CSAs.

6.1.3 Are tractors under the mango tree more accessible for the average farmer?

Access to mechanisation services by the average small-scale farmer is challenged by the structural conditions of small farms and, for many, by the inability to pay cash for services upfront and before the harvest. Although private CSAs have been encouraged by the government to service this population, their business thrust has directed them towards larger clients (the farmers' union being the exception), whose fields offer better ploughing conditions and for whom timely payment for service is not a constraint.

By contrast, farmers' associations make available the machinery primarily for the service use of their members, offering service to non-members at a higher price. Likewise, individual farmers who bought tractors and equipment also provide services locally to their peers. When they do not need the machinery in their own farms, they provide mechanisation services to other farmers in the surrounding areas in the district. One farmer reported a maximum travel distance of 50km for ploughing five hectares for a farmers' association. Furthermore, while it is often the case that private CSA managers (with the exception of the union) do not know their clients,²⁴ individual farmers operate within their social network of relatives, neighbours, and friends. The fees they charge are similar to those of the CSAs. Yet, because of their social networks they are reportedly more willing to offer flexible paying conditions – including payment in kind – and be more sympathetic and accommodating with their peers with regard to delays in payment.

One of the tractor-owning farmers interviewed noted that the harvest had not been good the previous year (2016/17) and many of his clients had failed to pay for the mechanisation services he had provided. Yet, because he knew them well, he was confident that with the current year's bumper harvest they would be able to make sufficient money to pay their debt. He also regarded service provision in the neighbouring communities as a way of helping to improve the lives of his peers:

The tractor is not only for the benefit of one person but it is to help everyone move forwards.²⁵

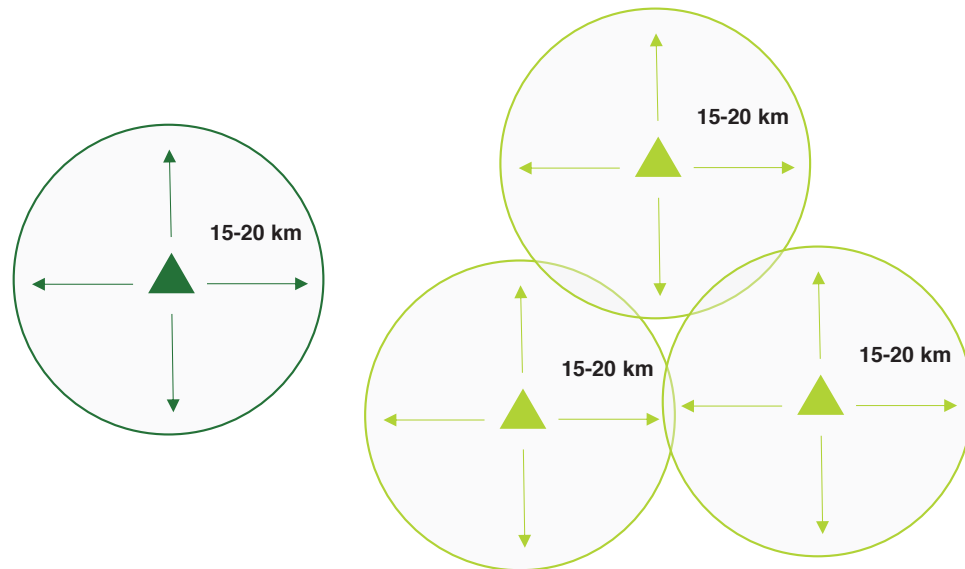
Some common characteristics of the three tractor-owning farmers interviewed are worth noting. They are medium-sized farmers with 15–60 hectares of farmed land. They already owned machinery (one other tractor, ploughs, and trailers) primarily for their use, which they kept in their farm or household – notably under the shade of a large mango tree in their back gardens (much like the farmers’ union). Their costs with machinery operators were reportedly lower than those of the CSAs and one of the farmers operated his own machinery when supplying services to others.²⁶ This latter farmer also owns a mill and a shop for agricultural inputs, and he is linked with local small-scale farmers as a seller of inputs, a buyer of outputs, and now a provider of mechanisation services.

Individual tractor owners report on average the same maximum distance of travel to service individual clients that private CSAs travel, which is 15 to 20 km

(exceptions to these occur when servicing several neighbouring farmers). Yet, because each of these individual tractor-owning farmers are spread around the district, they are, in principle, able to cover a larger territory (as Figure 6 schematically illustrates). Also, the clients of these individual farmers are, by the nature of the underpinning social and economic networks, all of relatively small size.

Although this study did not look extensively at the experiences of individual tractor buyers across the country, the evidence outlined above leads to the hypothesis that these individual small- to medium-scale farmers may constitute a more effective channel of peer-to-peer service delivery for the average Mozambican peasant, relative to the larger business-like CSAs. This is because of the former’s cost structures, social, and economic networks (and hence more flexible paying conditions), and their more dispersed locations. Further research is needed on mechanisation service coverage and this should explore the validity of this hypothesis.

Figure 6 Reported maximum distances travelled from the location of centre or homestead to the client’s farm)



- ▲ Private CSAs (69), each with 6 to 9 tractors
- ▲ Individual farmers (95), each with 1 to 2 tractors

Source: Author’s own.

7. CONCLUSION

Farm mechanisation has been a recurrent theme in African agriculture, and Mozambique is no exception. The rise of new sources of mechanical technology in the global South, which South–South cooperation has helped to market in Africa, has created favourable conditions for the return of the state to machinery procurement and distribution. Whereas in countries like Ghana, private markets for machinery (new, second-hand, and hiring services) have developed in recent years – in part because of past state-subsidised land clearance that reduced the current cost of mechanisation for farmers (Amanor 2018) – in Mozambique, the spread of mechanisation is still very much dependent on state support. Machinery stocks are low and there are few private machinery owners renting out equipment to other farmers.

The Brazilian MFI programme, with its small-scale ‘family farmer’ focus, offered an opportunity to address concerns about drudgery and improve the timeliness of farming operations for Mozambican farmers, in spite of the absence of push factors, such as the rising cost of labour and land consolidation observed in Ghana (Diao et al. 2014). Yet, the suitability of the Brazilian tractors to address the needs of the majority of Mozambican farmers is questionable, as the release of farm labour continues to not be a priority, given the material conditions of the Mozambican economy. And yet, tractors are powerful political instruments (Anthony 1988; Brautigam 1998), which can have significant implications for agrarian structures and relations. It is in this spirit that this study looked into the Mozambican unfolding mechanisation strategy, its modernisation thrust, claimed and *de facto* beneficiaries, and the processes of accumulation that have been assisted by tractors.

The mechanisation strategy recently pursued by the Government of Mozambique is liable to at least three types of criticism. First, it repeats past management oversights (Mrema, Baker and Kahan 2008) in that state top-down procurement was conducted without a prior surveying of needs and without due consideration of maintenance requirements and spare parts availability for the machinery. Second, the private–public service delivery model and the available machinery package

is not geared to the majority of Mozambican peasant farmers, who are dispersed and farm in small and rugged plots, where tractor ploughing is not cost-efficient. Also, only the better-off farmers are able to pay for tractor services and have the services offered to them within a suitable time frame. CSA managers have an incentive to prioritise clients with clear and larger plots that ensure efficient tractor utilisation and reduce the risk of broken parts.

Third, from a sustainability angle, the tractor-based strategy reinforces a tillage-centred productivist approach (i.e. a push for intensified production) by the Mozambican government which fits its modernisation ambition but is questionable from the point of view of diversification of farming systems. The centrality of tillage can be questioned from a soil conservation perspective.

Despite the above criticism, the adopted policy is not without its logic. To be sure, it is part of an ongoing process of accumulation that the state and its international development partners have nurtured, intentionally or accidentally, over the years. In line with the modernisation thrust, tractors are instrumental to a process of accumulation from above, where well-connected private investors (large farmers, business companies, or former civil servants) are entrusted by the government to embody the modern agribusinesses. When offered subsidised machinery and granted access to land, some of these large capitalised farmers may thrive and establish successful businesses. Others will likely follow the same path trialled by many before them and will pull out either because they never intended to become agribusiness entrepreneurs (but were in it for speculative or opportunistic reasons) or because they will not be able to cope with the many adversities facing farming in Mozambique. As observed by Smart and Hanlon (2014: 1):

Despite the dreams of ‘modern’ industrial agriculture, few plantation investments have succeeded in Mozambique since independence. Neither state nor private management has made new giant farms successful.

Alongside the delusional large-scale modernisation vision, the government's mechanisation programme is also, inadvertently perhaps, supporting a different process of accumulation in the countryside. This is a type of 'accumulation from below' (Cousins 2013), which is epitomised by the image of the tractor under the mango tree. Increasingly, small- to medium-scale farmers, holding enough capital to buy tractors and equipment, are able to buy their own machinery, which they can then rent out to other small farmers. Could these individual farmers of small to medium size and farmers' associations with similar capacity offer a more promising channel of mechanisation service delivery – promising in terms of reaching a wider subset of small farmers? Emerging evidence suggests that, relative to 'zinc-roofed' CSAs, the 'mango tree model' may be more accessible to the average small-scale farmer because of cost structures, social networks, and geography. Yet, the extent to which the 'mango tree model' is more inclusive needs empirical verification and therefore requires further research. If some will be able to pay the 'mango tree' tractor owners for their services, many more will probably not. What mechanisation solutions can be devised to help those at the bottom to 'step up' remains an open question.

Evidence is also needed on the power dynamics around mechanisation service provision, which are relevant in relation to either model of service delivery. Specifically, there is scope for exploring how class, political affiliation, social networks, gender, and age may determine access to services, besides the ability to pay and physical features of the land.

Finally, as the experience with tractors accumulates, there is also scope for investigating what social networks and relations take shape around them, following the footsteps of Lewis (1996) whose analysis of tractorisation in Bangladesh in the 1980s looked into bottom-up appropriation of 'lumpy' technology. Specifically, the introduction of tractors into small-scale Bangladeshi agriculture created new opportunities, including for brokers who became involved in dividing up the technology into smaller units that suited the numerous small-scale farmer clientele. Exploring how the African small-scale farming population interacts with tractors and appropriates them requires in-depth ethnographic research on the micro-level interactions between people and machinery. Such research is essential to explore the potential for transformative technological innovation that may emerge from the bottom and counteract the persistent top-down bias in mechanisation policy in Africa.

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1. Research Fellow, Institute of Development Studies, Brighton, UK.
2. Interview with leading Mozambican agriculture machinery trader and former government official working on the state-run mechanisation programme (Maputo, 21 March 2017).
3. Figure 1 contrasts the level of mechanisation for the three countries included in the APRA study on agricultural mechanisation.
4. www.fao.org/faostat/en/.
5. This brief reconstitution of history draws extensively on the account of two informants who were closely involved in mechanisation policy during the first decade of the post-independence period.
6. Thanks to Joseph Hanlon for highlighting the devastating impact of the war on the Mozambican countryside during the 1980s, where state farms and farm machinery were frequent targets of attacks by the RENAMO forces.
7. The apparent downward trend since 2016 may reflect the severe debt crisis that the country has been facing, and the consequent slowdown in foreign direct investment and trade.
8. Interview with the FDA, March 2018.
9. This section benefited substantially from insights provided by Marco Machado. Any errors or omissions are the author's exclusive responsibility.
10. Report communicated to author.
11. This complex had been inaugurated in 2015 and featured modern storage and agro-processing facilities (funded by a \$60 million dollar loan from China), with capacity to process 60 thousand tonnes of rice and 1,200 tonnes of tomato per year (Muiambo 2015).
12. Land in Mozambique is owned by the state. Local peasant communities have automatic rights to use the land and, according to Mozambican law, no formal title is required to secure their customary rights. Outside investors can apply for land concessions provided that local communities have been consulted and have agreed to the concession, in which case a land use title is granted by the relevant authorities to the investor (Shankland et al. 2016).
13. The full loan was actually expected to fund a total of 1,500 of such tractors, but so far only the first tranche has been executed.
14. Personal communication with government official in the Ministry of Agriculture, 22 November 2017.
15. Personal communication with government official in the Ministry of Agriculture, 22 November 2017.
16. Unlike an ordinary plough, the chisel plough does not move or invert all the soil and is therefore preferred from a soil conservation perspective.
17. Interview with FAO staff in Maputo, July 2018.
18. www.farmcointernational.com/tatu_machesan.
19. Sasakawa 2000 had previously attempted to promote 2WTs in Mozambique in the late nineties but without success (interview with MASA official, March 2017).
20. Interview, Chókwè, March 2018.

21. Interview, Mutuali, July 2018.
22. Interview, Nampula, September 2017.
23. Interview, Ribáuè, July 2018.
24. For example, one of the managing companies described how it interviewed clients upon service request in order to find out about the location, size, and characteristics of their farms.
25. Interview, Ribáuè, July 2018.
26. This farmer had previously used a contracted operator but found out that the tractor was not properly handled and maintained and therefore took on the task himself to ensure that the machinery lasted longer (interview, Ribáuè, July 2018).

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