



# NIGERIA

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# Cost and policy determinants of features of tractor markets in Nigeria

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## Case studies of tractor sellers in Kaduna state and tractor owners in Benue state

Patrick Hatzenbuehler, Hiroyuki Takeshima, Hyacinth Edeh, and Akeem Lawal

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## ABSTRACT

Market functions for tractors in countries like Nigeria involve various transaction costs due to the indivisibility and low mobility of tractors, the seasonality of demand for tractor services, and the thinness of the market due to low overall demand, among others. In addition, credit market failures have important implications for how well tractor markets function because of the substantial investment required to obtain large capital items for farming, like tractors. Knowledge gaps remain regarding the economic factors that make access to tractors and to tractor hiring services uneven across space in farming systems such as those found in Nigeria. Greater understanding of these factors will help inform future policies and development decisions.

We partly fill this knowledge gap through a qualitative review of tractor markets in Nigeria. We describe conceptually how the unique characteristics of these markets are related to various transaction costs and review Nigerian government policies for mitigating market failures in providing credit for tractor purchases, both at federal and state levels. We then shed light on the business characteristics of both tractor sellers and owners in Kaduna and Benue states, respectively, based on two small surveys. Since such information has not been widely documented in African countries, including Nigeria, we also describe how the characteristics of tractor sellers and owners are associated with various transaction costs in tractor markets. The surveys suggest that several supply-side factors lead to significant unevenness across space in access to tractors and to tractor hiring services. However, the government may not be able to address such unevenness effectively. Rather, government can play a role in informing stakeholders on how the unique characteristics of tractors may lead to such unevenness in tractor market performance due to economic factors. However, it remains an empirical question to what extent the private sector can mitigate the effects of supply-side characteristics on the spatial distribution of accessibility to tractors and hiring services.

**Keywords:** transaction costs, tractor sellers, tractor owners, Kaduna state, Benue state, Nigeria

## 1. BACKGROUND AND OBJECTIVES

The Malabo Montpellier Panel (2018) report on agricultural mechanization in Africa promotes action among stakeholders to address the stagnant growth of adoption of tractors and other types of agricultural machinery on the continent. Specifically, the Panel argues that the development of a coordinated mechanization system can greatly reduce poverty and improve economic performance throughout Africa. In this study, we contribute to such efforts to enhance the use of tractors in Africa by describing the key characteristics of markets for tractors in Nigeria. Nigeria is among a set of countries in Africa that has both low agricultural productivity and low agricultural mechanization growth (Malabo Montpellier Panel 2018). Current understanding of the tractor market in Nigeria mainly highlights only specific aspects of mechanization issues or only delves into the application of specific emergent mechanization technologies.<sup>1</sup> Consequently, many stakeholders do not have sufficient understanding of how tractor markets in Nigeria are organized both in vertical and in geographic terms.

We focus on four-wheel tractors and their associated spare parts and implements, because this is the area of mechanization within the agricultural supply chain that has received the most attention from policymakers at both federal and state levels in Nigeria.<sup>2</sup> Tractors are bulky, expensive items, and virtually all tractors operating in Nigeria are imported. Depending on specifications, such as horsepower and type of drive train, new John Deere tractors with 50 horsepower cost USD 20,000, not inclusive of shipping and other import-related costs (TractorsInfo 2018). The dominance in Nigeria's tractor markets of large and expensive tractors and the thinness of markets due to low overall demand result in significant transaction costs. These include search costs on preferred product designs, obtaining spare parts and attachments, and costs related to credit provision, such as loan qualification assessment and monitoring payments and loan performance. These factors force agents in tractor markets, including both private-sector tractor sellers and individual tractor owners, to adopt certain business practices, which can be considerably different from those business characteristics anticipated in standard market theories.

Due to these high costs for tractors and poorly developed capital markets in Nigeria, the federal and state governments have intermittently engaged in direct acquisition and distribution of tractors using public funds. There have been shifts in policies at the Federal Ministry of Agriculture and Rural Development (FMARD) and in some states, such as Kaduna, in recent years to move towards more market-based policy frameworks. However, these government entities remain active in the agricultural mechanization sub-sector, and in some states, such as Benue, subsidies for tractors are planned to increase. Thus, there is a need for stakeholders to improve their understanding of the dynamics that influence the sector, which can help inform future policy and development decisions.

The type of information on tractor markets in Kaduna and Benue state presented in this paper is largely qualitative. It is intended to serve as the foundation for future more rigorous analyses. We first discuss conceptually how the unique characteristics of four-wheel tractors and the structure of the markets in which they are sold in Nigeria are related to various transaction costs and credit-market imperfections. We also describe the policies of the federal government, as well as those of the governments of Kaduna and Benue states, that are oriented towards mitigating credit-market failures for tractor acquisition by

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<sup>1</sup> This includes the technology developed by Hello Tractor, as discussed by the Malabo Montpellier Panel (2018). Hello Tractor helps tractor owners manage their tractor through monitoring tractor and farm activities, compiling them, and providing them to the tractor owner to assist the owner make informed tractor usage decisions, particularly around the provision of tractor services to other farmers.

<sup>2</sup> Furthermore, because of its versatility, the introduction of the tractor has often been considered the single most important mechanical innovation in agriculture (Hayami & Ruttan 1970, pp. 1124–1125).

farmers.<sup>3</sup> We then describe, based on small surveys of tractor dealers in Kaduna state and tractor owners in Benue state, the key characteristics of these tractor sellers and owners. The sample sizes for the surveys are very small largely because the total population of tractor sellers and tractor owners in both states is quite small in the first place – 30 tractor sellers in Kaduna and 68 tractor owners in Benue. The survey results, however, still shed light on the operations of these participants in tractor markets in Nigeria. The activities of these agents remain largely in the informal sector and have not been widely documented in Nigeria or elsewhere in Africa.

Our surveys show that the Kaduna retail tractor market is much more developed than that in Benue state. However, we also see distinct types of actors in both markets. Among tractor sellers in Kaduna state, there is a small group of new tractor sellers clustered around Kaduna city, while there is a larger, more geographically dispersed group of used tractor sellers clustered in three areas along a transportation corridor in an agriculturally productive zone in the northern part of Kaduna state. Among tractor owners in Benue state, they are split between those who obtained their tractors from government sources and those who obtained them from the private market.

The survey results suggest that transaction costs are closely related to the characteristics of the tractor sellers and the tractor owners. The survey of tractor sellers in Kaduna state shows that the new tractor market is highly concentrated among a few dominant firms. The operating scale of these tractor sellers is large, with firms typically selling between 20 and 40 tractors per year mostly to individual buyers. This scale of business may indicate the minimum that is sufficient to profitably overcome transaction costs. Tractor markets in Nigeria are still fairly thin, so that sourcing tractors typically involves significant transportation domestically (often over 500 km), and internationally (USD 1000 in cost). Many tractor sellers also exploit economies of scope, by engaging in repairs and refurbishments of tractors, as well as other income-earning activities. That they do so may be associated with the high transaction costs in contracting out these activities to other specialized agents. At the same time, some transaction costs that buyers face are lowered by the tractor sellers. For example, many sellers provide demonstrations of their tractors to lower the information costs buyers face, while also stimulating demand for the machines.

The Benue tractor-owner survey also shows that government, as it seeks to intervene in tractor markets to accelerate adoption, faces high transaction costs. These costs make it difficult for the government to support only the most efficient tractor owners and service providers. The more efficient tractor owners keep their costs low and are more knowledgeable about tractor brands. Compared to fertilizer or seed subsidies, beneficiaries of government intervention in tractor markets are much fewer. The negative consequences of selecting less efficient service providers or owners to be program beneficiaries, therefore, is more significant in tractor programs than in those for fertilizer or seed.

The rest of the paper is structured as follows. Section 2 describes the theory and literature on transaction costs, within the tractor market context. Section 3 describes recent tractor-related policies of the federal government and Kaduna and Benue states. Section 4 describes the characteristics of tractor sellers in Kaduna state and of tractor owners in Benue state. Section 5 concludes.

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<sup>3</sup>In this paper, we focus on Kaduna and Benue states, because they are two of the seven Feed the Future focus states selected by USAID for where research was to be conducted. Studying tractor-sector issues in these two states is important for several other reasons. Kaduna is one of the states in Nigeria with a significant concentration of tractor distribution channels, according to local stakeholders. In contrast, Benue state is one of the states in Nigeria where information on the local tractor market is very scarce. For example, three rounds of the Nigeria Living-Standards Measurement Study – Integrated Survey on Agriculture found that none of the 160 farm households interviewed in Benue state indicated the use of tractors in any of the three waves (2010/11, 2012/13, 2015/16). While this is due to the very low adoption of tractors in Benue state and the small sample size of the LSMS-ISA, it also motivates us to obtain information of tractor owners through a separate survey.

## 2. ECONOMIC THEORY AND LITERATURE ON TRANSACTION COSTS

Transaction costs are any resources used to implement a transaction (Allen 2000). A transaction is a transfer of a good or service from one party to another (Williamson 1981). Transaction costs for a tractor sale have some unique aspects relative to other agricultural inputs. Specifically, tractors are indivisible technologies, which means they cannot be broken down into sub-units for concurrent use by multiple farmers. This is distinct from divisible technologies, such as fertilizer or seed, for which the common units, e.g., bags, can be divided among individual farmers and be used concurrently (Lu et al. 2016).

Additionally, since tractors are bulky and expensive purchases, the seller incurs transaction costs related to importation and trade, as well as for the search for buyers. Damania et al. (2017) found that machinery use in agriculture in Nigeria is inversely related to transportation costs. Hence, lower transaction costs are associated with greater machinery use. Lower transportation costs can improve the likelihood of technology adoption because they reduce the amount of resources needed to implement the actual physical transfer of the asset. Moreover, lower transport costs increase the likelihood of achieving a match between sellers and willing and able buyers.

The economic theory of cost minimization as outlined in Chambers (1988) is provided here to give some theoretical background regarding how transaction costs can influence the market structure for agricultural machines, especially the types of firms that participate in such a market. We differentiate between new and used tractor markets, since we found that both exist in our field observations, and because the types of firms that participate in these markets likely differ due to their relative ability to accommodate various kinds of transaction costs. The transaction that is relevant for this discussion is the acquisition of a tractor, either imported as a new tractor or sourced domestically as a used tractor after importation. The substantial differences in unit value between new and used tractors due to variation in need for maintenance and risk of breakdown, among other things, means that these markets are segmented. Segmentation here means that the firms participating in the new tractor market generally do not participate in the used tractor market, or vice versa.<sup>4</sup> We assume, however, that there are some overlaps in transaction costs, and so the theoretical framework we outline is applicable to both markets.

In this theoretical exercise, the market has three firm types: private domestic ( $d$ ); government ( $g$ ); and, foreign ( $f$ ). Each of the firms faces the same total cost to purchase a tractor,  $\bar{c}$ . This cost is a function of a general set of inputs related to business operation costs,  $x$ , which are common across firm types, and include such things as electricity, administration, transportation, and a composite bundle of transaction cost items,  $t$ , that include, among others: 1) acquisition of foreign exchange; 2) knowledge of importation-related institutions, e.g., contracts; 3) local knowledge of the domestic tractor market; 4) local knowledge of the domestic agricultural sector; and, 5) general managerial skill. To simplify, we set the general business operation costs price,  $w_x$ , as the numeraire so that its value is equal to 1.

The prices of the composite of transaction costs vary across firm type such that the transaction costs for the private domestic firm are,  $w_t^d$ , those for the government are,  $w_t^g$ , and those for the foreign firm are  $w_t^f$ . Thus, for each firm  $i = d, g, f$ , the decision rule for the supply of a tractor is to do so while minimizing costs based on the firm's own unique transaction cost bundle and the common input costs. Under such conditions, the supply of tractors is defined as,  $y^i = g(x, t)$ . We assume a general linear form of the cost function and a strictly quasi-concave production function, as in Chambers (1988; p. 59), so that there is a unique cost minimizing bundle of common inputs and transaction cost-related inputs that each firm chooses to reach as an ideal level of tractor supply. The feasible input bundles are, thus, determined by:

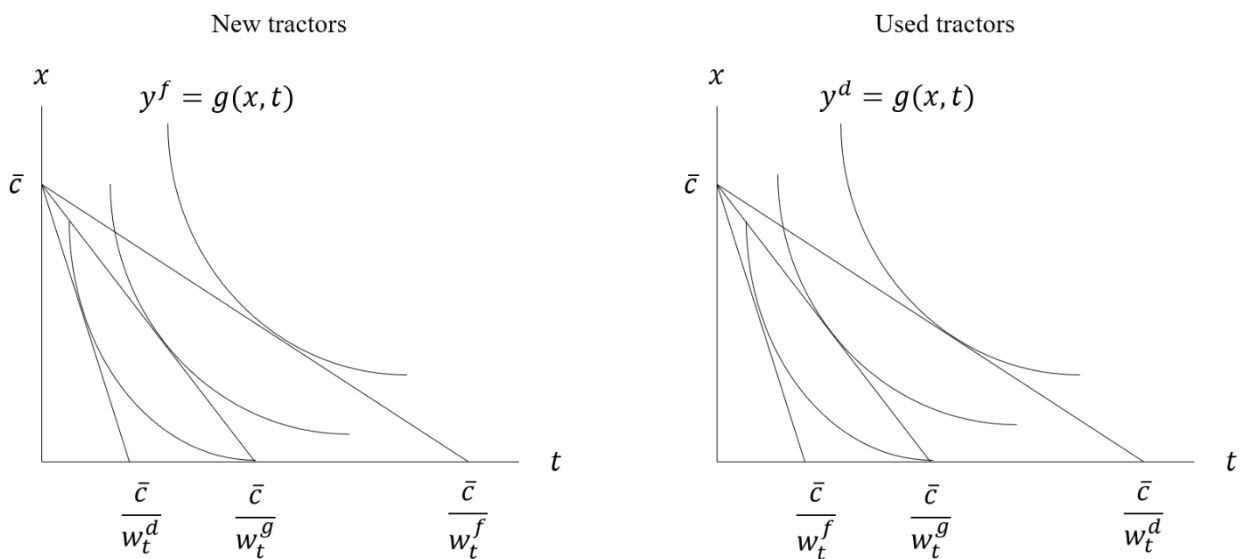
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<sup>4</sup> The data from the survey of Kaduna retailers presented in section 5 are consistent with this specialization.

$$\bar{c} = x + w_t^i t. \quad (1)$$

Figure 1 shows the feasible input combinations for each type of firm based on the variation in transaction costs across firm types for both the new and used tractor markets. For the new tractor markets, we conjecture that for any given level of general business inputs,  $x$ , the foreign firm can afford a larger number of transaction cost-related inputs, and can, therefore, also supply more new tractors than the government or the domestic private sector at a given total cost. This is plausible due to findings such as those in Menon (1996) that multinational firms commonly transfer foreign exchange across units within the firm to accommodate exchange rate fluctuations, and, hence, have easier access to foreign exchange than firms that must source foreign currency domestically, and, in doing so, incur foreign currency conversion fees. The government also likely has an advantage in access to foreign exchange over private domestic firms due to the common currency exchange activities of the central bank in its actions to devalue and revalue the currency. In the market for used tractors, where the foreign exchange cost advantage is irrelevant and local knowledge of market conditions and the general agricultural sector are more important, domestic private firms plausibly have a transaction cost advantage relative to foreign firms and the government. Specifically, domestic private firms have lower search costs than both foreign firms and the government due to specialization and greater local knowledge of primary and upstream market conditions.

**Figure 1. Stylized representation of the Nigerian new and used tractor markets in a cost minimization framework**



Source: Authors.

Note: This figure is adapted from that in Chambers (1988; p. 59). The input  $x$  is common across firm types,  $i = d, g, f$  (private domestic,  $d$ , government,  $g$ , and foreign,  $f$ ), and the total cost to supply a tractor,  $\bar{c}$ , is assumed fixed. The composite bundle of transaction costs  $t$  varies across firm types due to conjectures that their prices,  $w_t^i$ , vary across firm types. For example, the foreign firm is conjectured to have a lower cost of acquiring foreign exchange than the government and domestic private firms.

The main takeaways from this theoretical discussion are that: 1) transaction costs can limit business establishment and market participation, and thus, segment markets for differentiated products such as new and used tractors; and, 2) in the case of a fully imported product, like tractors in the case of Nigeria, government intervention is more likely if there is a mandate to meet a certain quota and foreign firm participation is limited, since the government has a cost advantage relative to domestic private firms in obtaining foreign exchange for imports. We next discuss how transaction costs within each of the markets can influence market structure, both regarding the number of firms that participate and the geographical positioning of firms.

## 2.1 Transaction costs and market structure

In the transaction cost literature, the transaction or transfer of an asset or service is the unit of analysis rather than the actual asset or service (Williamson 1981). A shift to focus on the resources needed to make a transaction provides insights into the structure of the market, because some transactions require more monetary and temporal resources than others. Williamson (1981) makes a distinction between firms and markets. That is, in situations in which there is greater certainty regarding the transaction, markets, composed of individual entities, will enable efficient implementation of transactions. However, when there is greater uncertainty regarding the implementation of transactions, individuals will form firms to pool resources and better accommodate shifts in circumstances. Since tractors are an imported good that is expensive and complex, and the potential buyers are dispersed over wide areas, it follows that both sellers and buyers face much uncertainty in transactions of tractors. This implies that there are high transaction costs, especially for new tractor sales, and, hence, there is a natural tendency for individuals to pool resources into the formation of firms rather than to implement transactions in a market setting composed of many independent entities that do not cooperate with each other. Implementation of sales for used tractors is plausibly less costly than it is for new tractors. Thus, the formation of firms to pool resources across individuals is less needed, and, hence, less likely to occur.

### 2.1.1 Market competition and concentration

These ideas regarding the formation of firms to accommodate high transaction costs and uncertainty and the likelihood that differentiated products, such as new tractors and used tractors, experience varying degrees of firm formation have implications for market competition and concentration. The structure-conduct-performance paradigm (SCPP), which examines the relationship between market structure and individual firm decision-making, and its successor literature, as outlined by Sheldon & Sperling (2003), is relevant here. Early contributions to this literature argued that the degree of competition or concentration of an industry determines the profitability of firms that participate in that sector. However, more recent studies argued that the performance of individual firms and the degree of competition is endogenous. This implies that the profitability and cost structure of a firm can influence its choice to participate in an industry.

The tractor market in Nigeria has similarities to those agricultural commodity markets in Africa for which there are many farmers that are dispersed over wide geographical areas. Of interest in such markets, as argued by Rousseau et al. (2015), relates to the costs of implementing transactions, which has implications for the degree of competition and market structure. For example, in the case of the shea nut market in Burkina Faso, the presence of many small farmers dispersed over wide areas means that transaction costs for gathering shea nuts are higher than they would be if farmers were larger and closer together. This has led to an organizational structure that has a pyramid form with a few corporate end-users at the top buying from a higher number of wholesalers, who have bought shea nuts from the many, dispersed farmers (Rousseau et al., 2015). More generally, as Delgado (1995) argued, African agricultural markets have higher transaction costs and marketing risk than other parts of the developing world. It follows that there will be greater competition and more firms in the used tractor market than in the new tractor market due to the relatively low transaction costs associated with used tractor sales.

### 2.1.2 Regional and vertical clustering

The nature of transaction costs not only has implications for the participation of firms and the interaction of firms within an industry, but also for the choice of the actual geographical locations where firms choose to implement their business activities. Based on findings in the New Economic Geography (NEG) and Evolutionary Economic Geography (EEG) literatures, firms that are engaged in tractor sales are expected to cluster in certain geographical areas. In the NEG paradigm, as outlined by Krugman (1991), industry clusters form in certain geographical areas because some firms initially establish themselves in certain locations and

then other firms follow. This sequence of choices of firms to locate in a certain area occurs because of benefits that emerge from external economies, which are like the agglomeration externalities of Marshall (1920), such as pooling of labor, improved access to markets (both input and output), and technology spillovers.

Such clustering of firms in the same industry has been observed as a stylized fact for various sectors in Africa by McCormick (1999). She argues that the formation of clusters is particularly important for African industrial development due to the existence of poorly developed capital markets, thin final product markets, and low physical infrastructure. These characteristics imply that some business costs can be reduced or shared through clustering. An example of such clustering in the agricultural sector is the concentration of processing and storage infrastructure in urban areas observed by Jayne (1994).

## 2.2 Credit market imperfections

The relatively poor condition of African credit markets is likely an important part of the explanation of the current structure of industrial sub-sectors across Africa in general, since the quality of local credit markets influences the ability of buyers to participate in markets and sellers to stay in business. Credit-market failure, which is common in developing countries, affects the level of transaction costs in any markets. Even in Asia or Latin America, the use of formal-sector credit for tractor financing had been largely limited in the early phases of tractor market development. In the 1980s, personal savings were the dominant financial source for investments in rice threshers in Thailand and the Philippines (Juarez and Pathnopas 1983; Mongkoltanatas 1986). In those African countries that are now in an early phase of tractor adoption, personal wealth and savings of the investors are the major source of finance for investments in agricultural machinery (Kienzle et al. 2013, Figure 1.4; Chapoto et al. 2014; Takeshima et al. 2015; Diao et al. 2016). Such personal wealth had often accumulated from farm incomes (Takeshima et al., 2017), although recently urban residents are seen to account for an important share of machinery investments (Jayne et al., 2016). Where the purchase of tractors or other agricultural machines were financed by loans, one of the dominant sources of such loans has been tractor distributors (IRRI 1986, p. 13) or tractor leasing companies (World Bank 2009).

Evidence for formal bank financing accounting for a significant share of tractor purchases via finance is relatively scarce, especially in smallholder-dominated countries. While financing from banks accounted for a significant share of the financing for tractor purchases in Brazil in the 1960s (Sanders & Ruttan 1978; Elias 1985; Rao 1989), the farming sector in Brazil had historically been characterized by substantially larger average farm sizes – 75 ha in 1961 and 59 ha in 1970 (de Janvry & Crouch 1981) – than in Nigeria today, where average farm sizes are between one and two hectares. Therefore, it is unclear whether direct financing by banks is currently applicable to countries like Nigeria. The use of other loans, such as microfinance loans for large tractors has been limited in Africa, because microfinance loan packages are small and come with short repayment periods (Kahan et al., 2018).

Where bank financing is provided for tractor purchase in Nigeria, the repayment period is often relatively short and its provision is dependent on exchange rate fluctuations. The experiences of the Tractor Owners and Hiring Facilities Association of Nigeria (TOHFAN) provide an instructive illustration. TOHFAN now manages over 550 tractors, of which 200 were acquired by tractor owners under a partnership with the Nigeria-based First City Monument Bank (FCMB). Under the program, the bank provided financing for tractor acquisition and associated TOHFAN management fees for qualified participants. The loan repayment was over two years (Garba 2018). However, due to the substantial devaluation of Naira from 170 Naira/USD in February 2015 to close to 300 Naira/USD by July 2016, the resultant nearly doubling of the tractor price in Naira caused tractor acquisitions under the program to decline from an average of 44 tractors per year between 2013 and 2016 to zero in 2017. Longer repayment periods could reduce the

effects of such devaluations, but high costs in payment monitoring, among others, often discourage banks from extending loan repayment periods.

To help facilitate transactions in the absence of vibrant credit markets, developing country governments have often intervened by directly procuring tractors and distributing them with some form of subsidies. However, in Nigeria, the quantities of tractors obtained through such schemes have accounted for a relatively small share of the total number of tractors used in the country. This indicates that government support for financing has contributed relatively little to growth in the number of tractors and other agricultural machines in use.

Developing countries in Asia have experienced a similar evolution in government interventions. In Bangladesh, for example, between the early 1960s and the early 1980s, over 6,000 power tillers were imported, of which more than 4,000 were sold to the private sector on highly subsidized credit provided through the Bangladesh Krishi Bank (BKB) (Jabbar et al. 1983). However, by the early 1980s, bullocks still plowed an estimated 98 percent of cropland, and most operations were still done manually or by animal draft (IRRI 1986, p. 90). A more substantial increase in power tillers in Bangladesh occurred from the late 1980s when private demand for power tillers had increased substantially and importations of Chinese power tillers started. The number in use reached 100,000 by 1996 with little direct intervention by government.

Similarly, in the Philippines, some power-tillers had been financed through the First Central Bank – International Bank for Reconstruction and Development (CB-IBRD) fund that was initiated in 1965 (Sanvictores 1978). While some agricultural machines, like tractors and power tillers, had been sold through such funding mechanisms during the late 1960s and the 1970s, they accounted for a relatively small share of total machinery sold during this period. For example, while over 3,000 power tillers were sold through the CB-IBRD scheme between 1966 and 1975, this accounted for only about 10 percent of the over 31,000 power tillers sold during this period. Similarly, the just over 4,000 four-wheel tractors sold through CB-IBRD between 1961 and 1976, which accounted for only about 20 percent of total tractor sales (Sanvictores 1978).

While some Asian countries lately have gradually increased subsidies on agricultural machinery, it has generally happened after substantial growth in mechanization provided by the private sector had occurred. For example, in China, large-scale subsidy provision started in 2004 (Zhang et al., 2017). However, by then, 40 percent of sown areas in China was mechanically plowed (Wang et al., 2016), which is considerably higher than around the 10 percent share in Nigeria today. Although subsidies since 2004 in China might have contributed to further increases in the mechanically plowed area, which is now close to 70 percent of total sown area (Wang et al., 2016), significant growth in mechanical land preparation before 2004 was likely induced by other factors than subsidies, such as the introduction of hybrid varieties and institutional reforms in the agricultural sector.

### **3. TRACTOR SUBSIDY POLICIES IN NIGERIA: FEDERAL LEVEL AND KADUNA AND BENUE STATES**

Over the course of the past decades, the federal and various state governments in Nigeria have sought to boost tractor usage in three main ways: 1) direct procurement and subsidized sale to farmers and farmer groups; 2) facilitation of farmer and farmer group acquisition at subsidized rates through public-private partnerships in coordination with local banks; and, 3) publicly administered tractor hire services through federal and state level agricultural development programmes (ADPs) (PrOpCom 2011; Takeshima et al. 2013). In this section, we describe how the federal and state mechanization programs in Benue and Kaduna

states have evolved over time and identify how the policy shifts are related to local market structure and market development dynamics.

Since the launch of the Agricultural Transformation Agenda (ATA) in 2011 and its successor, the Agriculture Promotion Policy (APP), in 2016, the Nigerian Federal Ministry of Agriculture and Rural Development (FMARD) has, inter alia, sought to use public funds to boost agricultural private sector development. In addition to the large-scale Growth Enhancement Scheme (GES), which provided subsidies on fertilizer and improved seeds to millions of farmers (see Wossen et al. 2017), FMARD has also procured agricultural machines for distribution at favorable borrowing rates. Specifically, in 2011, FMARD established the Private Sector Driven Agricultural Mechanization Programme (PSDAMP), which allowed private sector individuals and groups to obtain tractors initially acquired by the FMARD to form Agricultural Equipment and Hiring Enterprise (AEHE) businesses, which specialize in the rental of tractors and other farm machinery. The program’s goal is to provide individuals and groups who are interested in establishing agricultural mechanization services enhanced access to equipment by lowering acquisition costs (FMARD 2011).

Table 1 displays the timing, the number of AEHE centers established, the amount of equipment available at subsidized rates per AEHE center, and a description of the subsidy policy for each PSDAMP phase. For implementation FMARD acquired the tractors from foreign partners, including Case and John Deere, and then individuals or groups submitted applications to FMARD to establish AEHEs. Successful applicants were provided tractors upon provision of the 20 percent down payment on the retail price. The remainder of the cost of the tractor was met with loans from FMARD; the Bank of Agriculture, a federally operated and administered bank; and, vendor partners. The details of the subsidy are such that the Bank of Agriculture and vendor partners are paid back first FMARD receives its funds afterwards. The nominal and economic costs absorbed by FMARD in its administration of the program are foreign exchange acquisition, contracting and purchasing of equipment, shipment and storage of equipment during the application period, and lost interest payments during the first two years of repayment. The planned nearly 50 percent expansion of the program in 2018 shows that federal government support for the establishment of AEHEs remains a priority of FMARD.

**Table 1. Federal Ministry of Agriculture and Rural Development tractor acquisitions under the Agricultural Equipment Hiring Enterprise Initiative of the Private Sector Driven Agricultural Mechanization Programme: Quantities and subsidy policy description**

Year	Number of AEHE centers established	Subsidized equipment available per center	Subsidy policy
Phase 1 2011	80	5 tractors and 5 power tillers	FMARD, Bank of Agriculture (BOA) and Vendor Partners provide 80 percent loan on tractors at retail price; Service Provider Operators provide other 20 percent; 7 percent interest rate, with payment over 4 years; BOA and vendor partners repaid in first 2 years, and FMARD repaid in last 2 years
Phase 2 2015	31	3 tractors	
Phase 3 2018 (planned)	80	5 tractors	
Total <sup>a</sup>	191	896 tractors and 400 power tillers	

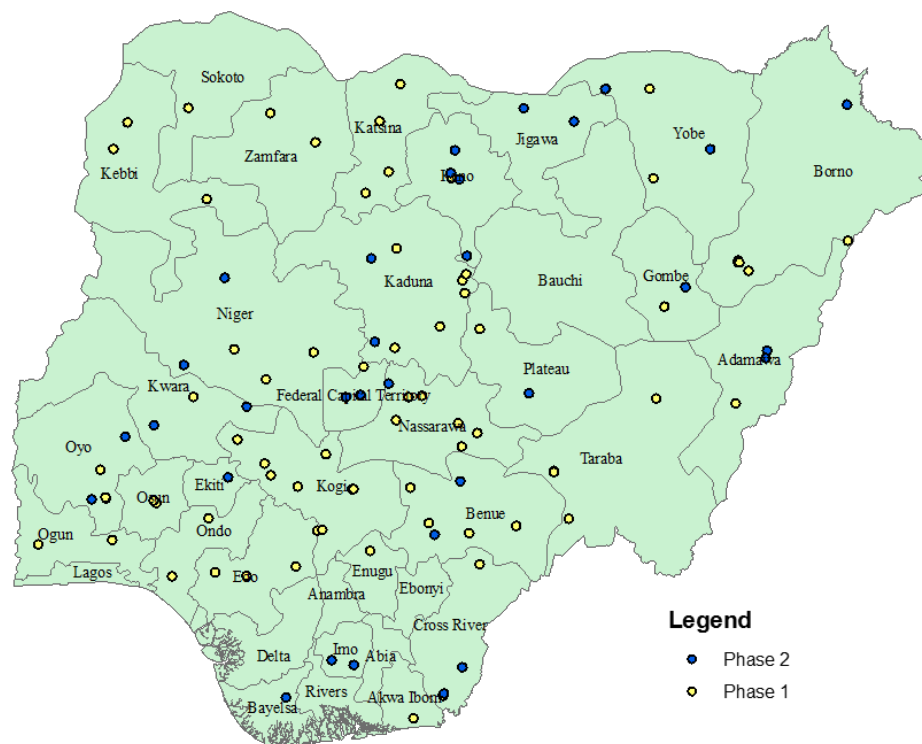
Sources: FMARD (2011) and Abubakar (2018)

<sup>a</sup> Assuming centers obtained maximum amount subsidized. AEHE = Agricultural Equipment Hiring Enterprise.

Figure 2 is a map of Nigeria that shows the geographic distribution of AEHE businesses established during phase 1 and phase 2 of PSDAMP. Most phase 1 enterprises were concentrated in the Northwest, North Central, Southwest, and Northeast regions. Some states, such as Kaduna, Kano, Kogi, and the Federal Capital Territory (Abuja), had clusters of AEHEs. The enterprise distribution for phase 2 of the program shows more geographic dispersion. Some AEHEs were established in the Southeast and South-South regions, where they were not in phase 1. A few states, such as Anambra, Bauchi, Delta, and Lagos, do not yet have any AEHEs. We also find that in certain states, such as Borno, Niger, and Taraba, which have large

land areas, the concentration of AEHEs in one part of the state. This means that large areas do not yet have easy access to tractor services provided through PSDAMP. Implementation of phase 3, and future extensions of the program, will determine whether there is sufficient demand in these areas to justify AEHE establishment to supplement any existing state or private sector enterprises.

**Figure 2. Agricultural Equipment Hiring Enterprise Locations for Phase 1 and Phase 2 of the Private Sector Driven Agricultural Mechanization Programme**



Sources: Abubakar (2018) and DIVA-GIS.

Figure 2 shows that AEHEs were established in both Benue and Kaduna states during phases 1 and 2 of PSDAMP. Their establishment coincided with various subsidy schemes implemented by the Ministries of Agriculture in each state.<sup>5</sup>

Table 2 presents the timing, quantities, and subsidy details for the mechanization acquisition programs implemented by the Benue Ministry of Agriculture and Natural Resources (BMANR) in recent years. While both the Benue state government and FMARD mechanization policies supported the expansion of mechanization with the use of public funds, the BMANR programs differ. First, the primary recipients of the tractors are farmers or corporate farms, rather than independent tractor service businesses. Second, BMANR programs have provided a direct subsidy, such that the recipients can acquire a tractor by paying a price that is substantially lower than retail. Thus, the relative costs absorbed by the BMANR are substantially higher than those accommodated by FMARD, since BMANR absorbs all the same nominal and economic costs, such as costs of acquisition and storage, but also pays for a substantial share of each tractor in the form of a price subsidy. The BMANR mechanization program planned for 2018 will increase the level of price subsidy to 60 percent, up from 30 percent in previous iterations. This is a signal that the current state government seeks to provide greater support to allow farmers and companies to obtain tractors than was the case over the previous decade. Moreover, the Lower Benue River Basin Development Authority, a federally administered program that has provided tractor rental services,

<sup>5</sup> Takeshima et al. (2013) have further data on historical procurements by state governments for Bauchi, Nasarawa, and Yobe states, and the Federal Capital Territory (Abuja).

remains active in the state. However, it has not acquired any tractors since the inception of the federal PSDAMP.

**Table 2. Tractor procurements and subsidy policy of the Benue State Ministry of Agriculture and Natural Resources from 2005-2018**

	2005	2009-11	2012-16	2018 (planned)	Total
<b>Number of tractors procured</b>					
Benue Ministry of Agriculture and Natural Resources	25	0	148	60	233
Benue Tractor Hiring Authority	13	0	0	0	13
Lower Benue River Basin Development Agency	0	30	0	0	30
<b>Subsidy policy</b>		30 percent subsidy on retail price; 30 percent down payment required on subsidized rate; payments completed over 3 years		60 percent subsidy on retail price; 30 percent down payment required on subsidized rate; payments completed over 3 years	

Sources: Izobo (2018) and Lower Benue River Basin Development Authority (2018).

The Kaduna State Ministry of Agriculture and Forestry (KDMAF) also procured and distributed tractors to farmers and farmers groups at subsidized rates in the past decade, but has adjusted its mechanization program dramatically in the past few years. The most recent procurement effort occurred in 2014, but was discontinued prior to delivery due to an issue with the vendor partner. KDMAF does not currently plan to devote any funding toward direct procurement of tractors, but rather sees its role to be a liaison between farmers and tractor vendors in the state (Musa 2018). When KDMAF was implementing a program to facilitate the purchase of tractors by farmers and farmers group, the program differed significantly from that of BMANR. Specifically, by 2010 KDMAF no longer allowed for tractor purchasers under the program to repay over time. This redesign was likely due to issues associated with repayment failures and the high costs of monitoring tractor recipients who participated in the 2006 program.

**Table 3. Tractor procurements and subsidy policy of the Kaduna State Ministry of Agriculture and Forestry from 2006-2014**

Year	Tractors procured	Subsidy policy
2006	100	40 percent subsidy on the retail price; down payment of one million Naira required; one year for re-payment of the balance
2010	186	60 percent subsidy on the retail price; one-time payment on the subsidized rate
2014	47	60 percent subsidy on the retail price; one-time payment on the subsidized rate
Total	333	

Source: Musa (2018).

This review of past and present tractor procurement and distribution programs by FMARD and the Ministries of Agriculture of Benue and Kaduna states provide several takeaway messages:

- Both federal and state governments remain active in devoting public funds toward the acquisition and distribution of tractors at subsidized rates, but to varying degrees. FMARD's PSDAMP, which procures and distributes tractors to AEHE applicants, is larger than recently implemented programs in Benue and Kaduna states, but is also the least generous in terms of subsidy. Moreover, recently it has been shifting its focus from providing tractors to individual farmers or groups to specialized service providers.
- The continued procurement of tractors by federal and state governments implies that transaction costs related to tractor acquisition remain too high from the point of view of many

Nigerian agricultural policymakers. In consequence, they view public procurement and distribution of tractors as a desirable use of public funds.

- The FMARD and KDMAF programs have evolved toward a more private sector orientation over time, while that of BMANR has shifted toward devoting even greater public funds to farm machinery subsidies.

These overlaps and divergences in policies imply that there are mixed perceptions regarding the development of the agricultural equipment sector by agricultural policymakers at federal level and in various states of Nigeria. In the next section, we describe the structure and performance of the private agricultural machinery markets in Benue and Kaduna states. These case studies describe the general level of development of the agricultural machinery markets in each state, which help provide reasons for why these policy divergences exist.

## 4. CHARACTERISTICS OF PRIVATE AGRICULTURAL EQUIPMENT MARKET IN BENUE AND KADUNA STATES

We implemented two small surveys to gain a more thorough understanding of the level of development of the private agricultural machinery sector in Nigeria. The first survey was of private agricultural machinery sellers in Kaduna state, while the second was of tractor owners in Benue state. Our initial goal was to interview tractor sellers in both Kaduna and Benue states, but there were so few private tractor sellers in Benue state that it was deemed not to be possible to implement the seller survey there. Thus, while there are a few AEHE centers and 70 farmers who own tractors in Benue state, whom we identified through a snowball selection method, the absence of many private sellers of new and used tractors and other farm machines implies that the farm machinery sector is much more developed in Kaduna than in Benue.

The sample sizes are small for both surveys – 30 for the Kaduna tractor seller survey, and 68 for the Benue tractor owner survey, out of whom 54 actually used their tractors in 2017. Nevertheless, the information provided from these surveys is instructive, because so little information exists on tractor sellers and owners in Nigeria.

### 4.1 Tractor Sellers in Kaduna State

Among the 30 Kaduna tractor sellers interviewed, two types of sellers were identified – relatively large sellers mostly handling new tractors (*large-sellers* hereafter), and relatively smaller sellers who mostly sell used tractors (*small-sellers* hereafter). Their respective characteristics are often considerably different. Therefore, we differentiate them in discussions in this section where appropriate.

The survey for tractor sellers covered issues such as the size of individual firms, sources of tractors, motivations for entry into the industry, costs of tractor acquisition and distribution, seasonality of business operations, other tractor service provision, and alternative sources of income. These characteristics of tractor sellers indirectly also offer insights into the types of transaction costs that matter. (The Appendix to this paper summarizes the revenue and cost structures of small-sellers.)

It was observed that both new and used tractor selling firms were clustered in certain locations across the state. Specifically, new tractor sellers were nearly exclusively based in Kaduna city, the state administrative and commercial hub. This is likely due to the presence of the state government, banks, other manufacturers, and transportation infrastructure, e.g., an airport, all of which help facilitate the activities of these new tractor firms. Three clusters of used tractor sellers in Kaduna state were also identified: 1) along a road corridor that extends across the northern part of the state to Funtua, which is just across the border in Katsina state; 2) in Saminaka and its surrounding areas; and, 3) in Zaria and nearby towns. Clustering of

these smaller used tractor firms in these locations allows the firms improved access to spare parts for repairs and refurbishments and knowledgeable workers.

Table 4 provides an overview of the number of tractor firms, and the number of facilities each firm operates, both within Kaduna state and in other parts of the country. Most firms are small and operate only one or two facilities. A few firms are larger and operate up to seven facilities. This implies that firms that sell tractors in Kaduna state are somewhat few, and that they are generally small and do not operate multiple franchises under a common management structure.

**Table 4. Tractor sales facilities operated, number**

Number of facilities	Number in the sample
1	15
2	5
3	0
4	4
5	1
6	3
7	2
Total	30

Source: Authors.

The sellers source their tractors from different types of enterprises, as shown in Table 5. Most firms obtained their tractors from other retailers, distributors, or farmers. This implies that there is a vibrant resale tractor market in the state, and that farmers and businesses commonly buy and sell tractors to each other over time. Only a few of the firms obtained tractors directly from the government or from importing firms. Thus, there are multiple vertical segments within the new and used tractor supply chains, such that firms specialize in the gathering and distribution of tractors.

**Table 5. Sources of tractors for sale**

Type of tractor suppliers	% of tractors purchased from these suppliers	% purchasing at least one tractor from these suppliers	Number of suppliers in total for those who purchased from each type, mean / median
Farmers	32	50	12 / 8
Importers	28	42	2 / 1
Wholesalers	10	35	8 / 2
Other retailers / distributors	10	46	13 / 4
Other individuals in Nigeria	6	31	4 / 2
Government (federal, state)	4	19	4 / 5
Companies / enterprises	1	12	1 / 1
Other individuals abroad	1	8	3 / 2

Source: Authors.

Table 6 shows information on the number of tractors that were sold by each firm in the first year of operation and in the current year.<sup>6</sup> More than half of the firms had greater sales in the current year than in their first year in business. However, many firms had not yet implemented a sale this year at the time of the interviews, which took place during the peak season of tractor sales in March and April. A few firms have expanded greatly since their inception, while others have not grown whatsoever. The finding that the four firms with the top sales account for over three-quarters of total sales implies that a few large firms

<sup>6</sup> Those who could not remember how many tractors were sold in their first year were excluded.

dominate the market, but that a larger number of smaller firms can sell along the periphery and mainly in the used tractor market.

**Table 6. Quantity of tractors sold in first year of operation and current year, sales for 19 selected firms**

Tractor seller ID	Sales of		Tractor seller ID	Sales of	
	tractors in first year, number	Current sales, number		tractors in first year, number	Current sales, number
1	1	2	11	2	7
2	1	3	12	2	20
3	1	5	13	3	22
4	1	7	14	5	0
5	1	12	15	5	3
6	2	0	16	12	50
7	2	0	17	30	45
8	2	0	18	39	100
9	2	0	19	39	100
10	2	0			

Source: Authors.  
Note: 19 observations

The tractor firms provided distinct reasons for entry into the tractor sales business, as shown in Table 7. Most did so because they were familiar with the agricultural sector, and many also knew the tractor business well. Only five of the respondents cited that they expected growth in the agricultural sector to be higher than in other sectors, and that this was their motivating reason for entry. None of the respondents stated that the possession of tractors or other assets was their primary entry factor. These results imply that familiarity with tractors and the agricultural sector are, in general, the key motivating factors for tractor sales business establishment.

**Table 7. Primary reasons for choosing tractor sales business**

Reasons	Share of respondents, %
Already familiar with the business	30
Familiar with agricultural sector	43
Think agricultural sector will grow more than other sectors	17
Already had large stock of tractors, or other necessary capital / assets	0
Others (not revealed)	10

Source: Authors.  
Note: 30 observations

Table 8 provides more detail on the perceptions of tractor sellers regarding knowledge and other skills that they considered useful upon entry into the tractor business. Like the responses on their familiarity with the agricultural sector in general, most respondents said that knowledge of crops grown in the region was critical to their entry. This is potentially because the demand for tractors varies with crops, typically with rice the highest having the highest demand, followed by other grains, while being lowest for root crops or vegetables (Takeshima et al., 2013). Knowledge of potential customers was also important, which is reasonable given the context of generally high transaction costs, including the cost of moving tractors to customer's locations, and the need to establish trust in receiving payments. Few respondents cited general business conditions and laws or regulations as important to their entry decision, which is a signal that these sellers either are highly specialized or there is weak enforcement of these legal measures. Most of the respondents learned about crops grown in the region and the general business environment from common acquaintances. General skills such as reading, writing, and business management were obtained at least to some degree in schools and other training facilities.

**Table 8. Knowledge at entry into the business**

Type of knowledge	Respondents that consider knowledge as critical / somewhat critical / not critical, for entering the business	% having sufficient knowledge when entering the business, among those considering it critical or somewhat critical	How they mastered the knowledge, among those considering it critical or somewhat critical					Years taken to master this knowledge, mean / median
			A	B	C	D	E	
Common crops grown in the region	16 / 9 / 5	76	17	1	5	0	1	8 / 3
Other major industries or employers in the region	5 / 16 / 8	71	17	1	2	1	0	7 / 3
Business operation laws and regulations	9 / 11 / 9	65	16	1	1			3 / 2
Farmers and farmer organizations	12 / 10 / 7	82	11	0	1	2	7	6 / 2
Current number of tractors available in the market	12 / 2 / 15	53	3	0	2	1	4	3 / 2
Other tractor suppliers/retailers/renters	15 / 6 / 8	71	12	0	0	1	6	3 / 2
General business management skills	12 / 7 / 10	79	9	0	10	0	0	3 / 2
Brands and specifications of tractors that are popular in the area	11 / 10 / 8	62	12	0	1	2	3	6 / 2
Typical frequency of machine breakdown and costs of repair / spare parts	12 / 9 / 8	86	10	0	2	4	3	3 / 2
How to operate tractors	10 / 9 / 10	84	15	0	1	0	0	2 / 2
How to repair / maintain tractors	9 / 6 / 14	87	7	0	6	0	0	3 / 3
Spare parts suppliers nearby	11 / 3 / 15	57	9	0	2	0	2	4 / 4
Repairers nearby	6 / 11 / 12	88	9	0	1	0	3	3 / 2
Potential customers in other LGAs	14 / 10 / 5	71	7	0	0	1	13	3 / 2
Potential customers in other states	17 / 7 / 5	63	7	1	0	2	12	3 / 2
Accounting / book-keeping	8 / 10 / 11	78	5	0	7	0	0	3 / 2
Reading skills	9 / 12 / 8	81	6	0	13	0	0	5 / 3
Writing	10 / 10 / 9	80	2	0	14	0	0	5 / 3

Source: Authors.

Note: A = Self-learning by observing family members, friends, neighbors;  
 B = Self-learning through media (internet, newspaper, radio, TV);  
 C = Through external training program;  
 D = From suppliers;  
 E = From buyers.

Knowledge of potential customers was commonly cited as a reason for business entry. Almost two-thirds of the tractors that were reported as sold went to individual farmers, and nearly all the sellers provided at least one tractor to an individual farmer (Table 9). Typically, those selling to individual farmers sell to about 22 such buyers (sample median) or 38 buyers, on average. These numbers suggest that, even for fairly expensive items like four-wheel tractors, sellers seem to deal with a somewhat large number of buyers. There may be some scale-economies in the business, where knowledge requirements on the business are still high due partly to transaction costs discussed above. Sales to other retailers and distributors, cooperatives and farmers organizations, and non-governmental organizations were also common. Relatively few tractors were sold to government agencies, implying that government agencies that do acquire tractors tend to deal directly with importers or foreign vendor partners rather than buying through local firms.

**Table 9. Characteristics of tractor buyers**

Type of buyers	% of tractors sold to these buyers	% selling at least one tractor to these buyers	Number of buyers, among those who sold to each type of buyer, mean / median
Individual farmers	67	96	38 / 22
Companies / enterprises	1	16	3 / 3
Other retailers / distributors	9	36	11 / 5
Government agencies	3	12	3 / 3
Non-governmental organizations	12	28	2 / 2
Cooperatives / farmer organizations	9	28	27 / 13

Source: Authors.

Table 10 provides information on importation patterns among tractor sellers. Only about a quarter of the surveyed firms imported tractors, and less than that imported other agricultural machines or spare parts. The most common countries of origin for imported tractors were India and Pakistan, where, we were told, U.S. and Europe-based tractor manufacturers currently have production facilities.

**Table 10. Importation of tractors and other machines by tractor sellers in Kaduna state**

Category	Tractors	Other agricultural machines	Spare parts for tractors or other agricultural machines
Tractor sellers who are also importing tractors or other types of machines, percent	27	24	14
Countries of origins	India – 4 Pakistan – 4 UK – 1 Netherlands - 1	Pakistan – 3 Turkey – 2 India – 1 UK - 1	Pakistan – 3 India – 1
Typical transportation costs, USD/item	1,000	3,068	972
Typical lead time between placing order and receiving the product, days, mean / median	82 / 90	84 / 90	110 / 120
Source of information about these foreign suppliers, among sellers who responded to question, number of sellers:	Did not know before, and supplier contacted you Did not know before, and you contacted supplier Not related, but knew personally Introduced by the government Other	3 2 1 1 2	3 2 3 2 1
Reasons for not importing from foreign countries, among sellers who responded to question, number of sellers:	High costs of shipping Lack of connection to foreign suppliers No demand in the local market Lack of information about machines in foreign countries Other	9 5 2 1 6	8 3 3 1 7
Sellers reporting that they do not import these machines because of these reasons (other than “no demand”), percent	57	36	48

Source: Authors.

Note: Observations: 30 tractor selling firms. Due to the small sample size, figures across all origin countries are combined.

The finding that it takes more than eighty days on average to import a tractor after the initial order, also shown in Table 10, is significant, especially when considering that the peak period of tractor sales occurs between March and May. This implies that the firms must not only manage their cash flow to have

enough funds to purchase and transport the tractors, but also plan well in advance to place the orders so they arrive by the peak sales period.

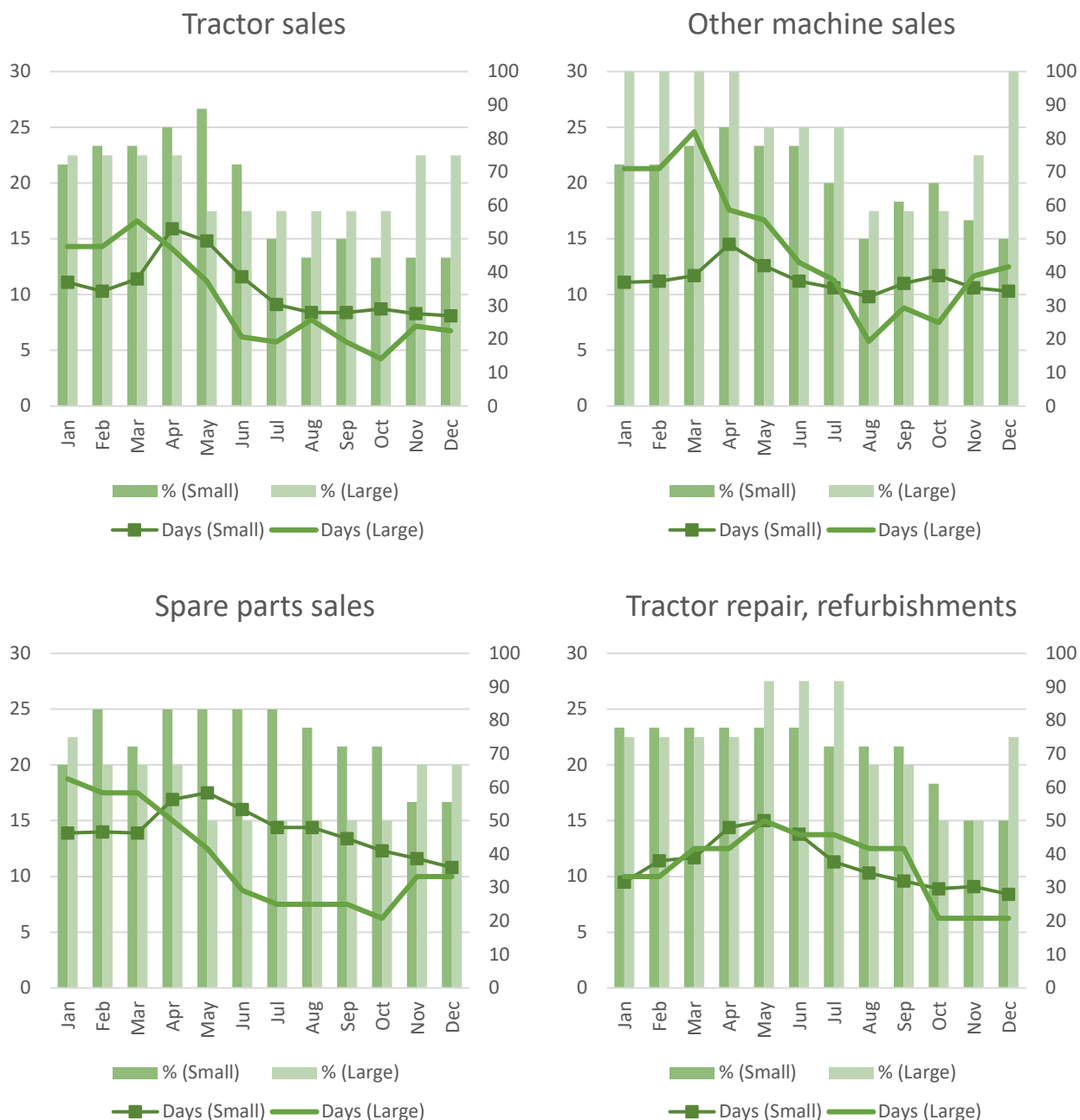
High shipping costs were commonly cited as a primary reason for not importing tractors. The reported typical figure for shipping costs per tractor of about USD 1,000 is small relative to the typical value of tractors which is at a minimum USD 20,000. However, these costs may be substantial relative to the profit margin the sellers obtain (see the Appendix for more details on net revenue). Long distances to their tractor suppliers may, therefore, remain an important source of transaction costs for tractor sellers .

Interestingly, most tractor importers indicated that they did not know the foreign suppliers before they started importing. Often these foreign suppliers contacted the tractor sellers, while occasionally it was the reverse. These patterns indicate that establishing such connections may not be very costly. The lack of connection to foreign suppliers is also reported as a secondary constraint that may result in a seller not importing tractors. Additional studies are required to better understand the process through which these connections between tractor sellers in Kaduna state and foreign suppliers are formed.

Transaction costs are also primarily responsible for seasonality in the business operations of tractor sellers. Figure 3 illustrates this seasonality in terms of average days operated in each month and the percent of sellers surveyed operating at least one day in each month for the sales of tractors, other machines, spare-parts, and tractor repair/refurbishments, respectively, differentiated by large and small tractor sellers.

Business operations related to tractor sales, repairs, or refurbishments exhibit seasonality for both types of sellers. Large sellers also exhibit considerable seasonality for activities related to the sales of other machines or spare-parts. This is primarily due to the seasonality of demand, as farmers in sub-Saharan Africa prefer to obtain agricultural inputs right before the start of the production season. This pattern appears to hold for tractors, other machines, and spare parts. Since demand is seasonal and time-sensitive, potential buyers prefer to minimize their transaction costs, including the time associated with search costs. Such factors also induce sellers to cluster to increase the number of potential buyers. However, the extent of seasonality is somewhat modest for small sellers for certain operations, including the sales of other machines and spare parts. This may explain in part why these tractor sellers are less clustered than the large tractor sellers.

**Figure 3. Seasonality of business operations of tractor sellers, by month and scale of business – left axis is average days operated each month; right axis is percent of sellers in sample operating at least one day in each month**



Source: Authors.  
 Note: Observations: 30 tractor selling firms.

Those who source their tractors domestically also face substantial transportation costs in terms of transport equipment rental, fuel, and time, as shown in Table 11. It is relatively common for tractor purchasers to pay for the transport of the tractor from the seller’s premises. On average, domestically-sourced tractors are obtained from sellers over 500 kilometers away, and it takes over ten hours for delivery. There are only a handful of commercial hubs in Nigeria, mainly in the south near the ports, to which new tractors are initially imported and from where they are then distributed throughout the country to clusters of tractor sellers, such as that found in Kaduna state. Similarly, for used tractors, domestic markets are still fairly thin.

**Table 11. Methods of transportation for buying and selling tractors**

		Typical distance travelled to purchase tractors for those buyers who cover transportation costs, mean / median		
		km	hour	
Pay transportation cost of purchased tractors, percent of buyers	50			
Typical mode of transportation, %	Rent loader + driver	50	515 / 625	10 / 11
	Pay transporter	43	469 / 200	52 <sup>a</sup> / 12
	Drive tractor	7	200 / 200	5 / 5
	Use own loader	0		
	All	100	475 / 350	28 / 11

Source: Authors.

<sup>a</sup>This figure may include the total time between placing the order and receiving the tractor.

Most tractor sellers demonstrate the capabilities of their tractors and other machines to potential buyers (Table 12). Smaller sellers in particular said that such demonstrations were common and were held at least a few times a year. While uncommon for large sellers, when they did have them, they invited a greater number of potential buyers (91 potential buyers on average), and they were implemented some distance away from their business base. These demonstrations help reduce transaction costs associated with information gathering for potential buyers, so tractor sellers are incentivized to provide these services.

**Table 12. Activities related to provision of information to potential buyers**

Category	Frequency	Tractors			Other agricultural machines
		All	Large sellers	Small sellers	
Provide demonstration of tractors to potential buyers, %		53	58	50	37
Frequency of providing demonstrations, %	Once a month	12	0	20	
	A few times a year	53	14	80	73
	Once a year or less	35	86	0	27
Average number of buyers to whom demonstration is provided, for sellers who provide demonstrations	Once a month	2		2	
	A few times a year	17	75	10	14
	Once a year or less	75	75		80
Approximate number of buyers in a year <sup>a</sup> to whom demonstrations are provided, for sellers who provide demonstrations		52	91	25	47
Typical distance travelled to provide demonstration, minutes	Once a month	5		5	
	A few times a year	50	24	26	45
	Once a year or less	23	23	24	0
	All	37	54		33
Observations		30	12	18	

Source: Authors.

<sup>a</sup>For those answering "a few times a year", assigned 2.5 times a year.

Table 13 shows that demonstrations remain the primary type of advertising used by tractor sellers. No sellers use radio or television advertisements, and less than half use the internet for sales or purchases of tractors. Additionally, of those who use the internet for sales of tractors or tractor parts, the use of the internet was attributed for only between 10 and 20 percent of all sales. These results imply that face-to-face interactions remain the most important medium for the exchange of information and resources related to a tractor sale.

**Table 13. Use of internet for advertising and business promotion**

	Small	Large
Use internet to buy or sell tractors, %	17	83
Percent of time internet is used (if > 0) (mean / median)	10 / 5	18 / 20
Use internet to buy or sell agricultural machines	11	83
Percent of time internet is used (if > 0) (mean / median)	8 / 8	12 / 10
Use internet to buy or sell tractor attachments / spare parts	11	50
Percent of time internet is used (if > 0) (mean / median)	19 / 19	13 / 13
Use internet to buy or sell spare parts for other agricultural machines	6	50
Percent of time internet is used (if > 0) (mean / median)	6 / 6	13 / 13
Observations	18	12

Source: Authors.

The tractor sellers not only provide farmers' access to tractors, other machinery, and spare parts for purchase, but also provide many repair and refurbishment services, either for a fee or on tractors they have acquired for resale, as shown in Table 14. While there were somewhat more tractors repaired than refurbished, the presence of refurbishment services is a signal that the used tractor market successfully operates in extending the use-life of tractors. Engines, ignitions, transmissions, and hydraulic systems were the most commonly repaired parts.

**Table 14. Repair and refurbishment of tractors**

Parts	% repairing this part before selling tractors	Number of tractors with this part repaired, mean / median		% refurbishing this part before selling tractors	Number of tractors with this part refurbished, mean / median	
			Among those who actually repaired			Among those who actually refurbished
Engines	57	4.0 / 1.5	8 / 7	33	2 / 0	7 / 8
Parts for fuel supply & carburetion system	31	2.2 / 0	8 / 5	17	1 / 0	9 / 5
Tires	21	1.6 / 0	8 / 3	24	4 / 0	16 / 10
Parts for cooling systems	24	2.1 / 0	9 / 7	24	2 / 0	9 / 5
Parts for electrical ignition system	48	4.8 / 0	10 / 8	21	2 / 0	10 / 9
Parts for transmission system	45	3.6 / 0	8 / 8	38	2 / 0	6 / 4
Parts for hydraulic system	52	4.0 / 0.5	8 / 8	45	2 / 0	5 / 3
Bearing and beam	41	3.0 / 0.0	8 / 8	28	2 / 0	8 / 8
Drive shaft	21	1.9 / 0.0	10 / 7	17	1 / 0	5 / 4
Axel and drawbar	10	1.1 / 0.0	8 / 6	10	2 / 0	9 / 5

Source: Authors.

Such engagements in various activities other than tractor sales may be driven by economies of scope. Economies of scope often arise due to transaction costs in contracting out certain activities to other specialized agents. Transaction costs in this case may be associated with finding and bringing tractors to repairers or mechanics or finding such repairers or mechanics who can do the repairs and refurbishment that the sellers want.<sup>7</sup>

Tractor sellers are also involved with other activities to supplement their income, as displayed in Table 15. Half of the interviewed respondents were involved in farming, although this was more common

<sup>7</sup>It should be recognized that there are a significant number of repairers and mechanics in the informal sector in countries like Nigeria, who provide services to various tractor owners at costs below the willingness-to-pay of tractor owners or sellers, and their roles should not be undervalued. However, transaction costs are also important to the extent that interviewed tractor sellers often take care of repairing or refurbishing the tractors themselves.

with small than large sellers. Of those who do farming, the median farm size is eighteen hectares, which is somewhat big for farms in Nigeria. While some additional sources of income are reported, the firms are generally specialized as tractor sellers – 80 percent said that tractor sales are their largest source of income. It is notable that, six out of 12 large sellers had a government salary as their primary source of income prior to their current business. While future studies need to investigate this more closely, work experience at government institutions might have helped them overcome various transaction costs, including the cost of obtaining information on foreign suppliers and developing a business relationship with commercial banks to finance business investments, among others. For small sellers, the primary sources of income prior to tractor sales reported were farming and mechanic services.

**Table 15. Alternative sources of income among tractor sellers**

Categories	All	Small sellers	Large sellers
Incomes from farming, %	50	67	25
Incomes from farming in rainy season, %	50	67	25
Incomes from farming in dry season, %	27	28	25
Rainy season farm size, ha, mean / median	24 / 18	28 / 20	11 / 11
Dry season farm size. ha, mean / median	13 / 3	21 / 8	1 / 1
Rice farming, %	33	39	25
Farming other than rice, %	47	61	25
Livestock rearing, %	7	11	25
Other major sources of income excluding farming, %	37	56	8
Receives salary from government institutions, %	3	6	0
Construction, %	3	6	0
Trading agricultural machinery, spare parts, %	87	11	100
Providing mechanic service for agricultural equipment, %	3	0	8
Reporting tractor sales business as the largest income source, %	80	89	67
Percent of income realized from tractor sales in 2017, mean / median	64 / 75	68 / 75	56 / 60
Percent of income realized from sales of other agricultural equipment in 2017, mean / median	48 / 40	51 / 50	44 / 13
Were mechanic or repairers of machines, before entering tractor sales business, %	23	22	25
Largest source of income before entering the tractor sales business			
Farming	30	33	25
Salary from government institutions	23	6	50
Mechanic / repairers of machines	17	28	0
Sales of automobiles	13	11	17
Livestock rearing	3	6	0
Transportation	3	6	0
Other	10	12	8
Observations	30	18	12

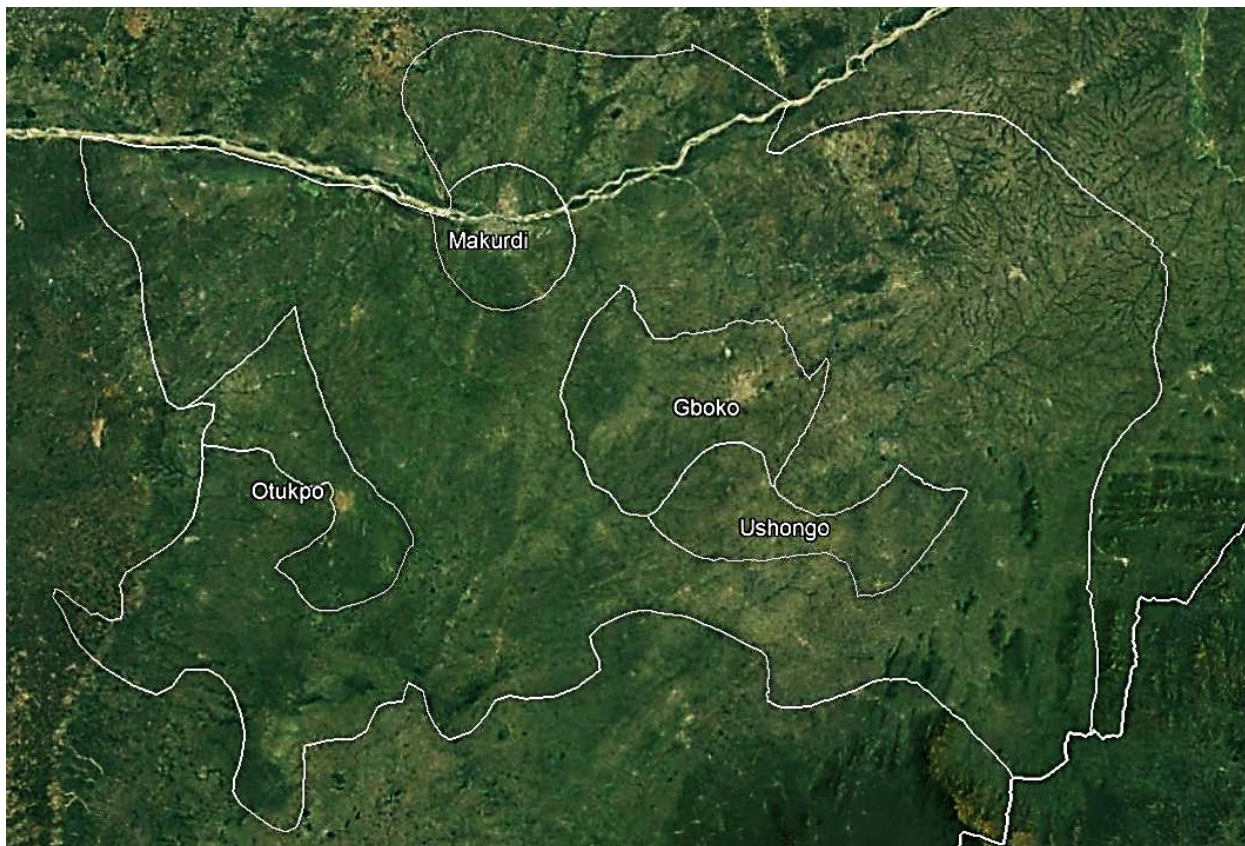
Source: Authors.

## 4.2 Tractor Owners in Benue State

In Benue, we focused on tractor owners who commonly use their tractors for farming and rent them out when they are not in use on their own farms. Our focus is on the transaction costs these owners face in obtaining their tractors, and the relative efficiency of farmers who acquired their tractors from the market. We differentiate between sellers like those described above – that is, market-source owners, MS-owners hereafter – with those who acquired tractors as part of a government subsidy program – government-source owners, GS-owners hereafter. Such patterns reflect the high transaction costs for the government in

identifying efficient tractor service providers. Figure 4 shows the Local Government Areas (LGAs) within Benue state where tractor owners were identified and interviewed.

**Figure 4. LGAs in Benue where tractor owners were interviewed**



Source: Google Earth.

**Table 16. Locations where tractor owners obtained tractors, among those obtaining from private individuals or dealers, percent of tractor owners**

<b>Cities / States</b>	<b>All tractors</b>	<b>Massey Ferguson tractors</b>
Within Benue state		
Makurdi	20.0	23.7
Otukpo	15.0	18.4
Gboko	11.7	10.5
Outside Benue state		
Zaria	10.0	13.2
Lagos	6.7	5.3
Kaduna	5.0	2.6
Enugu	3.3	5.3
Kano	3.3	5.3
Other	25.0	15.8
Observations	60	38

Source: Authors field work.

Various indicators reflect the thin tractor markets and potentially high transaction costs tractor buyers face. Table 16 shows the distributions of reported locations where tractors were obtained, for all tractors combined and specifically for Massey Ferguson (MF) tractors, which was the most commonly identified tractor brand. Approximately half of the tractors owned by our survey sample owners were

obtained from locations outside Benue, including in cities such as Zaria, Kaduna, Kano, and Lagos, which are 500 km or more away. Transporting tractors from these states could cost several hundred dollars (Table 17). Transport over such large physical distances, however, may also involve substantial additional intangible transaction costs.

**Table 17. Transportation costs from place of purchase, in 2017 USD**

	Within LGA	Within state	Neighboring state	Non-neighboring state
Benue owners	nil	264 [42, 486]	424 [0, 1142]	844 [41, 1645]
Kaduna and Nasarawa owners (Takeshima et al. 2014) <sup>a</sup>	40 [9]	86 [58, 115]	110 [0, 256]	666 [129, 1,202]

Source: Authors.

Note: LGA = local government area; Numbers in brackets = 90% confidence interval.

<sup>a</sup> Figures in Takeshima et al. (2014) were in 2013 USD, but converted here to 2017 USD.

The use of formal sector credit is limited. On average, 85 percent of tractor finance is sourced from personal savings (Table 18). Such patterns of considerable reliance on personal saving were also found in earlier studies of tractor use in Kaduna and Nasarawa states (Takeshima et al., 2015). These patterns are consistent for both market-source (MS) owners and government-source (GS) owners. Credit provided by tractor dealers or sellers is still rare in Benue. This may be because the tractor market in Benue is still thin and sellers find it either too risky to extend credit to buyers or not sufficiently profitable to invest in developing credit facilities.

**Table 18. Source of tractor purchase financing, percent of buyers in sample**

Sources	All	Market-source owner	Government-source owner
Subsidy	10	0	3
Government loan	6	0	15
Other own contribution	94	100	
Personal finance	85	89	80
Bank loan	0	0	0
Non-governmental organization	0	0	1
Inheritance, family, or friends	8	11	3
Other sources	1	0	1
Observations	54	31	23

Source: Authors based on the survey.

Consequently, tractor owners have typically saved for between three and five years before buying tractors (Table 19). Market-source owners in particular saved for several years.

**Table 19. Number of years saving before buying first tractor or power tiller**

	All	Market-source owner	Government-source owner
	4.3	3.0	5.1 *
Observations	68	27	41

Source: Authors.

Notes: Asterisk indicates statistically significant difference from market-source owners.

#### 4.2.1. Relative efficiency of market-source tractor owners compared to government-source tractor owners

The data below show that MS-owners are relatively more efficient than GS-owners. This reflects the challenges facing government in identifying efficient tractor owners to support. Government faces high

transaction costs in selecting beneficiaries of its efforts to promote increased tractor adoption and to deepen tractor markets, rather than allowing selection to occur in the market.

Table 20 shows the differences between GS- owners and MS- owners regarding costs and revenues from tractor ownership, including hiring service revenues and imputed benefits of own-farm uses. Due to the small sample size, these comparisons are only descriptive. However, we provide some insights into which aspects are significantly different between the two types of owners. There are more MS-owners than GS-owners in the sample, although the difference is not large. While the difference between GS-owners and MS-owners is relatively small and insignificant in terms of revenues, the differences are larger and more statistically significant for costs. These results have substantial implications for relative profitability and show that MS-owners are more efficient tractor users. The cost advantages for MS- owners are particularly notable in terms of fuel use and expenditures on operators, and they spend about double the amount of GS-owners on maintenance. This finding is consistent with earlier findings in Kaduna and Nasarawa states in Nigeria (Takeshima et al., 2015), and neighboring countries like Ghana (Takeshima et al., 2017).

**Table 20. Profitability comparison over 12 months for tractor owners who obtained tractors from government sources and market sources**

Categories	Government-source tractor owners, mean / median		Market-source tractor owners, mean / median	
	1,000 Naira	USD	1,000 Naira	USD
Fuel / oil	1,105 / 429	3,069 / 1,192	659 / 163	1,830 <sup>†</sup> / 452 <sup>*</sup>
Operators	689 / 360	1,913 / 1,000	351 / 150	976 / 417
Repair / maintenance costs	34 / 13	94 / 37	67 / 37	187 / 102
Total costs	1,827 / 1,209	5,075 / 3,359	1,077 / 440	2,993 <sup>†</sup> / 1,222 <sup>*</sup>
Total revenues <sup>a</sup>	2,470 / 1,635	6,861 / 4,543	1,914 / 1,410	5,318 / 3,917
Net revenues	643 / 283	1,786 / 787	837 / 558	2,325 / 1,551
Observations	23		31	

Source: Authors' calculations based on the Benue tractor owner survey 2018.

Statistically significant difference from government-source tractor owners based on non-parametric tests for the difference of mean and median: \*\*\* 1%; \*\* 5%; \* 10%; † 15%

USD Figures are based on exchange rate: USD 1 = Naira 360.

<sup>a</sup> Includes the imputed value for own-farm use.

Unlike in Kaduna or Nasarawa, the MS-owners surveyed in Benue achieve efficiency by keeping their tractor use at lower levels (Table 21). However, even in Benue, the extent of their hiring service provisions in terms of area or days is not statistically significantly different from that of GS-owners, although the mean and median figures are considerably higher for GS-owners.

**Table 21. Extent of tractor use among Benue tractor owners for farming**

Categories	Per tractor	Per tractor	Per service provider	Per service provider	Per service provider
	Benue GS-owners	Benue MS-owners	Benue GS-owners	Benue MS-owners	Kaduna and Nasarawa, 2013 <sup>a</sup> All
	Mean / median	Mean / median	Mean / median	Mean / median	Mean / median
Area – own farm use, ha					
Total	63 / 40	50 / 42	93 / 40	106 / 43	51 / 25
Land Clearing	4 / 0	1 / 0	7 / 0	1 / 0	0 / 0
Harrowing	27 / 20	21 / 10	41 / 20	46 / 10	21 / 11
Ploughing / Tilling	26 / 20	23 / 12	33 / 20	46 / 24	16 / 8
Ridge making	4 / 0	5 / 0	6 / 0	10 / 0	12 / 0
Planting	2 / 0	1 / 0	4 / 0	2 / 0	1 / 0
Rotovating, Fertilizer application, Weeding, Harvesting	0 / 0	0 / 0	2 / 0	2 / 0	1 / 0
Area – hired-out, ha					
Total	154 / 79	93 / 40	230 / 100	157 / 60	156 / 74
Land Clearing	16 / 0	4 / 0	21 / 0	4 / 0	1 / 0
Harrowing	75 / 38	41 / 18	116 / 42	71 / 20	74 / 33
Ploughing / Tilling	54 / 31	47 / 20	78 / 31	81 / 26	49 / 11
Ridge making	6 / 0	2 / 0	10 / 0	2 / 0	30 / 0
Planting	3 / 0	0 / 0	5 / 0	0 / 0	2 / 0
Rotovating, Fertilizer application, Weeding, Harvesting	0 / 0	0 / 0	0 / 0	0 / 0	3 / 0
Total area, ha	217 / 117	143 / 100	323 / 151	263 / 130	208 / 124
Sample size	23	31	23	31	111

Source: Authors based on field survey.

<sup>a</sup> From Takeshima et al. (2014; Table 3.17).

Table 22 shows data on the use of tractors by both MS and GS- owners in Benue for uses outside of the farm. MS- owners use their tractors for off-farm activities slightly more than do GS -owners, but the difference is not large. These results imply that the cost differences between MS and GS-owners can be attributed to less tractor usage for on-farm activities. It is notable that Kaduna and Nasarawa farmers, as reported by Takeshima et al. (2014), use their tractors much more extensively for off-farm purposes than do Benue state tractor owners (both GS and MS). The profit differential between MS and GS-owners, then, appears to be explained mainly by the ability of MS -owners to obtain the same revenue as GS-owners while using their tractors less. This is plausibly due to factors such as MS-owners being generally more specialized and skillful in farming than are GS-owners.

**Table 22. Extent of tractor use among Benue tractor owners for off-farm activities**

Categories	Per tractor	Per tractor	Per service provider	Per service provider	Per service provider
	Benue	Benue	Benue	Benue	Kaduna and Nasarawa, 2013 <sup>a</sup>
	GS-owners	MS-owners	GS-owners	MS-owners	All
	Mean / median	Mean / median	Mean / median	Mean / median	Mean / median
Hours – own farm use					
Total	58 / 12	70 / 24	81 / 20	97 / 35	112 / 30
Milling / threshing / processing	0 / 0	0 / 0	0 / 0	0 / 0	7 / 0
Transporting farm products	34 / 10	48 / 12	47 / 12	69 / 25	75 / 18
Transporting non-farm goods	14 / 5	5 / 0	15 / 0	9 / 0	22 / 0
Local transportation	1 / 0	1 / 0	2 / 0	2 / 0	1 / 0
Fetching water	1 / 0	0 / 0	3 / 0	0 / 0	3 / 0
Firewood transport	10 / 0	5 / 0	15 / 0	6 / 0	5 / 0
Other	0 / 0	12 / 0	0 / 0	12 / 0	0 / 0
Hours – hired-out					
Total	87 / 0	57 / 0	102 / 0	74 / 0	177 / 10
Milling / threshing / processing	0 / 0	0 / 0	0 / 0	0 / 0	2 / 0
Transporting farm products	47 / 0	43 / 0	48 / 0	56 / 0	103 / 0
Transporting non-farm goods	40 / 0	2 / 0	54 / 0	4 / 0	44 / 0
Local transportation	0 / 0	0 / 0	0 / 0	0 / 0	6 / 0
Fetching water	0 / 0	0 / 0	0 / 0	0 / 0	8 / 0
Firewood transport	0 / 0	1 / 0	0 / 0	3 / 0	13 / 0
Other	0 / 0	12 / 0	0 / 0	12 / 0	0 / 0
Total hours	145 / 12	128 / 27	183 / 20	171 / 35	290 / 179
Sample size	23	31	23	31	111

Source: Authors based on field survey.

<sup>a</sup> From Takeshima et al. (2014; Table 3.17).

There are likely to be various factors that lead to the relative efficiency of MS-owners over GS-owners. However, one of the reasons may be that MS-owners appear to have knowledge and access to more brands of tractors from which to choose, and have bought at least one tractor based on preferred performance characteristics (Table 23). Our survey indicates that the share of such knowledgeable tractor owners is significantly higher among MS-owners, than among GS-owners. These patterns are again consistent with those in Kaduna and Nasarawa states (Takeshima et al. 2014).

**Table 23. Tractor owners who had multiple options in purchasing tractors**

Category	Benue	Benue	Kaduna / Nasarawa	Kaduna / Nasarawa
	GS	MS	GS	MS
Could select from many brands	38 [22, 55]	60 [47, 72]	42 [25, 59]	42 [31, 54]
Could select from a range of horsepower	42 [25, 59]	49 [36, 61]	39 [22, 56]	45 [33, 56]
Bought at least one tractor based on their performance	47 [31, 63]	64 [52, 76]	56 [41, 70]	76 [67, 84]

Source: Authors.

Note: Numbers in brackets = 90% confidence interval.

## 5. CONCLUDING REMARKS

The goals for this paper were to describe in greater detail on the key characteristics of participants in tractor markets in Nigeria than currently exists in the literature and to discuss how transaction costs that are associated with tractors' unique characteristics, such as indivisibility, limited mobility, and seasonality

of demand, are important for explaining the current tractor market structure. Some descriptive industry reports have been released in recent years that broadly show that the use of tractors in Nigeria is lower than in other developing countries. However, information on the vertical and geographical organization of the market remains sparse. Our review of the transaction costs literature and the description of market imperfections in capital markets allowed us to conjecture that the tractor market in Nigeria is likely very concentrated, both vertically, such that a small number of firms control much of the market, and horizontally, with tractor sellers clustered in locations that allow them to reduce transaction costs. Additionally, in the high transaction cost and poor credit environment of Nigeria, we expected, and found evidence of, ongoing subsidy provision by the FMARD and state Ministries of Agriculture for the acquisition and distribution of tractors. While there is a movement toward a more private market-based system with the establishment of specialized tractor rental businesses at federal level and in some more highly developed states such as Kaduna, in contrast, the Benue State Ministry of Agriculture and Natural Resources pledged to increase its subsidy for tractor acquisition by farmers in the state in 2018.

The results of our surveys of tractor sellers and owners indicate that transaction costs are in fact closely related to the characteristics of the tractor market in Kaduna and Benue. The tractor market in Kaduna is concentrated both vertically and geographically. The top four firms accounted for over 75 percent of the new tractor sales in 2017. Nearly all new tractor sellers are based in Kaduna city, where they have access to business services such as knowledgeable labor, spare parts, and banks. The used tractor market there is less concentrated, but there are still three main clusters along a transportation corridor in an agriculturally productive area. This market concentration and clustering is likely a way to pool resources to reduce the generally high transaction costs for tractor sales in terms of acquisition and customer matching.

While the tractor market in Benue remains thin in terms of both the number of sellers and owners, the results from our survey of tractor owners show that a sizable number still obtain their tractors from market sources. Additionally, and consistent with prior work in Nigeria, those who sourced their tractors from the private market rather than government sources were more profitable. This is largely because they were able to use their tractors more efficiently at lower cost, while still obtaining comparable revenues, relative to government-source owners. This implies that government-source tractors have not been allocated to the most efficient farmers.

These findings suggest a few key policy implications. First, it is important to recognize that access to tractors and to tractor hiring services remains spatially uneven, even where demand for them can be high. A significant part of such unevenness may be due to various types of transaction costs that are associated with the general nature of tractors, including indivisibility, low mobility, as well as credit-market failures that exist in Nigeria and whose effects are more substantial given the popularity of expensive, large tractors. The government can try to address some of the market imperfections, but not all of them. The government may, therefore, focus on carefully informing stakeholders of how such unevenness in access occurs for economic reasons, emphasizing that the government may not always be able to assist in overcoming all the relevant transaction costs for tractor ownership by farmers.

The latter point is also implied by the survey of tractor owners in Benue, where the government faces challenges in selecting efficient tractor owners, partly due to transaction costs associated with identifying such beneficiaries. If the planned allocation of subsidized tractors by the Benue Ministry of Agriculture and Natural Resources moves forward, then it is recommended that efforts are made to allocate subsidized tractors to those with characteristics most like those farmers who source their tractors from the market. In Kaduna state, the shift in policy away from direct acquisition and toward facilitation of tractor market transactions is consistent with our findings. However, even then, the effects of high transaction costs on tractor market characteristics will persist if they are due to the unique characteristics

of tractors and if neither the private sector nor the government can overcome such costs. In such a case, the unevenness of access to tractors and hiring services will remain. In such a case, government can focus on informing stakeholders that such unevenness is due to economic forces and not due to anything inherent to government's execution of its program.

Second, while the unevenness of access to tractors and hiring services is expected, more research is needed to gain a deeper understanding of its extent. Our surveys imply that the private sector certainly engages in activities that mitigate the effects of transaction costs, including long-distance travel to obtain tractors and demonstrations of their use by tractor sellers. Additionally, we found evidence of cost-efficient tractor use by market-source tractor owners. It remains an empirical question to what extent these abilities of the private sector mitigate the effects of supply-side characteristics on the spatial distribution of tractors and hiring services, which should be investigated through continued research.

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## APPENDIX: REVENUE AND COST STRUCTURES OF SMALL TRACTOR SELLERS IN KADUNA STATE

Table 24 through Table 28 show information on the business revenues and cost structures of *small-sellers* of tractors in Kaduna state. The information for *large sellers* is not shown due to the difficulty in assessing the costs specifically for machine and equipment sales.

The small tractor sellers interviewed earn average gross revenues of USD 126,094 while incurring costs of USD 120,367 annually. The medians are considerably lower, with median annual gross revenues and costs at USD 59,319 and USD 41,583, respectively.

Most gross revenues come from tractor sales, accounting for about two-thirds of revenues (USD 84,198). The remaining is obtained mostly from the sale of other equipment, attachments, and spare parts, while repairing or refurbishing of tractors, attachments, and other machines contributes a relatively small share (Table 25).

The purchase of machines and equipment for later resale accounts for about 80 percent of the cost of machines and equipment themselves (USD 96,390). Among the remaining costs, transportation costs account for about half. The residual half consists largely of the costs of repairing, maintenance of store facilities, labor costs, and depreciation of fixed capital assets (Table 26). Costs for labor and non-labor items consist of various types (Table 27 and Table 28).

**Table 24. Total revenue and costs of small tractor and other agricultural machine businesses, USD/year**

	Gross revenue	Total cost
Mean	126,094	120,367
Median	59,319	41,583

Source: Authors.

Note: Observations: 18 small sellers

**Table 25. Net revenues of small tractor and other agricultural machine businesses, by revenue category USD/year**

Categories	Gross revenue	Cost (only of machine themselves)
Tractor sales including dealership margin	84,198	65,293
Sales of other equipment	22,924	26,054
Attachments and spare parts	16,985	5,043
Gross revenues from providing repairing or refurbishing services for tractor owners	865	
Revenues from providing repairing or refurbishing services of tractor attachments and other machines	1,122	
<b>Total</b>	<b>126,094</b>	<b>96,390</b>

Source: Authors.

Note: Observations: 18 small sellers

**Table 26. Total costs other than the costs of machines themselves for small tractor and other agricultural machine businesses, USD/year**

<b>Cost items</b>	<b>USD</b>
Labor costs	2,818
Costs of repairing and doing maintenance of store facilities	3,376
Transportation costs for tractors	10,273
Transportation costs for spare parts or other agricultural machines	2,271
Capital and fixed assets (depreciation, rental)	3,416
Non-labor costs	1,822
<b>Total</b>	<b>23,976</b>

Source: Authors.

Note: Observations: 18 small sellers

**Table 27. Annual labor use and labor costs for small tractor and other agricultural machine businesses**

<b>Type of workers</b>	<b>Non-family members, person-days, mean / median</b>	<b>Family members, person-days, mean / median</b>	<b>Value, USD/year</b>
Store / facility managers	56 / 28	14 / 0	627
Machine operators	103 / 24	12 / 0	733
Repairers, mechanics	151 / 12	14 / 0	734
Other casual laborers	48 / 0	7 / 0	109
Administrative Assistants	2 / 0	62 / 0	29
Security guards	20 / 0	4 / 0	370
Agents	47 / 60	3 / 0	216
<b>Total</b>			<b>2,818</b>

Source: Authors.

Note: Observations: 18 small sellers

**Table 28. Non-labor costs for small tractor and other agricultural machine businesses, USD/year**

<b>Cost items</b>	<b>Value</b>
Electricity	12
Fuel / diesel for machines	288
Fuel / diesel to run generators	45
Workshop tools	75
Oils	122
Grease	48
Bags	10
Stitching	11
Other materials	27
Rent for on-site premise (land, buildings, etc.)	769
Rent for off-site warehouse	182
Business certificate	38
Business registration fees	36
Any other tax / fee payments	160
<b>Total</b>	<b>1,822</b>

Source: Authors.

Note: Observations: 18 small sellers

## About the Author(s)

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**Patrick L. Hatzenbuehler** was until mid-2018 an Associate Research Fellow with IFPRI's Nigeria Strategy Support Program and is currently an Assistant Professor and Extension Specialist in the Department of Agricultural Economics and Rural Sociology at the University of Idaho, USA. **Hiroyuki Takeshima** is a Research Fellow in the Development Strategy and Governance Division of the International Food Policy Research Institute (IFPRI), based in Washington, DC. **Hyacinth Edeh** is a Research Analyst with IFPRI's Nigeria Strategy Support Program, based in Abuja. **Akeem O. Lawal** is the Department Head in the Agricultural Engineering Department of the National Agricultural Extension & Research Liaison Services, Federal Ministry of Agricultural & Rural Development, Zaria, Nigeria.

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**INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE**  
1201 Eye Street, NW | Washington, DC 20005-3915 USA  
T: +1.202.862.5600 | F: +1.202.862.5606  
Email: [ifpri@cgiar.org](mailto:ifpri@cgiar.org) | [www.ifpri.org](http://www.ifpri.org)

**IFPRI-ABUJA**  
c/o International Fertilizer Development Center  
No.6 Ogbagi Street | Off Oro-Ago Crescent, Garki II  
Abuja | Nigeria  
[ifpri-nigeria@cgiar.org](mailto:ifpri-nigeria@cgiar.org) | [nssp.ifpri.org](http://nssp.ifpri.org)

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