

Farm scale as a driver of agricultural development in the Kenyan Rift Valley

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ABSTRACT

Farming in Sub-Saharan Africa (SSA) is historically dominated by small-scale farms (SSFs), but evidence suggests that medium-scale farms (MSFs) are becoming increasingly prominent. These MSFs are often portrayed as entrepreneurial innovators, bringing dynamism and commercialization to SSA agriculture without displaying the negative features of land grabbing processes. However, there is little empirical evidence supporting these claims. We deployed a survey of 319 farmers covering a wide range of sizes in the Kenyan Rift Valley. Results show that MSFs are not a new phenomenon in the area, and are mostly farms that incrementally increased in size by buying or renting additional land. Furthermore, we find no differences in yields for various crop types between SSFs and MSFs. On average, MSFs use a higher share of their land for grazing, and have more dairy cattle per farm but less per hectare. The average MSF has a higher propensity to grow cash crops and serve non-local markets than the average SSF, and they employ significantly fewer people per hectare. However, within-category heterogeneity is high for all investigated dimensions, while past decision-making and future aspirations reveal entrepreneurship to occur in all farm size categories. We conclude that only a subset of all MSFs can be characterized as entrepreneurial, while these qualities can also be attached to many SSFs. Hence, we find that farm scale is an imperfect proxy to gauge the characteristics of a farm system, and presenting MSFs as a developmental panacea for SSA's rural areas is therefore unwarranted.

1. Introduction

The African agricultural sector is undergoing major reconfigurations, as large-scale land acquisitions and contract farming are reorienting vast areas of land towards export production (Deininger and Byerlee, 2012; Otsuka et al., 2016). These high-profile land dynamics may have obfuscated other changes that have a smaller individual scale but potentially a larger combined effect. This is signaled by the evaluation of repetitive agricultural surveys in multiple Sub-Saharan African (SSA) countries, which shows that the distribution of farm sizes is shifting rapidly (Jayne et al., 2016). After a long period of small-scale farm (SSF) domination, there has been an increase in land managed as medium-scale farms (MSFs) since the year 2000. MSFs are loosely defined as farms that are relatively larger than what is usual in their immediate context (Hall et al., 2017), and empirical studies for SSA tend to set the lower threshold to distinguish MSF at 5 ha (Samberg et al., 2016). Observed trends in MSF may signal that agriculture in SSA is experiencing a watershed moment, as a continuation of current trends would vest the majority of land in the hands of MSFs in many

SSA countries in the near future. This observation is in contrast with theoretical expectations, which generally posit that demographic and economic trends predicate a persistence of small-scale family farming across most of SSA (Hazell et al., 2010).

The emergence of MSFs is attracting academic interest to understand the drivers and consequences of these developments. Farm size is an element of wider debates around food security, agricultural productivity, poverty, and economic growth (Meyfroidt, 2017). Yet, little is currently known about the characteristics of MSFs, the actors owning and managing them, the drivers of their emergence, their geographical contexts, their environmental consequences, and the future pathways they may signal.

To study this phenomenon, two general approaches are often used. First, available agricultural censuses are mined to distill farm size distributions and their trends. On a global scale, such studies reassert the dominant role of smallholders in developing countries in producing food (Samberg et al., 2016). Furthermore, they show that the majority of low- to lower-middle-income countries are experiencing a drop in average farm size (Lowder et al., 2016). However, reporting regional

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averages can obscure intraregional heterogeneity. Average farm sizes can decrease while the number of MSFs increases, and a rise in larger-scale farms can be a driver of decreases in farm size of the smallest farms (Masters et al., 2013). On a national scale, in-depth analysis of agricultural censuses illuminates MSF dynamics specifically (Jayne et al., 2016). These analyses not only reveal the increasing importance of MSF, but also offer some preliminary insights on the types of actors behind MSF. Second, a number of pioneering case studies try to profile MSFs in SSA (e.g. Anseeuw et al., 2016; Chapoto et al., 2013; Sitko and Jayne, 2014). These case studies are essential building blocks to arrive at more general knowledge on MSFs. Traits of MSFs that are found in these studies include entrepreneurship, an orientation towards export or urban markets, and a capacity to assert state-backed land tenure claims, often at the expense of existing customary land tenure arrangements. The actors are often urban-based individuals with current or former urban employment, although examples of rural elites who successfully expand their farms have also been described.

The interpretability of observed trends in national-scale agricultural censuses is limited, because their agronomical focus does not provide insight into other characteristics of MSFs, such as the background of their owners. Meanwhile, case studies with a focus on MSF remain scarce. Surveys have mostly sampled only MSF (Anseeuw et al., 2016), which allows for exploratory profiling exercises but not for comparisons between groups. Hence, it is difficult to assess whether MSF are, as is suggested, really different from SSF in aspects other than total farm area, and whether they truly represent a new pathway with different socio-environmental traits.

Here, we aim to provide new empirical insights to assess to what extent MSF are different from small-scale farms (SSFs), and to what extent they represent a novel dynamic that may act as a driver of socio-environmental change. To that end, we have conducted a survey including farms of different sizes in the Rift Valley of Kenya. We sampled farms in an area characterized by a high agricultural potential and rapid urbanization, and hence a potential hotspot for the agricultural dynamics addressed in this paper. Survey results allow us to compare MSFs with SSF in terms of the crop types they grow, the markets they serve, their labor characteristics, and their farm development. In addition, we surveyed a number of large-scale farms (LSFs) for further contextualization of these results.

The rest of the paper first presents a theoretical background on the developmental, political, economic, and agronomic debates around farm scale. Building on this background, research questions are formulated. We then present the survey results and discuss their implications for wider rural development debates, as well as the extent to which they match commonly held beliefs concerning MSFs.

2. Theoretical background

Because agriculture is the dominant sector in terms of employment and revenue, and also the primary driver of environmental degradation in most developing countries (UNCCD, 2017), the evolution of agricultural systems takes center-stage in both developmental and environmental debates. In this respect, the impact of different farm sizes, for example in terms of agricultural production, employment, and income, is highly relevant. Insights into these matters can inform the tenuous discussion on what constitutes an “appropriate” or “optimal” farm scale (Carr, 2013; Collier and Dercon, 2009). In this debate, opinions range between a vision of large-scale, highly mechanized farms to small-scale, labor-intensive farms (Meyfroidt, 2017). A major agronomical dimension of this wider debate is the question on optimal scales of production to maximize yields. The advantages and disadvantages of different farming systems have been discussed extensively in literature on development studies (Lipton, 2006; Wiggins et al., 2010) and provide a background for the assessment of MSF as discussed below.

The rich literature concerning large-scale land acquisitions could be instructive to explain the rise in MSF. The rapid and ongoing

acquisition of large tracts of land, often by international business interests and investors, is an aberration that goes against prevailing demographic and economic trends in SSA. An incremental increase in farm size, accompanied and mutually reinforced by urbanization and productivity increases, is expected in SSA following structural transformation processes (McMillan and Headey, 2014). However, large-scale land acquisitions do not develop gradually, but appear as a result of power inequalities in global and national land governance, and are thereby able to claim smallholder-dominated or natural areas (Debonne et al., 2019; Messerli et al., 2014). MSFs could be conceptualized as a domestic version of large-scale land acquisitions, with national instead of international investors. Some commonalities are apparent, namely the involvement of non-local actors and the instrumentalization of power imbalances in land governance. Agricultural censuses show that, in SSA, a large and rising fraction of agricultural land is owned by urban households, who often own significantly more land per household than average rural households (Jayne et al., 2016). This indicates that MSF could be a product of urban households acquiring land resources, but national-scale surveys lack sufficient depth to warrant strong conclusions. Urban elites can mobilize capital and lobby power to acquire land, at smaller scales compared to large-scale land acquisitions but at larger scales than what is within the reach of smallholders (Hilhorst et al., 2011; Sitko and Jayne, 2014). This urban, non-local appropriation of agricultural land is facilitated by the fluid nature of land governance and land tenure arrangements in SSA. Customary land tenure, where the relations governing the ownership and use of land are strongly localized and where authority is vested in traditional authorities, remains highly important in SSA (Alden Wily, 2018; Higgins et al., 2018). However, African states are increasingly formalizing land tenure, thereby overthrowing customary institutions or creating bifurcated, legally pluralistic land tenure systems (Stellmacher and Eguavoen, 2011; Ubink and Quan, 2008). This legal ambiguity is often exploited by the lateral, urban entrants in SSA agriculture that constitute many MSFs. These actors are better able to navigate bureaucracies to acquire statutory (state-backed) land titles on customary land, in many cases overruling local people and their customary rule-sets (Chimhowu, 2018; Chitonge et al., 2017).

Counterbalancing this negative narrative of expropriation, MSF may also be seen as a source of dynamism (Jayne et al., 2016). For at least five decades, visions on the pathways to SSA economic development and poverty reduction have tended to include a central role for smallholders (Wiggins et al., 2010). The smallholder sector is the dominant provider of food and livelihoods in SSA, and those engaged in this sector are disproportionately more likely to be poor and food insecure (Kamara et al., 2019). An inverse relationship between farm size and productivity is argued to exist, owing to diseconomies of scale and the absence of economies of scale in agriculture (Wiggins et al., 2010). Small farms rely on family labor, which is self-motivated to maximize yields, contrary to large farms where hired labor may not have such incentives. However, the causality or even the existence of an inverse relation is contested (Muyanga and Jayne, 2019; Carletto et al., 2013).

Taking inspiration from successes associated with the Green Revolution in Asia, transformative agricultural modernization is argued to be the most effective engine for broader development (De Schutter, 2011; Diao et al., 2010). However, the persistence of low-input subsistence agriculture and rural poverty has led to doubts on this conventional wisdom (Sitko and Jayne, 2014). As the agricultural sector globalizes, the question is raised whether African smallholders, who typically achieve relatively high land productivity but low labor productivity, can be competitive on a world stage (Dercon and Gollin, 2014). Taking this line of thought one step further, MSFs could be a necessary advancement to break the developmental impasse and deliver technological innovation and competitiveness.

The smallholder sector is faced with significant institutional and logistical handicaps in accessing markets beyond the local village market. Supermarkets and exporters are increasingly setting

production, quality, and consistency requirements, which in turn create higher transaction costs that can act as a barrier for small producers (Colen et al., 2012). For the procurement of fresh produce for urban centers, SSA retailers tend to favor farmers that can deliver year-round (often requiring irrigation), have sufficient storage and transport capabilities, and have the necessary human capital to handle value chain paperwork (Neven et al., 2009). While institutional innovations can help overcome these challenges, e.g. in the form of cooperatives, smallholders often cannot meet these requirements and resort to staple crops instead (Verhofstadt and Maertens, 2015). Instead, markets for high-value cash crops are often more readily available for larger-scale farmers. MSFs could thus be a solution for market failures apparent in SSA. Whether this is optimal in terms of, for example, poverty reduction vis-à-vis institutional innovations to enable smallholders is debatable (Hall et al., 2017). This depends, among others, on the ability of MSFs to create high-quality employment (Neven et al., 2009).

Against this backdrop, MSF have been framed as a “best of both worlds” solution. They may be able to combine high labor productivity with better access to capital and markets (Meyfroidt, 2017). Meanwhile, their local linkages are likely stronger compared to large-scale land acquisitions, which are mostly managed by foreign interests in an enclave-like fashion (Hall et al., 2017). This could provide MSFs with the ability to generate local benefits and mitigate negative regional impacts often associated with large-scale land acquisitions. In this framing, MSFs act as seeds of local dynamism, with a potential to create positive technological and institutional spillovers to neighboring smallholders (Deininger and Xia, 2016).

It is highly relevant to gain insight into whether MSFs are a “best of both worlds” solution, or rather an inferior development pathway with opportunity costs vis-à-vis a smallholder-led pathway, or neither. Farm scale is a product of agricultural policies, and policy biases can drive farm scale increases or decreases. Globally, governments explicitly or implicitly favor larger or smaller farms (Bartolini and Viaggi, 2013; Byerlee, 2014). In SSA, preliminary findings suggest that MSFs tend to hold strong positions in agricultural lobby groups, thereby ensuring that public agricultural spending disproportionately favors their business model (Jayne et al., 2016). Such policy biases can hold significant opportunity costs: the beneficial effects of agricultural development on poverty reduction or food security may be much higher when smallholders are the focus of governance. In the context of large-scale land acquisitions, the empirical evidence of local benefits and threats clearly points to the existence of such opportunity costs (De Schutter, 2011) while for MSF, this is less clear (Hall et al., 2017).

Based on the discourses and debates discussed above the research questions we address in this paper are: (1) whether MSFs are a recently emerging class of farmers, as is suggested by recent literature (Jayne et al., 2016); (2) Whether land tenure regimes are different for MSFs compared to SSFs; (3) Whether MSFs have a higher or lower crop productivity and different crop mixes; (4) Whether MSFs use different amounts and different sources of labor; (5) and whether MSFs are providing for different markets and are embedded in different networks. Furthermore, using the LSF data points, we provide further context concerning these dimensions.

3. Survey and data analysis

3.1. Study area

The study was undertaken in, Nakuru County, Kenya (Fig. 1). The area is part of the Kenyan highlands as well as the Great Rift Valley and is considered to be among the agriculturally high-potential areas of Kenya. People in Nakuru are dominantly of either Kikuyu or Kalenjin ethnic background. Within this county, a large variety of agro-ecological zones exists, with altitudes of sampled areas ranging between 1900 and 2800 m a.s.l. Farms in the county are often integrated crop-land-livestock operations, although a large diversity exists (Herrero

et al., 2014). The main food crops produced include maize, beans, Irish potatoes, and wheat, as well as various fruits and vegetables and a thriving livestock sector (van de Steeg et al., 2010).

Kenya, and the Rift Valley specifically, has had a dynamic history in terms of land governance and farm scales. During British colonial rule, many areas in the Rift Valley were part of the White Highlands, a region of settlement by British farmers operating large farms and ranches using newly landless Kenyans as labor sources. Apart from these settler areas, Kenyan farmers persisted in designated “native reserves”, and this colonial dichotomy forms the precursor of many farm scale patterns observed today (Hakizimana et al., 2017). The Swynnerton plan (1954) aimed to be a comprehensive colonial solution to modernize Kenyan agriculture, among others by issuing title deeds to promote land tenure security, providing technical assistance, and provide pathways to farm consolidation (Thurston, 1987). This plan thus forms the historical basis of the current land tenure system in Kenya. After Kenya attained independence, the Million Acre Settlement Scheme constituted a major land reform to redistribute White Highland landholdings to Kenyan families. This resulted in a repopulation of the area by a diverse group of farmers originating from a variety of Kenyan provinces, although much land was also granted to elites as a patronage tool (Kiplimo and Ngeno, 2016). In recent decades, population pressures have led to severe land fragmentation, leading to a broad pattern of relative large, intensive farms in many former White Highland Areas and very small, fragmented and degraded farms in many former “native reserves” (Syagga, 2006).

The study area was chosen because it has a high agricultural potential and includes the fast-growing and dynamic urban center of Nakuru City, which makes it a prime area to study dimensions of rural change (Migose et al., 2018). Parts of the county are used for horticulture, floriculture, and other cash cropping, which is often controlled by foreign interests or domestic value chain actors (supermarkets, processors, breweries) through ownership or contracts (Neven et al., 2009; Wanjala et al., 2018). The majority of farms in Nakuru county is small, averaging 0.77 ha. However, the majority of the land is occupied by MSFs and LSFs. Consecutive generational farm subdivision is increasingly creating economically unviable farm sizes among the SSFs. The county is relying on agribusinesses, notably horticultural and floricultural enterprises, to generate employment for land-poor households (Nakuru County Government, 2013).

3.2. Survey

A survey was conducted between November 2018 and January 2019 in sub-counties of Bahati, Kuresoi, Njoro and Subukia. For every sub-county, the sampling frame were all SSFs (managed land < 5 ha), MSFs (managed land 5–50 ha), and LSFs (managed land > 50 ha).¹ In line with recent other work on MSFs (Anseeuw et al., 2016; Sitko and Jayne, 2014), and recognizing that what constitutes a small or large farm is highly context-dependent (Meyfroidt, 2017), these size brackets were defined to represent an intermediate position between what is understood to be a smallholder and a large farm in the Kenyan Rift Valley. The sampling frame was obtained from the sub-county Ministry of Agriculture farmer registries. These farmer registries were subdivided based on farm size categories (SSFs and MSFs), and from these two lists, every nth farmer was selected to be a respondent, n being dependent on the population of the sub-county. The LSFs were purposefully sampled,

¹ Note that different studies have defined “medium-scale” differently. Samberg et al. (2016), working at the scale of the Global South, distinguish medium-scale farms between 5 and 15 ha, large-scale farms between 15 and 50 ha, and very large-scale farms beyond 50 ha. Jayne et al. (2016), who discuss MSF for Sub-Saharan Africa, define medium-scale to be between 5 and 100 ha. Local case studies tailor the definition of MSF to the relevant context (e.g. Anseeuw et al. (2016) use 5 to 50 ha to represent MSFs in Malawi).

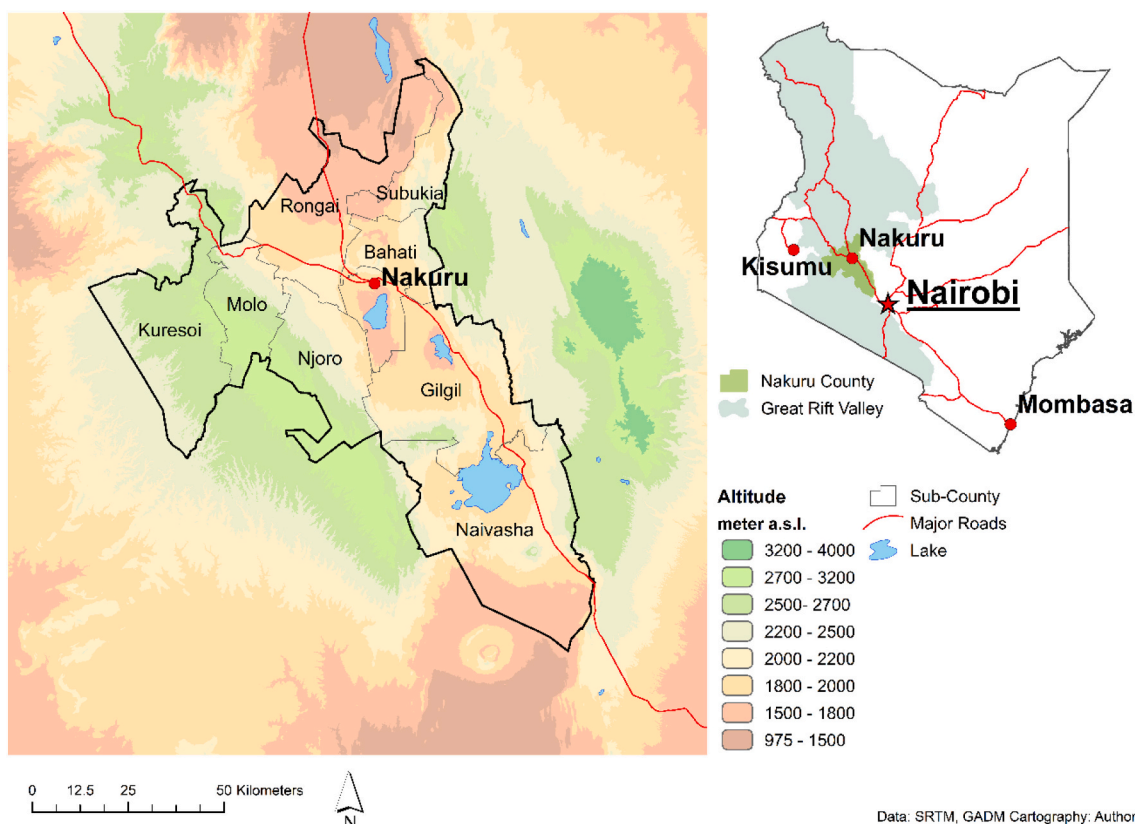


Fig. 1. Map and location of the study area, Nakuru, in the Great Rift and Kenya, with sub-counties indicated. The survey was conducted in the sub-counties Kuresoi, Njoro, Bahati, and Subukia.

and were not used in subsequent statistical analyses, but only to contextualize our findings. Hence, a total of 332 respondents were visited. After a pilot ($n = 9$) and subsequent revisions, the survey was conducted in Swahili by three trained enumerators.

Questionnaires were conducted with the household head or another knowledgeable family or farm staff member. In some cases, a farm manager or accountant answered at the behest of an absent farm owner. Prior to conducting an interview, respondents were informed of the purpose and nature of the questions, and were given the opportunity to grant or deny consent to participate. Refusal to participate occurred in no more than a handful of cases, although refusal to answer specific questions was more common (e.g. questions concerning wages), resulting in no-data for these questions. Questionnaires were digitally transcribed using Kobo Toolbox.

The questionnaire (supplementary material) consisted of mostly closed-ended questions on (1) farm history and household characteristics, (2) farm owner characteristics, (3) land tenure, (4) farm land use, crop production, and livestock, (5) water management, (6) social networks, (7) markets, and (8) threats and opportunities. The survey received ethical approval from the nationally accredited Moi University College of Health Sciences / Moi Teaching and Referral Hospital Institutional Research and Ethics Committee.

3.3. Data analysis

Questionnaires were subjected to a validation procedure, checking for internal consistency of answers, completeness, and adherence to the sampling frame. After validation, 319 interviews were retained, including 186 SSFs, 120 MSFs and 13 LSFs. The SSF and MSF data points were subsequently used for statistical analysis, while LSF data were only used to add context. In this statistical analysis, we compared SSFs and MSFs across a number of dimensions, corresponding to the research

questions outlined above. We used two-tailed t -tests to test for differences in quantitative data, and χ^2 tests to test for differences in categorical data. Each test is performed for the full SSF and MSF dataset, and additionally for the subset of SSFs and MSFs that were established with the current farm owner in or after the year 2000. The latter tests provide information on whether recently established MSFs are different from recently established SSFs, building on the idea that recent newcomers are different in origin or characteristics. Statistics were performed in the R statistical package.

4. Results and discussion

4.1. Farm and farmer characteristics

Contrary to reports of a recent surge in the establishment of MSFs in SSA (Jayne et al., 2014), MSFs are not new in our study area, and there is no significant difference in the year of establishment of MSF and SSF (Table 1). Farms in both categories have been established throughout post-colonial history. Fig. 2 further details this diversity in time of farm establishment. Table 1 presents key figures concerning the year of establishment, alongside other farm and farmer characteristics.

The study area is known for an increasing land scarcity that has led to progressively smaller farms, in line with general trends in Kenya (Hakizimana et al., 2017; Kiplimo and Ngeno, 2016) and other SSA nations (Jayne et al., 2014). Our results show that, in tandem with this farm fragmentation process, MSFs continue to emerge, in contrast with this process. This suggests that the establishment dynamics of MSFs show signs of continuity, as farms of this size were never uncommon. At the same time, it shows signs of discontinuity, because where overall trends in SSA tend towards ever smaller farms, MSFs continue to be established unabatedly in the study area.

In our study, perceived land tenure security is high overall, with

Table 1

Summary statistics concerning farm dynamics and farmer characteristics. Significance tests are the result of student's t-tests and χ^2 tests for, respectively, continuous and categorical dependent variables.

Survey question	Full survey		Post-2000 subset			
	SSF (n = 186)	MSF (n = 120)		SSF (n = 76)	MSF (n = 44)	
Farm establishment, tenure and size dynamics						
Average farm establishment year with current farm owner	1995	1993	–	2008	2006	–
% without land title ^a	41.9	26.7	***	57.1	31.8	**
% indicating land loss due to dispossession or poor land rights to be a moderate or very important risk	7.0	10.0	–	10.5	15.9	–
% of respondents who initially acquired all or part of their land using transactional methods (buying or renting)	65.9	80.0	**	60.5	70.5	–
% leasing or renting all or part of their land	30.1	45.8	***	32.9	68.2	***
% of respondents that have increased their farmland area	58.6	73.3	**	53.9	86.4	***
% of respondents that have decreased their farmland area	10.2	12.5	–	7.9	4.5	–
Farm owner characteristics						
Mean age of farm owner	55.4	55.5	–	46.3	47.1	–
% farms in female ownership	17.5	15.7	–	17.3	9.3	–
% farms in dual ownership (male and female)	65.0	67.8	–	65.3	67.7	–
Farm owner mean years of formal education	10.2	11.5	***	10.9	11.6	–
% farm owners with a tertiary education	25.5	32.8	***	28.0	35.7	–
% farm owners ever employed in any other wage-paying job	63.4	62.5	–	65.8	61.3	–
% of farmers ever employed in high-profile jobs ^b	31.7	36.7	–	36.8	34.1	–
% absentee farm owners	4.3	10.1	**	6.6	18.2	*
% farm owners who grew up locally	41.4	45.0	–	50.0	53.7	–
% Farm owners with ethnicity other than Kikuyu or Kalenjin	9.1	4.8	–	15.9	6.6	–

- $P > 0.1$, * $P \leq 0.1$, ** $P \leq 0.05$, *** $P \leq 0.01$

^a Land lease or rent is considered equivalent to titled land tenure.

^b High-profile jobs include public servant, police, politician, or business manager.

73% of respondents indicating that a loss of land rights is not an important risk and only 9% indicating this to be a moderately to very important risk. Differences in land tenure arrangements and security are often quoted to explain why MSFs continue to emerge amidst an overall trend of farm fragmentation (Chimhowu, 2018). MSFs are significantly more likely to have a state-backed land title for their land. However, having a title does not seem to influence perceived land tenure security (χ^2 -test: $P = 0.54$). Many MSF respondents were aware of their relatively privileged land endowment and expressed fears of land claims by squatters, tenants, or local officials. The reason why MSFs are more inclined to have a title may therefore be that they perceive themselves to be more vulnerable to hostile land claims and conflicts. Another possible reason is the costs involved in obtaining a land title, which many SSFs may not be able or willing to pay.

Signs that MSFs are able to leverage power differentials to acquire land are not apparent. MSFs are significantly more likely to have used transactional methods (renting or buying) to acquire land. For the full sample, transactional acquisition was used by 67% of respondents, although only 50% used only transactional methods and not relational (inheritance, marriage, intra-family transfer) methods. Hence, our findings suggest that, amidst an overall trend of land fragmentation, MSFs are consolidating land by buying or renting from fragmenting

smallholder farms. This aligns with findings in Meru County (Hakizimana et al., 2017) and implies that a willing buyer/willing seller system appears to prevail. However, insofar as land transactions are driven by distress sales (e.g. following a failed harvest or other livelihood shocks), this accumulation process could be detrimental to the livelihood assets of a growing landless class. Whether this is occurring or not cannot be deduced from our survey but remains a highly relevant rural policy question.

MSFs are more likely to have increased their farm size after establishment, and this difference is more outspoken for farms established after 2000. This lends credibility to a profile of entrepreneurial smallholders who use the land market to attain MSF status. MSFs are also significantly more likely to rent part or all of their farmland. While MSFs are more likely to have increased their land size, farm size increases are also found for the majority of SSFs. Although relational methods to increase farm size are important, transactions are the dominant method (86% of expansive farmers rented and/or bought the additional land). SSFs and MSFs are equally likely to use transactional methods (χ^2 -test: $P = 0.30$). It is noteworthy that a vision of land redistribution via land markets and a freehold land tenure system was central to the colonial Swynnerton Plan (Thurston, 1987). This plan held the belief that, to modernize agriculture, smallholders should

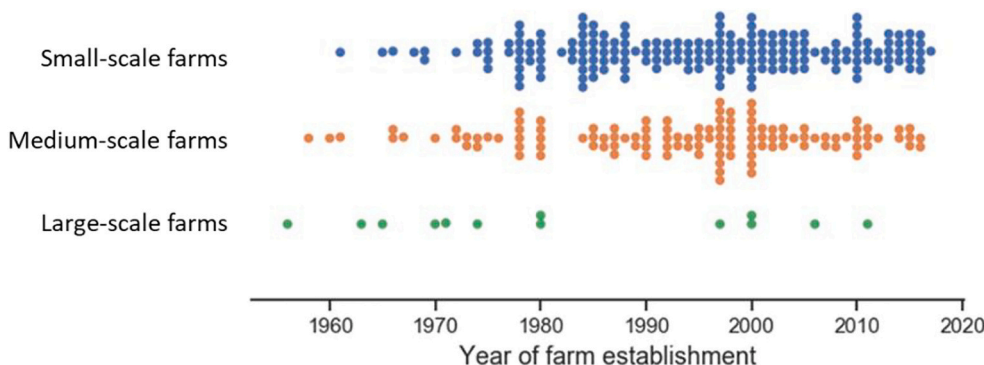


Fig. 2. Year of farm establishment with current farmers. Each dot represents a survey respondent.

able to use land transactions to develop their farms with the assurance that their tenure status would remain upheld. These results suggest that such a land market is indeed at work today, although the importance of land titles is not as important as envisioned.

Farm owners of an MSF have received significantly more years of formal education, and are significantly more likely to have received a tertiary education. However, there is no indication that many MSF farm owners are people who acquired capital or bureaucratic agility by being or having been employed in non-farm jobs, because they are not more likely to have been employed as public servant, business manager, politician or other high-profile jobs. MSF owners are more likely to live away from the farm, but farm owner absenteeism is low in general. MSF farm owners are not more or less likely to have grown up locally, and a majority of respondents indicates to have migrated towards their current farm (Table 1). Furthermore, there is no significant ethnic over- or underrepresentation in the MSF category (Table 1), nor are farm sizes of non-Kalenjin/Kikuyu farmers significantly larger or smaller (*t*-test, *P* = 0.76). This indicates that, while land issues in the Rift valley can have ethnic dimensions, MSF dynamics are not particularly ethnic in nature.

From these characteristics, a preliminary generalization may be drawn: MSFs, though not new, are emerging alongside land fragmentation, yet power disparities or land tenure issues cannot fully explain this. Instead, MSFs are often successful expanders, using land markets to acquire land from exiting, non-viable fragmented farms. This dual fragmentation-consolidation process has also been found in Meru, Kenya (Hakizimana et al., 2017). However, it should be noted that there is diversity within farm scale categories: a large minority of MSFs are more accurately typified as older farmers who acquired land in times when larger farms were the norm.

The LSFs in our sample often trace their origins to colonial times, with owners indicating that they are either direct descendants of British colonial farmers or (have ancestors who) occupied high positions in colonial bureaucracies. Other very large farms in our sample are government-owned or collectively managed by a community. These arrangements are likewise rooted in the land redistribution programs immediately after decolonization. Among LSFs, fears of losing land rights were generally high except for government-owned farms. LSFs mostly had experienced instances of squatting or unauthorized cattle grazing on their land, and feared that redistributive land reforms could target them.

4.2. Crop productivity, crop mixes, and farm strategies

MSF and SSF are comparable in terms of their crop productivity for

each of the five crops for which our survey has sufficient data to allow for comparison (Table 2). This absence of difference in crop yields suggests an absence of (dis)economies of scale in productivity. This implies that our results do not support inverse farm size – productivity relationship found elsewhere (Carletto et al., 2013), nor can we find indications that larger-sized farms are a requirement to meet growing agricultural demands or to use land more efficiently (Sender and Johnston, 2004). Conceivably, these findings are the compound result of two counteracting drivers: smaller farmers may attain a yield bonus following the logic of the inverse farm size – productivity relationship (i.e. self-motivated family labor), and a yield penalty as they have less access to inputs and technologies.

While productivity is highly similar, crop mixes, as expressed by share of farmland dedicated to various crop groups, differ to a large extent (Fig. 3). On average, MSFs are using significantly less land for staple crops. Still, the average MSF uses 46.6% of land for staple crops (Table 2, Fig. 3). Instead, MSFs often use their larger land endowment to accommodate cattle, as they have significantly more cattle per farm and a higher fraction of farmland used as grazing land (Table 2). However, SSFs are rearing cattle considerably more intensively, with 2.5 times more cattle per hectare of on-farm grazing land. SSFs are able to accommodate high numbers of cattle on limited space by deploying zero-grazing or semi-zero-grazing systems, thereby relying on fodder which is often bought from neighboring larger farmers. This highlights that different farm scales can be complementary to each other: zero-grazing systems labor-intensive but require little space, while fodder crop growing requires the opposite. Many respondents indicated an ambition to further intensify dairy farming, and move towards zero-grazing systems and away from mixed crop-livestock systems.

SSFs are more inclined to grow vegetables (Fig. 3), which typically has high labor requirements per hectare compared to cattle grazing. This suggests that, to some extent, land substitutes labor and vice versa, in livelihood and farm management strategies. Where land is relatively limited (SSFs), labor-intensive crops are more frequently cultivated, while labor-extensive practices with high land demands are more frequently applied where labor is relatively limited (MSFs, LSFs). The role of SSFs as vegetable growers puts them in a central position to guarantee nutrition security at the local level (Ogutu et al., 2019).

The average crop mixes offer an informative snapshot of current practices, but obfuscate the large heterogeneity within categories and do not reveal the past and future strategies of farmers. In Fig. 4, respondents are subdivided into either staple crop farms (> 75% of land is cereals or pulses), cash crop farms (< 25% of land is cereals or pulses), or mixed farms (everything in between). Circles indicate share of the respondents in each category at start (five years ago for left

Table 2

Summary statistics concerning crop production and productivity. Significance tests are the result of student-*t*-tests. Because not all crop are grown on all farms, comparisons of yields per crop are based on subsamples only.

Survey question	Full survey			Post-2000 subset		
	SSF (n = 186)	MSF (n = 120)	Sig.	SSF (n = 76)	MSF (n = 44)	Sig.
% of land used for staple crops (cereals and pulses)	52.4	46.6	*	57.1	48.0	*
% of land used as grazing land	16.6	28.6	***	14.2	26.6	***
Number of crop types grown ^a	4.0	3.9	–	3.8	4.2	–
Self-reported maize yield (kg/ha)	4377 (n = 160)	4927 (n = 92)	–	5135 (n = 64)	5494 (n = 35)	–
Self-reported beans yield (kg/ha) ^b	1077 (n = 39)	989 (n = 24)	–	1142 (n = 16)	934 (n = 9)	–
Self-reported wheat yield (kg/ha) ^b	6034 (n = 5)	4141 (n = 20)	–	3830 (n = 3)	3374 (n = 8)	–
Self-reported potato yield (kg/ha) ^b	9535 (n = 81)	8365 (n = 63)	–	7862 (n = 32)	7059 (n = 24)	–
Self-reported peas yield (kg/ha) ^b	5171 (n = 28)	4177 (n = 29)	–	3566 (n = 14)	4291 (n = 15)	–
Number of dairy cattle per farm (excluding beef cattle)	3.6	9.7	***	4.4	9.1	**
Dairy cattle per hectare of on-farm grazing land (excluding farms without cattle)	18.4 (n = 142)	7.5 (n = 105)	***	19.3 (n = 51)	7.8 (n = 8)	***

- *P* > 0.1, **P* ≤ 0.1, ** *P* ≤ 0.05, *** *P* ≤ 0.01

^a Crop types: Cereals, pulses, tubers and roots, vegetables, fruits, flowers, coffee and tea, grazing land.

^b Yields are reported per plot and are aggregated per farm for all plots with crop as main crop last growing season. Where multiple crops are grown on a single plot, this plot was excluded from this analysis.

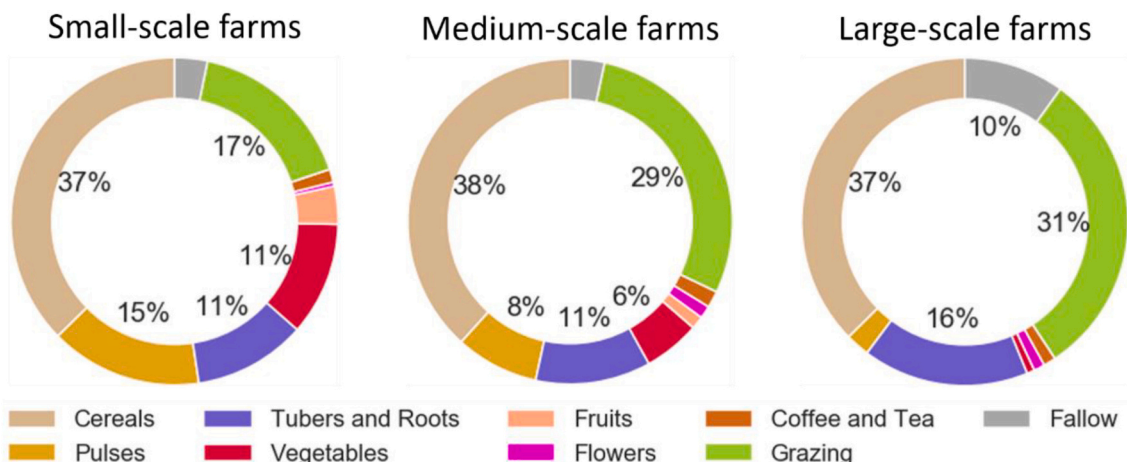


Fig. 3. Crop mixes on SSFs, MSFs, and LSFs, as average percentages of farm land area.

panels, current for right panels), and arrows indicate transitions pursued in the last five years (left) or aspired for the next five years (right). A mixed portfolio with both cash and staple crops is dominant for SSF and MSF (Fig. 4, circles in panels c and d), and a persistence of this portfolio is the most pursued and most aspired dynamic. The share of staple crop farms is remarkably similar for SSFs and MSFs (22%

compared to 20%) in the current situation (Fig. 4 c-d), and both SSFs and MSFs have seen a major reduction of this share in the last five years (arrows Fig. 4 a-b). Moves towards cash crop-focused portfolios have been marginal in the past five years but are relatively often aspired, especially by SSF. Moreover, the vast majority of current cash crop farms intends to persist (arrows Fig. 4 c-d).

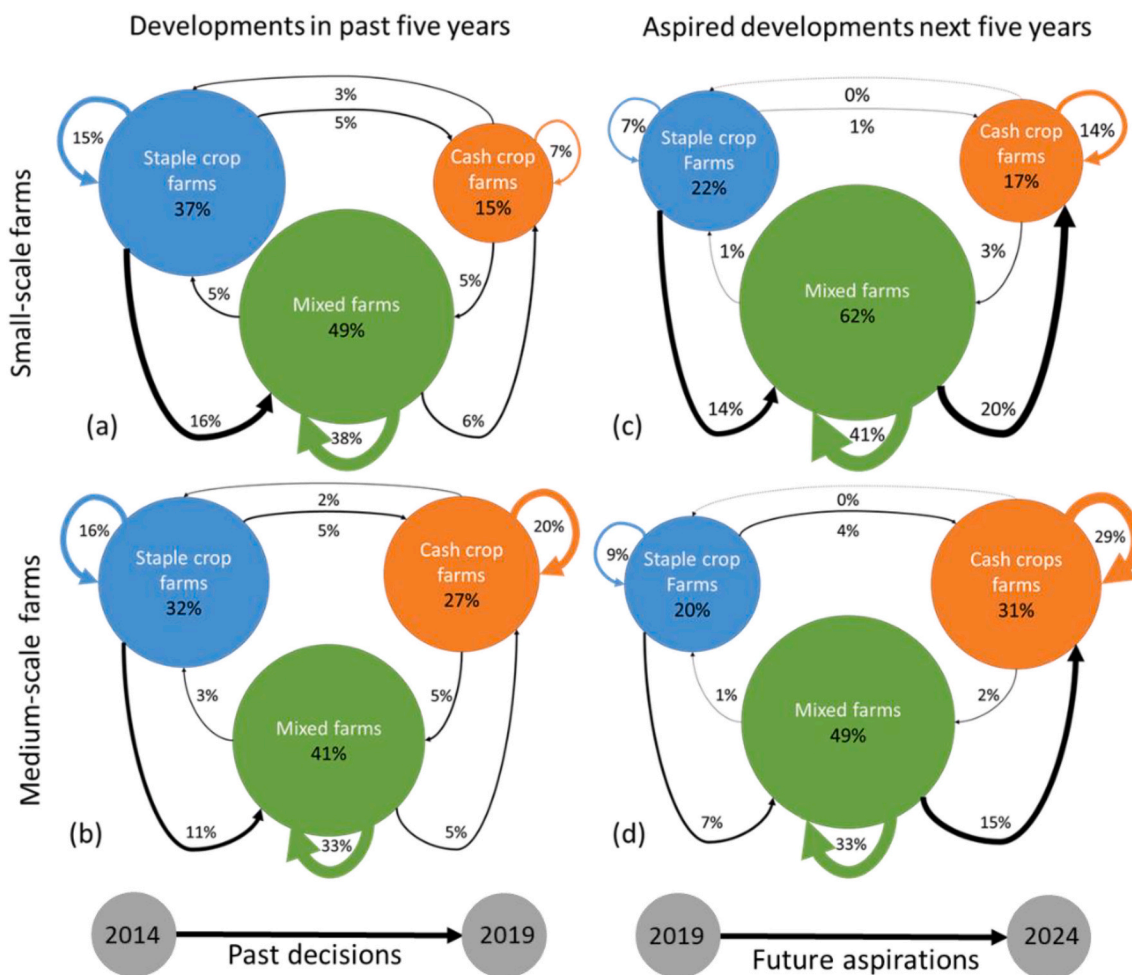


Fig. 4. Developments in farm types. Farms are considered staple crop farms if grains and pulses cover at least 75% of the farm area, and are considered cash crop farms if this share is below 25%. Farms in between these thresholds are considered mixed farms. Circles indicate share of the respondents in each category at start (five years ago for left panels, current for right panels). Arrows indicate share of respondents moving from category to category as reported for the last five years (a,b) and as aspired for the next five years (c, d).

These observations partly resemble archetypical notions of entrepreneurial MSFs with a strong focus on cash crops (the share of MSFs that can be categorized as cash crop farms is indeed much larger than for SSFs), but also add nuance. Farm scale is an imperfect proxy for entrepreneurship at best, as almost half of MSFs are mixed farms and one in five are staple crop farms. Conversely, a large fraction of cash crop farms are small, implying that it is attainable for small farms to focus on cash crops. The most important aspired transitions for SSFs are shifts away from staple crop farms and towards mixed or cash crop farms. However, there is a discrepancy between stated future aspirations and the observed strategies in the past five years: while a transition towards cash crop farms is often aspired, such transitions have only rarely been pursued in the past five years. This has two explanations: First, respondents have likely not performed a feasibility analysis when expressing aspirations, and as such aspirations are not concrete plans. Second, aspired shifts away from staple crops could be hindered by financial, food security or logistical constraints. For example, moving away from staple crops has transition costs and requires market access (both to sell cash crops and to reliably buy food). Identifying and addressing these constraints may assure that stated aspirations have a higher chance to materialize in the coming years. MSFs, on the other hand, appear to have less dynamic aspirations and are more inclined to keep their crop mix as-is. This could mean that MSFs are less constrained to materialize their aspirations and already find themselves in a preferred position.

Over the past five years, farmers have, on average, diversified (i.e. increased the number of crop groups they grow (t -test, $p < 0.001$)). However, average aspirations for the future are to specialize and drop one or more crop groups (t -test, $p < 0.001$). This past diversification and aspired specialization are farm scale-independent. Beyond these average trends lies a large heterogeneity: 50% of respondent neither diversified nor specialized, and 41% diversified (Fig. 5). Over the past five years, farmers have experimented with new crops beyond the typical maize-beans mix, which can be caused by an increased accessibility of alternative market outlets and input providers. Many respondents indeed indicated having started growing potato or vegetables as a side project. This abandonment of maize was, according to respondents, due in part to competition from imported maize, which reduced selling prices, and in part to reduced yields and weather predictability.

Concerning aspirations for the next five years, respondents would often state that a certain crop is not profitable anymore and that they aspire to move land and labor resources to their more profitable activities, mainly dairy, potatoes, and fruits. Yet, both SSF and MSF plan to change less in the near future than in the near past (Fig. 5 b-d). The lack of any meaningful difference in term of specialization or

diversification between SSFs and MSFs indicates that SSFs and MSFs have similarly varied strategies and aspirations.

Relative to both SSF and MSF, LSFs are more inclined to leave some land fallow and dedicate somewhat more land to grazing. Potato growing is more prevalent among LSFs (Fig. 3), and aspirations point to a further expansion of this crop's importance among LSFs. Moreover, labor-intensive crops, such as vegetables, take up only a small fraction of LSF area.

4.3. Farm labor and labor productivity

Multiple results indicate that the nature and organization of farm labor is scale-dependent (Fig. 6). Overall, MSFs employ on average over four times fewer people per hectare when counting both casual (day labor) and non-casual (permanent or seasonally fixed labor) employment (Table 3). While the vast majority of respondents use at least some family labor, MSFs additionally source non-casual labor from outside the family four times more often. This signals a departure from the family farming system at larger scales. 31 of 319 surveyed farms rely only on non-family labor and can thereby be profiled as company farms rather than family farms. We find these company farms predominantly in the MSF (18 farms) and LSF (6 farms) categories. The use of casual labor, expressed in Kenyan Shillings spent per hectare per year, is characterized by a high variability and does not differ significantly between SSFs and MSFs.

The difference between farm labor in MSF and SSF implies that, on a per-hectare basis, larger farms provide less employment and that the same area of land managed as MSFs may provide livelihoods to fewer people. This could be explained by a host of factors, including higher mechanization, higher labor productivity, and a less labor-intensive crop mix. The average SSF is closer to the typical family farm structure, employing less non-family or casual labor.

Labor on LSFs shows a high diversity between the sampled farms. Some LSFs show very low labor use per hectare. These are either highly mechanized farms or farms managed by old people nearing retirement who leave much land fallow. Other LSFs employ relatively abundant amounts of mostly casual labor. One LSF respondent explicitly mentioned that he deliberately keeps mechanization levels low and labor levels high because hiring local labor grants him goodwill from neighboring communities and decreases chances of conflict. This shows that some LSF owners do not take their privileged position for granted and tend to have strategies to maintain a positive image.

4.4. Market orientation and agricultural networks

Farmers working at different scales have a different market

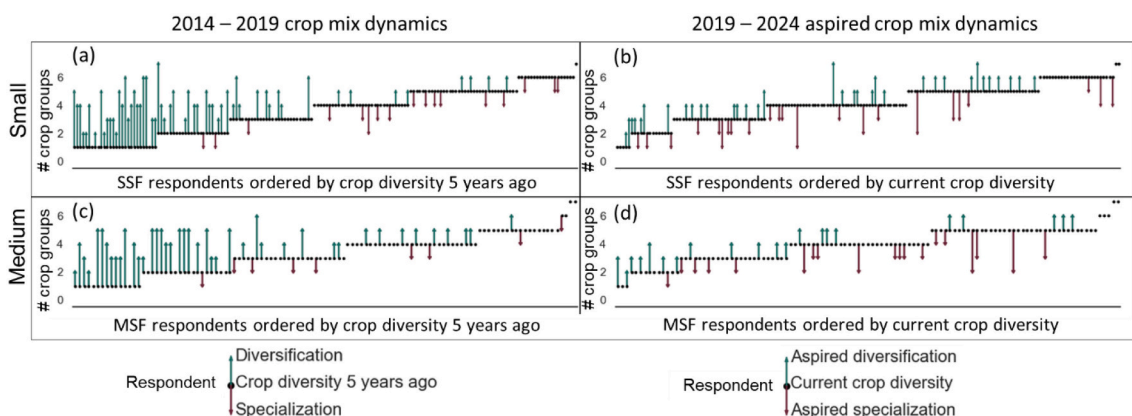


Fig. 5. Crop mix diversification and specialization for SSF and MSF, as observed in the past five years (left) and as aspired for the next five years (right). Crop groups are “cereals”, “pulses”, “tubers and roots”, “vegetables”, “fruits”, “flowers”, “grazing land” and “coffee and tea”.

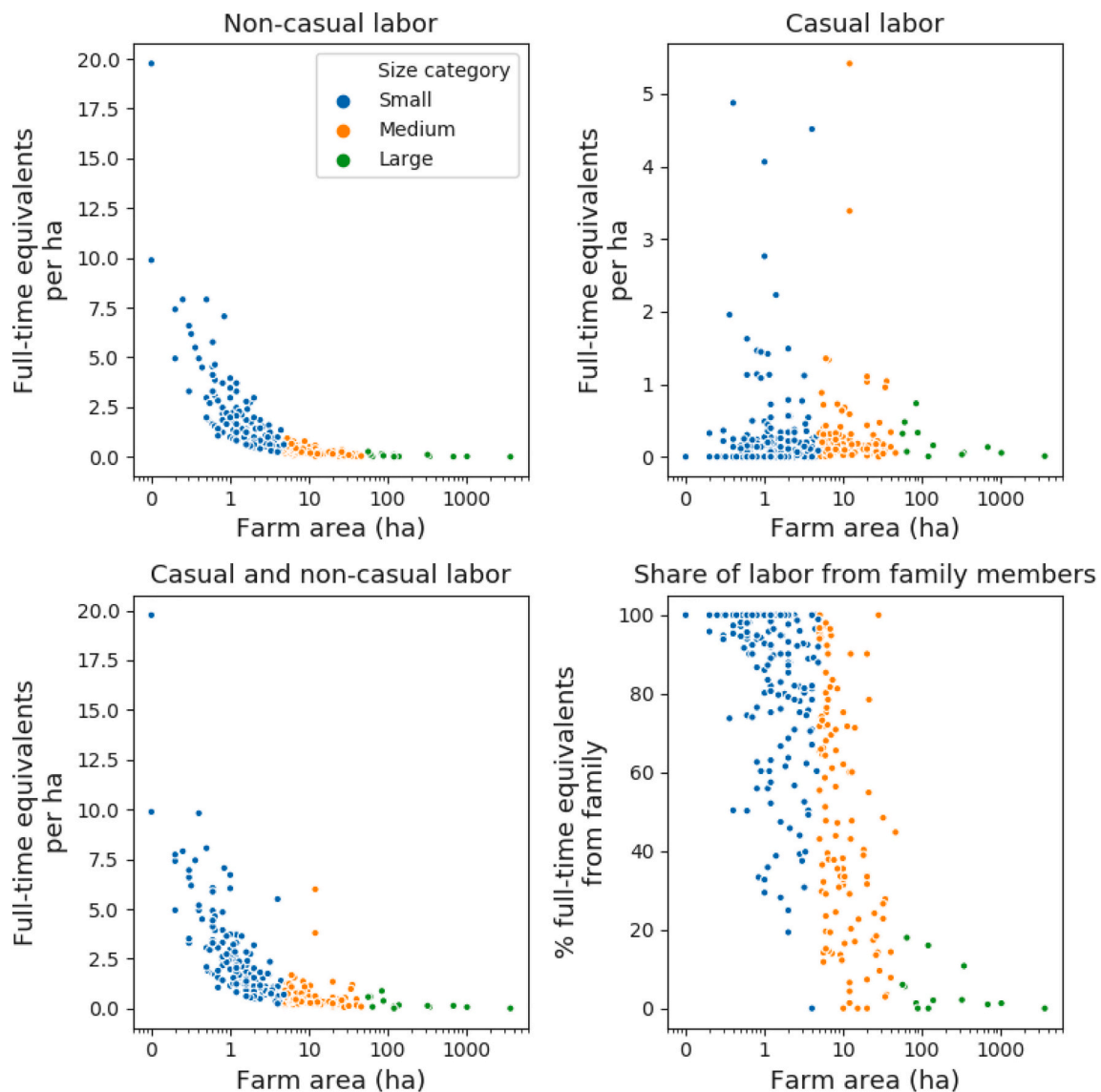


Fig. 6. Relations between farm area and labor. Note logarithmic scale on x-axis.

Table 3

Summary statistics concerning farm labor. Significance tests are the result of student-t-tests and χ^2 tests for, respectively, continuous and categorical dependent variables.

Survey question	Full survey			Post-2000 subset		
	SSF (n = 186)	MSF (n = 120)	Sig.	SSF (n = 76)	MSF (n = 44)	Sig.
Total labor to land ratio (casual and permanent full-time equivalents per hectare)	2.64	0.63	***	3.34	0.75	***
Labor-to-land ratio (full-time equivalents for permanent workers per hectare, averaged across farms)	2.34	0.34	***	3.07	0.35	***
Labor to land ratio (permanent workers per hectares aggregated over total land used by farmer group)	1.34	0.25	n.a.	1.42	0.25	n.a.
% of respondents using non-family permanent labor	13.4	55.0	***	14.5	56.8	***
% of respondents using only non-family labor	3.9	15	***	5.2	11.4	-
Casual labor to land ratio (Kenyan Shilling spent per hectare per year)	25,256	20,719	-	24,838	35,118	-

- $P > 0.1$, * $P \leq 0.1$, ** $P \leq 0.05$, *** $P \leq 0.01$

orientation and are embedded in different networks. Specifically, MSFs use a more diverse set of market outlets and are less likely to identify the village market as their most important market outlet (Table 4). Furthermore, they are significantly more often a member of a cooperative or association and are more likely to use private extension services (e.g. from agrochemical companies or seed farms). Contract farming is widespread among both SSFs and MSFs, in line with the

generally high prevalence of such schemes in Kenya (Oya, 2012).

Although MSF have a more diverse set of markets and more connections to professional organizations, the results do not clearly show a profile of strictly entrepreneurial, urban- or export-oriented MSFs. For 61% of MSFs, the village market remains the most important outlet, and this does not decrease by much for the more recently established MSFs. When asked to give relative weights to the various market outlets used,

Table 4
Summary statistics concerning market orientation and agricultural networks. Significance tests are the result of student-t-tests and χ^2 tests for, respectively, continuous and categorical dependent variables.

Survey question	Full survey			Post-2000 subset		
	SSF (n = 186)	MSF (n = 120)	Sig.	SSF (n = 76)	MSF (n = 44)	Sig.
% of respondents identifying village market as most important market	73	61	**	76	57	**
Number of market outlets used	1.29	1.48	***	1.23	1.45	***
Membership of farmer cooperative or association	16.1	27.5	**	15.8	29.5	–
% using farming contracts	71.5	76.5	–	77.1	77.3	–
% relying on private extension programs	3.8	10.8	**	2.6	13.6	*

- P > 0.1, *P ≤ 0.1, ** P ≤ 0.05, *** P ≤ 0.01

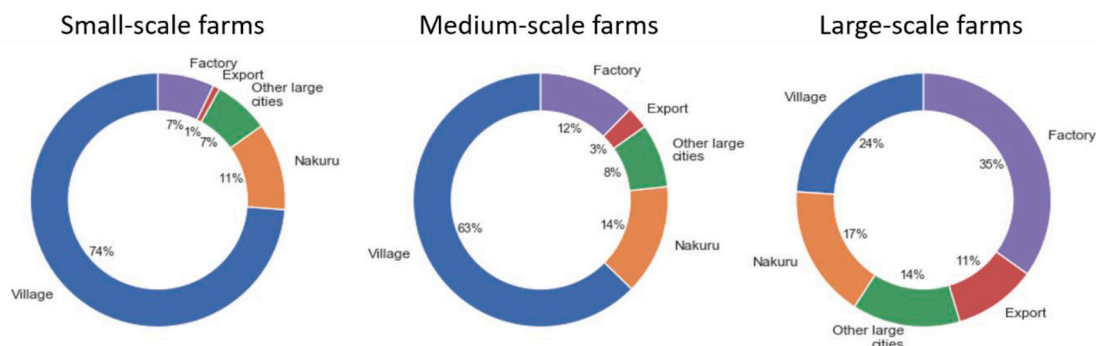


Fig. 7. Average self-assessed importance of different market outlets. Respondents were asked to rank all market outlets they used, and assign numbers corresponding to how important each outlet is to their farm business. On average, the village market is almost three times as important as all other outlets for SSFs (74%), while it is 1.7 times more important for MSFs (63%). 73% of smallholders consider the village market to be the most important (or only) market, while this is 61% for MSFs (Table 4).

MSF respondents on average gave the village market 63% of the total weight (Fig. 7). Although this is a lower importance compared to SSFs (74%), this means that the majority of MSFs are dominantly producing for similar markets as the majority of SSFs. Export markets are marginal for both SSFs and MSFs.²

The archetype of entrepreneurial, business-minded farmers can only be assigned to a minority of MSFs, as well as to a minority of SSFs. Among respondents indicating that non-village markets constitute at least three quarters of their self-assessed market importance (n = 52), 20, 23, and 9 are SSF, MSF, and LSF, respectively. Insofar as this is a measure for entrepreneurship, this means that 11% and 19% of SSFs and MSFs respectively are entrepreneurial. This subset is not necessarily recently established: their average establishment year of these entrepreneurial farmers is statistically equal to that of the full sample. Measured this way, entrepreneurship may be more common among MSFs, but it is not unique or dominant for MSFs.

For the surveyed LSFs, village markets are less important, with only 4 out of 13 LSFs serving village markets and only one identifying it as the most important market. Instead, factories (e.g. grain processors) are dominant, which could be due to a general preference of such factories to work with a few large farms instead of many small farms (Reardon et al., 2009). LSFs are also active on highly specialized markets, with respondents rearing and exporting race horses, and cultivating and distributing potato seed.

5. Implications and conclusions

In SSA, the agricultural sector continues to represent the foundation of the majority of livelihoods and agricultural dynamics remain the

² Commonly mentioned export crops include avocado, pyrethrum, cut flowers, and French beans.

primary drivers of environmental change. Understanding shifts in farm systems and the consequences in terms of employment, market orientation, or crop production is therefore crucial. Both anecdotal and statistical evidence have suggested a recent increase in the amount of MSF in SSA. This paper provides empirical evidence to further assess this development and to assess to what extent MSF are different from SSF in terms of their period of establishment, tenure situation, productivity and crop mixes, labor, and market orientation. In doing so, this paper calls into question whether farm scale or farm scale category, simple measures that are easily derived from census data, are sufficiently informative to describe an agricultural system in terms of its entrepreneurial qualities or its association with unequal land access, as is currently common (Jayne et al., 2016).

The portraits of MSFs that we sketch based on our survey results are only partly in line with the archetypical MSF described in recent literature. We find that MSFs in our study area are not a recently emerging phenomenon, and neither are many of them lateral entrants in agriculture who acquire land using capital gained in urban employment. Such profiles are reported in our survey, but they remain a small minority. Instead, MSFs are often found to have been SSFs at establishment who have used transactional methods (renting in or buying) to acquire incrementally more land. Another fraction of MSFs in our survey are relatively older farmers who acquired land in a time when larger farms were the norm. Only a small minority can reasonably be portrayed as urban-based entrepreneurial farmers. The most clear factor to distinguish such farmers is farm owner absenteeism, which is indeed significantly higher for MSFs, especially the post-2000 subset of our survey. Still, this concerns only one in ten MSFs. These findings are in contrast with findings for Zambia, where MSF growth is mostly attributed to urban-based elites (Sitko and Jayne, 2014).

Highly unequal abilities to acquire land, which is a major tenet of global large-scale land acquisitions in the global land rush (Anseeuw et al., 2011), are not apparent among the SSFs, MSFs and LSFs in our

study area: farm size inequalities are mostly found to be colonial relics or the result of incremental farm size increases using transactional methods. A profile of MSFs as elites who are able to leverage power imbalances to acquire land (Chimhowu, 2018) is not dominant in our study. We find that MSF are more often engaged in growing cash crops for non-village markets, but similar profiles are far from rare among SSFs. MSFs tend to reserve more land as grazing land, but SSFs run significantly more intensive animal production systems, and innovate towards labor-intensive zero-grazing systems using limited land resources. Even among MSFs, the village market is most often ranked as the most important outlet, and close to 50% of their farmland is used for staple crops. From this, we conclude that while the average MSF differs from the average SSF in terms of markets and crop mixes, most MSFs are highly similar to most SSFs.

Agricultural labor is a dimension for which farm size does matter, as larger farms provide fewer jobs per hectare and rely more on non-family labor. This implies that, insofar as the total agricultural area remains constant, any rise in larger-scale farms is associated with a decrease in rural livelihood provisioning. In the absence of a considerable rise in urban and off-farm livelihoods, this will have negative effects such as landlessness and unemployment. Today, employment in the non-agricultural sectors is growing faster than agricultural employment (Timmis, 2018), but the World Bank (2016) qualifies these trends as a slow structural transformation at best, which is insufficient to drive an agricultural exodus (and thus a discernable average farm scale increase).

This case study was undertaken in an area that is, in many ways, unique. The (post-)colonial history, the specific agro-ecology and demographic dimensions are among many factors that set the area apart from other Kenyan or SSA sites. However, while each context is particular, issues surrounding rural development and the rise of MSFs will likely be similarly characterized by a mix of persistence and novelty. Positioning the rise of MSF as a new dimension of the land rush or an urban takeover of the SSA countryside is missing the fact that MSFs are mostly not new and often not so different from SSFs. Likewise, positioning MSFs as a necessary source of dynamism and engine of growth for the purportedly stagnant smallholder sector misses the fact that, in our survey and throughout SSA, entrepreneurial SSFs are appearing where conditions are favorable. We conclude that farm scale represents entrepreneurial or elitist qualities poorly, and more holistic measures should be developed to baseline and track farm system developments in SSA.

Throughout SSA, colonial and postcolonial historical land governance have left different signatures that continue to shape current land distribution dynamics. The scale of farms in a region is generally determined by the height of salaries in the non-farming economy, the crop mix, and policy biases (Byerlee, 2014). In Kenya, processes of land consolidation and land fragmentation (a product of the inheritance system which divides land across generations) are co-occurring. This is to a large extent a result of consecutive colonial and post-colonial land policies (for an overview, see Hakizimana et al., 2017). There are trade-offs between two policy goals: on the one hand, larger farms achieving higher labor productivity could be deemed desirable to achieve a competitive market position (Collier and Dercon, 2009). On the other hand, policies could be supportive of smaller farms, that provide livelihoods for a growing rural population that cannot be fully absorbed by the non-farming sectors. Our results indicate that, beyond these considerations of labor productivity, which are central to rural development issues, there are few other differences in performance between SSFs and MSFs. Farms of different scales tend to show high within-category diversity and tend to fulfill different functions. Labelling the rise of MSFs as either a source of dynamism or a new land rush fails to acknowledge this, and therefore risks, respectively, to miss the dynamism in SSFs or to exaggerate the extent of domestic land issues.

Declaration of Competing Interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.agry.2020.102943>.

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