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MECHANISED AGRICULTURE AND MEDIUM-SCALE FARMERS IN NORTHERN GHANA: A SUCCESS OF MARKET LIBERALISM OR A PRODUCT OF A LONGER HISTORY?

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ACRONYMS

ADC	Agricultural Development Corporation
AMSEC	Agricultural Mechanisation Service Centre
CPP	Convention People's Party
FAO	Food and Agricultural Organization of United Nations
GSSP	Ghana Strategy Support Program
IFPRI	International Food Policy Research Institute
IMF	International Monetary Fund
ISSER	Institute of Social, Statistical and Economic Research
NGO	non-governmental organisation
NLC	National Liberation Council
NRC	National Redemption Council
PP	Progress Party
SG 2000	Sasakawa Global 2000
UGFCC	Union of Ghana Farmers Cooperative Council
USAID	United States Aid Agency for International Development

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SUMMARY

In recent years, the significant uptake of tractor-ploughing services in Ghana has been heralded as a success of market liberal policies. It has been argued that market reforms have enabled medium-scale farmers to expand their operations and invest in tractors, which they also hire out to smallholders, enabling a significant expansion in agricultural outputs of both categories of farmers. This is often contrasted with the failures of state-led agriculture policies before structural adjustment. However, this argument is based upon the assumption that with structural adjustment and the rolling back of state services, past policies on mechanisation disappeared and left no footprints in agrarian production.

This study argues that there are uncanny resemblances between the areas in which there are high uptakes of mechanisation and those areas targeted by state agricultural policies in the 1960s and 1970s, and between the medium-scale commercial farmers rooted in urban civil servants and traders that are proclaimed to be the success of recent market policies, and the commercial farmers of the 1970s rooted in political and bureaucratic elites. Market liberalisation resulted in the privatisation of state agricultural services and tractors: it did not lead to the disappearance of tractors and tractor services. Most of the areas recording high rates of uptake of tractor-ploughing services in recent years occur in areas that were cleared by the state in the 1960s and 1970s, rather than in new frontier areas that have been recently stumped to enable tractor ploughing.

Before structural adjustment, state agricultural interventions were not only concerned with building state farms but also in encouraging the emergence of commercial agriculture. Within the era of a liberalised markets programme, non-market interventions continue to exist, sometimes initiated by non-governmental organisations (NGOS), to encourage uptake of modern technologies by farmers. This paper argues that contemporary medium-scale farmers are not the creation of market liberalisation policies, but share many similar characteristics with the commercial farmers of the 1970s, including roots in the urban civil servant and trader class fractions. Thus, many features of the past agrarian structure continue to persist in spite of market liberalisation. The study is critical of contemporary approaches to mechanisation based on revised and updated theories of induced technology transformation, and advocates for an approach rooted in political economy and historical analysis.

1. INTRODUCTION

The development of agricultural mechanisation policies in Africa has been characterised by three phases (Mrema, Baker and Kahan 2008). In the first phase, from the 1950s to the 1970s, mechanisation was seen as an important part of agricultural modernisation, particularly in facilitating the emergence of a class of large-scale 'progressive' commercial farmers, who were receptive to modern technology, unlike the conservative peasant farmers.

In the second phase, from the 1990s to the 2000s, mechanisation was given low priority in agricultural development policy and was widely regarded as inappropriate for the main objectives of promoting more intensive production among smallholders, who were regarded as the main social force for agricultural development (Mrema *et al*. 2008; Binswanger and Pingali 1988). Lipton (1977) argued that the promotion of mechanisation was a policy distortion by dominant political interests within the state that promoted 'urban bias' and 'elite capture' of agriculture by urban bureaucrats investing in commercial agriculture.

The main focus in international agricultural development policy during the 1980s and 1990s was on incremental development and the adaptation of technology to the conditions of smallholder farmers. During the 2000s, the pendulum has swung back to promoting commercial agriculture through medium-scale commercial farmers, albeit through the market rather than state patronage. The emergence of medium- and large-scale farmers is now seen as reflecting the success of agricultural policies rather than elite capture (Jayne *et al*. 2016). The new policy narrative argues that the only feasible way for Africa to develop its agriculture is by promoting commercial agriculture, agribusiness solutions, and the uptake of new proprietary seeds and inputs. This has given a new lease of life to mechanisation; the demand for tractors by medium-scale farmers and the hiring out of tractor services to smallholders by tractor owners is seen as a success, reflecting the diffusion of cost-effective services to smallholders within a market economy.

A number of African governments are now promoting mechanisation and introducing tractor import and distribution schemes. A number of new industrialising nations with rising agricultural engineering industries are providing bilateral loans and credits for African states to purchase agricultural machinery at concessionary prices, most notably China, Brazil, and India.

Two main approaches to mechanisation can be seen in the recent literature. The first contrasts the decline of mechanisation within Africa during the 1990s with the advances in Asia. Mrema *et al*. (2008) argue that a global correlation exists between uptake of mechanisation and agricultural growth. They argue that the demise of mechanisation policies in Africa during the 1980s was a result of the politicisation of policy rather than the failure of mechanisation. They argue that the decline of agricultural mechanisation in the 1980s was related to changing agricultural development paradigms, which were brought about by economists working with theories of induced innovation in smallholder agriculture. These economists began to challenge the frameworks of agricultural engineers on the role of mechanisation in agricultural development (*ibid*.).

Mrema *et al*. (*ibid.*) argue that the uptake of mechanisation in Africa from the 1960s to the 1980s was limited and experimental. It did not provide sufficient data on which to make sweeping conclusions about mechanisation. They argue that the field studies that these economists built their theories on were contentious and did not incorporate a sufficiently long-term analysis of changing patterns of mechanisation within Africa in order to gain a deep perspective on the development of mechanisation before the 1980s. Furthermore, while these economists proposed that animal traction was a more appropriate alternative, this has failed to take off in Africa. This approach essentially seeks to revalidate the original framework of mechanisation (based on its success in southeast Asia) and update it to harmonise with the dominant contemporary macroeconomic framework of market liberalisation policies in Africa.

The second approach to mechanisation attempts to defend the theory of induced innovation and update it to account for the recent upsurge of interest and uptake of mechanisation within Africa (Diao *et al*. 2014). This seeks to disassociate the recent successes of mechanisation from statist policies of the past,

and present them as the outcomes of the success of market liberalisation (*ibid*.; Daum and Birner 2017). This approach attributes the recent re-emergence of mechanisation to successful market liberalisation policies and changing factors of production in relationship to the scarcity of land and labour. Diao *et al*. (2014) argue that these successes have facilitated the emergence of medium-scale farmers, who have in turn transformed smallholder farming in certain areas by providing tractor services on favourable conditions. However, this is very finely balanced on a framework that sees statist agricultural policies resulting in the failure of mechanisation by the 1990s, and liberal market policies resulting in a completely new strand of uptake of mechanisation originating in the 2000s, without any continuity between the two. Moreover, during the market liberalisation phase, there have been several attempts to stimulate uptake of modern agricultural technologies by farmers through several NGO initiatives that involve providing farmers with loans, discounted packages, and disguised and 'smart' subsidies, which are essentially non-market interventions to stimulate a market demand for technology.

This case study demonstrates that the assumptions that policy operates outside of historical contexts are a fallacy and result in the erasure of history by development doctrine. Working within a political economy framework that examines the linkages between processes of capital accumulation in agriculture and the articulation of policy, it explores the historical dimensions of mechanisation, and continuities in the agrarian structure between the period of state-led agriculture and market liberalisation. It rejects simplistic understandings of state policies in neo-patrimonial frameworks that associate the expansion of mechanisation with political patronage and diverting state resources for political support. The existence of expanding private markets in tractors after the imposition of structural adjustment in Ghana suggests otherwise.

This study also questions the framing of the concept of 'statist policies', since this conflates a wide range of social and political relations in differing periods. State mechanisation is widely used to refer to state farms, state organisation of cooperative societies, and state patronage of large-scale commercial farmers. State-mechanised agriculture embodies relationships between state agricultural agencies, multinational corporations producing farm machinery, international agencies promoting these services, donors, local retailers, tractor service providers, different classes of farmers, and farmers' organisations. These are the same types of relations that are embodied in the framework of 'good governance' based on the integration of state, market, and civil society.

This study seeks to disentangle the relationships that exist between these various actors through time and to examine the continuities and discontinuities in agricultural development policies. The research focuses on a case study of northern Ghana, which is the main area in Ghana in which there has been uptake of mechanisation. It draws upon field research conducted in five communities within the hinterland of Tamale, the major urban conglomerate in northern Ghana, which largely produces rice, maize, and groundnuts for urban markets. It also develops a historical analysis of the rise of mechanisation in northern Ghana based on secondary sources, examining agricultural development in the 1960s–1980s and agrarian class formation.

The first part of this paper provides an overview of the theory of induced innovation in the context of agricultural mechanisations and the revisions to this theory to update it to contemporary conditions in northern Ghana. This is followed by a discussion of the characteristics of the recent uptake of mechanisation in northern Ghana. The third section provides a historical analysis of mechanisation policies in northern Ghana in the context of state attempts to promote agricultural commercialisation and a class of capitalist farmers. This also examines continuities between the early phase of mechanisation that preceded structural adjustment and recent processes of mechanisation in the 2000s.

2 INDUCED INNOVATION AND MECHANISATION: A THEORETICAL FRAMEWORK

In a study of the recent uptake of mechanisation in Ghana, Diao *et al*. (2014) revisit the theory of induced innovation and attempt to update this to account for recent trends in mechanisation. The theory of induced innovation is associated with the writings of Binswanger and Ruttan (1978), Pingali, Bigot and Binswanger (1987), and Binswanger and Pingali (1988). Building upon a framework developed by Boserup (1965) and Ruthenberg (1980) on the relationship between population dynamics and technology change, they argue that tractors only become cost-effective where land is abundant and labour scarce. Although population densities in many African countries were relatively low in the 1970s (as compared with Asia) and land was available, the availability of land resulted in the dominance of bush-fallowing agricultural systems that were relatively easy to work at low intensity, and did not create a large demand for hired labour. These lands were full of tree stumps that easily damaged tractors and made the adoption of mechanisation highly expensive in land clearance.

Diao *et al*. (2014) that mechanisation can only become cost-effective when there is a transition to more intensive farming systems characterised by permanent cultivation and grassy environments, and where labour scarcity is valued over land scarcity. They argued that this stage had not arrived in most of Africa during the 1970s and the prevalence of woody fallows, woody growth, and stumps within most African environments required high outlays in clearing and stumping the land with bulldozers and crawlers, which constrained the uptake of tractors. They argue that until land and labour become scarce, to the point where it leads to transformations in farming practice away from bush fallowing, mechanisation will remain uneconomical in most African farming systems.

Diao *et al*. (2014) argue that the main evolutionary transition in African farming systems was likely to be from bush-fallowing systems to more permanent forms of cultivation in which animal traction was used. Animal traction does not require the expensive process of the clearing of stumps to make way for tractors to plough. They concluded that although states have invested heavily in promoting mechanised technologies, the returns to investments have been poor and unsustainable, and often guided more by political patronage and political distortions rather than by economic factors.

Pingali *et al*. (1987) and Binswanger and Pingali (1988), however, recognised that there were some African environments in which ploughing thrived. They theorised that ploughing was initially confined to areas characterised by floodplains and grasslands. The floodplains are often characterised by heavy vertisols and sparse vegetation. The heavy soils are very difficult to work with manual implements, resulting in low population density in these areas. The low population density results in an availability of land but a scarcity of labour, which further encourages the use of tractors. Tractor ploughing facilitates the development of commercial rice cultivation in these areas. The lack of tree stumps in grassland areas also make them suitable for tractor ploughing. Grassy areas are difficult to clear with fire, and fire does not destroy their root structures or lead to a significant build-up of nutrients, as in woody fallows. Thus, these areas are also amenable to tractor ploughing.

One of the major problems with this theory of induced innovation is the failure of the intermediate stage of animal traction to have taken off in Africa. While manual implements still continue to be used in many areas, in other areas, farmers have moved to the use of tractor ploughing without any discernible intermediate uptake of animal traction or other alternative forms of small-scale mechanical traction (Mrema *et al*. 2008).

Diao *et al*. (2014) seek to update and revise the theory of induced innovation to account for the changes that have occurred in agriculture, and the resurgence of tractors in agriculture in northern Ghana. The main revision to the theory of induced innovation lies in accounting for the factors that have resulted in a movement to tractor ploughing without an intermediate stage of animal traction. Diao *et al*. (*ibid.*) argue that by the 2000s, there was a pronounced move to permanent cultivation in many areas of Ghana and towards increasing crop areas per capita, particularly in the main food-producing areas in Brong Ahafo, the Northern and Upper West regions. This has resulted in increasing scarcity of agricultural labour, which creates

favourable conditions for introducing labour-saving technology. They argue that there has been a significant emergence of farmers with larger holdings during this period. Farmers cropping more than five hectares of land grew from 12 per cent of total farmers in 1992 to 17 per cent in 2005/6.[1]

Diao *et al*. (*ibid.*) argue that this expansion of a middle stratum of farmers was carried out without the expropriation of land from smallholders, since the holdings of smallholders also expanded during this period. This created a situation of a rising land–labour ratio and high costs of labour, which resulted in favourable conditions for the adoption of labour-saving technologies and the adoption of tractor ploughing. The rapid expansion of urbanisation also resulted in increasing demands for rice and maize, which are more labour intensive than other crops. At the same time, urbanisation exercised a pull on rural labour, resulting in a scarcity of agricultural labour and the rise in agricultural wages.

According to Diao *et al*. (2014), their survey data reveals that 60 per cent of farmers in the Northern Region use tractor ploughing, including 50 per cent of smallholders, who hire tractor services. The expansion of medium-scale farmers resulted in increasing investments of farmers in tractors, but also the hiring out of tractor services to smallholders by medium-scale farmers with the capacity to plough lands beyond their personal requirements. The investments of medium-scale farmers in tractors with capacities to plough larger areas than those cultivated by the medium-scale farmers enabled tractor services to be provided for smallholders, encouraging the expansion of smallholder farms. Diao *et al*. (*ibid.*) argue that market liberalisation policies create a favourable environment for agricultural growth of both smallholders and medium-scale farmers.

The major problems with this model of induced agricultural innovation is that it removes the political economy of agrarian accumulation from the picture, and the longer-term policy objective of supporting commercial agriculture, which did not originate with market liberalisation policies. This is particularly problematic in relation to mechanisation since previous patterns of development continue to have a presence within the agricultural landscape. Even if past patterns of agricultural accumulation and innovation are judged to be a failure, they still leave an enduring footprint on present-day agroecology and in the transformations of the vegetations and soils of stumped land. The huge investment in stumping these lands continues into the present, and has contributed towards creating favourable conditions for the continued use of tractors. Hence the areas with high rates of mechanisation today occur in the precise locations in which land has previously been ploughed and stumped and cleared of vegetation during the earlier period of mechanisation.

Moreover, these occur largely in the vertisol and grassland environments that were identified during the 1970s as the most favourable for tractor ploughing, and also around state farms, such as in the Ejura area. Similarly, the agrarian development initiatives of the 1970s were based on promoting a new class of agricultural capitalist farmers from among civil servants and merchants based in urban areas. These have many similarities with the new class of medium-scale farmers, which is also associated with civil servants that invest savings and pensions in agriculture and traders. Current approaches to mechanisation are based on huge assumptions that the mechanisation policies of the 1960s–1980s were a failure and have no impact on the present (beyond attempts by the state to reintroduce state subsidisation and patronage of tractor programmes); that the emergence of large- and medium-scale farmers is a product of recent market liberal policies and has no historical connections to the commercial farmers of the 1970s and to structural features of the Ghanaian economy; and that the present market in tractors and tractor services has emerged from the opportunities created by liberalisation. Thus, it is critical to examine possible connections between previous patterns of mechanisation and agricultural accumulation and their influences on contemporary processes.

In contrast with the works on contemporary patterns of agricultural mechanisation, many farmers in the Northern Region are deeply aware of the historical continuities in agriculture and mechanisation. For instance, Issahu Abdullai, a farmer interviewed at Nabogu commented:

> Our shift to cultivating large farms started when the government brought bulldozers some years back to clear the *bahi [fadama]* [2] land around here. The year they cleared these areas, there were a lot of tractors in this village. I think it was the time of Acheampong.[3] Come and see! The educated men from Accra and Tamale brought their tractors to this village and they were working day and night. It was these town people *(fong nima)* who came with their money and tractors that changed our way of farming in Nabogu here.[4]

The next section explores the contemporary characteristics of mechanisation within northern Ghana.

3. CONTEMPORARY PATTERNS OF MECHANISATION WITHIN NORTHERN GHANA

Although Ghana is presented as one of the countries representing the recent uptake of mechanisation, the trend of recent uptake of mechanisation among smallholder farmers is only pronounced in the Northern Region, parts of the Upper West, and areas in the vicinities of state farms in the forest–savanna transition zone of Brong Ahafo and Northern Ashanti (Ejura). These are areas with long histories of mechanisation supported by the state. The field studies conducted by IFPRI on mechanisation tend to be concentrated in these historical areas in which land clearance for tractor ploughing occurred in the 1960s and 1970s (Diao *et al*. 2014; Cossar, Houssou and Asante-Addo 2016). They do not occur in areas recently opened up through large-scale land clearance and stumping.

This study is based on fieldwork carried out in the Northern Region[5] in 2016 and 2017. This consisted of informal interviews with development agents and farmers, which were then complemented by semi-structured interviews with open-ended questions. These were administered to 500 farmers in five densely populated settlements in the agricultural hinterland of Tamale in the Northern Region. The five settlements are Guntingli, Dohi, Kpulyin, Bogupaligu, and Nabogu. These settlements have long histories of ploughing and stumping of land, originating in the 1960s and 1970s. Peasant farmers cultivate most of these lands. However at Nabogu, many townspeople from Savalugu and Tamale have established commercial rice farms. The interviewed farmers consisted of 296 men and 204 women.

The field research focused on the uptake of ploughing services and uses of inputs within peasant communities, rather than on the stratum of medium-scale farmers based in towns. Given limited resources, the survey does not go beyond merely documenting the usage of inputs and crops grown by farmers. However, these data are comparable with those presented in the IFPRI studies on mechanisation. The aim is to show the technologies that farmers prioritise in their farming strategies, and the activities to which they allocate scarce resources, including priorities in the use of farm chemicals, fertiliser, labour, ploughing services, mechanised harvesting, and purchase of modern seed varieties. The study does not attempt to quantify the expenditure of farmers on various inputs and labour.

Within the settlements in which research was carried out, land pressures are most intense at Kpulyin and Bogupaligu. This is reflected in smaller farm plots, and a much wider occurrence of permanent cultivation. (see tables 1, 2, and 3). These areas, which are close to Tamale, are experiencing a large acquisition of residential plots and conversion of farmland into real estate. Only 6 per cent of farmers at Bogupaligu and 7 per cent at Kpulyin have more than 10 acres of land available for farming, as compared to 39 per cent of farmers at Guntingli and 44 per cent at Dohi (see Table 1).

At Bogupaligu, Kpulyin, and Nabogu, most plots are farmed on permanent cultivation while at Dohi and Guntingli bush-fallowing strategies continue to be significant (see tables 2 and 4). At Guntingli and Dohi, farmers still have large areas of fallow land available and still practise bush-fallowing techniques (see tables 3 and 4). At Dohi, 37 per cent of farmers interviewed fallowed their land for more than three years, as compared to 19 per cent of farmers at Guntingli. In contrast, no farmers at Bogupaligu and only 2 per cent at Kpulyin fallowed for over three years. At Bogupaligu, 62 per cent and at Kpulyin 68 per cent of farmers cultivated permanent plots (see Table 4).

Beyond the variations between settlements, there are also significant differences in the fallowing strategies used by men and women. Forty per cent of men cultivate permanent plots as compared to 70 per cent of women. This reflects the less favourable access that women have to land. In all settlements women tend to cultivate less land than men. In the survey 45 per cent of women cultivated less than two acres of land as compared to only 4 per cent of men (see Table 2). According to several women interviewed, the plots they were allocated by husbands or other family relatives were often of poor fertility (often the result of constant cereal cultivation).

Nabogu lies in the low-lying valley areas of the Savelugu area, which during the 1970s were a major focus of government initiatives to promote commercial rice farming. Nabogu has a more pronounced social

differentiation than the other settlements. There are a significant number of commercial farmers from the surrounding large towns who have established large rice and maize farms. There are a number of local farmers who have also managed to accumulate from below (following the lead of town farmers) and now possess large areas of *fadama* land for commercial rice production. These large commercial farmers hire more labour than in the other settlements, which is reflected in higher numbers of farmers hiring out their labour than in the other settlements. About 70 per cent of farmers in the survey hired out their labour to other farmers. This rises to 82 per cent at Nabogu and Bogupaligu, in contrast with 52 per cent at Guntingli, 59 per cent at Dohi, and 65 per cent at Kpulyin.

Nevertheless, the hiring of labour is common throughout the settlements, with smallholders both hiring labour and hiring out their labour. This reflects the seasonality of labouring activities. The timeliness of labour is critical and at peak seasons there are large demands for labour to supplement household labour. The hiring out of labour is common among both men and women, with 70 per cent of men and 68 per cent of women working as casual labourers. Women mainly hire out their labour for weeding and crop harvesting.

The major crops currently grown by farmers are maize, rice, and groundnuts. Rice is largely grown as a commercial crop for market sale, while maize and groundnuts are for both home consumption and market sale (see Table 5). Other crops cultivated include pepper, yams, sorghum, and millet. Maize has displaced millet and sorghum as the main staple crop. Millet and sorghum tend to be intercropped with the main staple crops, but at much lower densities, while maize is often monocropped. About 62 per cent of the farmers in the survey purchased both sorghum and millet on the market. These crops are mainly used for preparing morning porridge. Groundnut is the

Table 1: Land holdings in select communities in the Northern Region

No. of acres	Guntingli (%)	Dohi (%)	Bogupaligu (%)	Kpulyin (%)	Nabogu (%)	Total (%)	Number of farmers
No land	0	0	8	6	9	5	25
Up to 2 acres	35	14	10	25	16	20	102
2.1–5 acres	15	19	45	28	16	24	120
5.1–10 acres	11	23	31	34	43	29	146
10.1–20 acres	22	25	6	3	13	14	68
Over 20 acres	17	19	0	4	3	8	39
Total no. of farmers	116	64	109	71	140	500	500

Source: Author's own.

Table 2: Distribution of land holdings by gender

No. of acres	Guntingli (%)		Dohi (%)		Bogupaligu (%)		Kpulyin (%)		Nabogu (%)		Total (%)		Number of farmers	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
No land	0	0	0	0	4	26	0	16	6	12	3	8	8	17
Up to 2 acres	4	60	0	33	1	53	4	64	8	25	4	45	11	91
2.1–5 acres	0	26	6	37	50	21	39	8	10	22	24	24	72	48
5.1–10 acres	14	9	27	19	38	0	46	12	46	40	35	20	105	41
10.1–20 acres	43	5	35	11	7	0	4	0	25	1	21	3	61	7
Over 20 acres	39	0	32	0	0	0	7	0	5	0	13	0	39	0
Total no. of farmers	51	65	37	27	90	19	46	25	72	68	296	204	296	204

Note: M = male, F= female. Source: Author's own.

Table 3: Availability of fallow land

No. of acres	Guntingli (%)	Dohi (%)	Bogupaligu (%)	Kpulyin (%)	Nabogu (%)	Total (%)	Number of farmers
No fallow	46	27	62	68	52	51	259
1–2 acres	13	25	23	16	24	20	101
3–5 acres	19	27	15	15	17	18	91
Over 5 acres fallow	22	21	0	1	7	11	49
Total number of farmers	116	64	109	71	140	500	500

Source: Author's own.

Table 4: Fallowing strategies used by farmers

No. of acres	Guntingli (%)	Dohi (%)	Bogupaligu (%)	Kpulyin (%)	Nabogu (%)	Total (%)	Number of farmers
Permanent cultivation	46	27	62	68	54	52	262
1–2 years fallow	35	36	38	30	29	29	166
3 and more years fallow	19	37	0	2	17	19	72
No. of farmers	116	64	109	71	140	500	500

Source: Author's own.

Table 5: Main crops planted

Crop	Male (%)	Female (%)	Total (%)	Total no. of farmers
Maize	90	50	74	370
Rice	90	38	69	343
Groundnut	65	77	70	351
Pepper	31	5	20	102
Yam	19	0.5	11	56
Sorghum	61	46	55	274
Millet	50	33	43	217
Total no. of farmers	296	204	500	500

Source: Author's own.

dominant crop grown by women, while men focus more on maize and rice, although groundnut has become an increasingly important cash crop in recent years.

Groundnut is particularly important for farmers whose land is less fertile and who do not have sufficient capital to purchase fertilisers. It is important for women since they often get access to land whose fertility has declined and they lack capital to purchase fertilisers. Specialisation in groundnuts enable women to cultivate plots that men are no longer interested in cultivating because of declining fertility. Farmers frequently use crop rotations, where cereal crops are followed with groundnuts as a way of restoring soil fertility and cultivating less fertile soils.

The uptake of agricultural inputs and ploughing services among smallholder farmers

There are significant differences in pressures on land within the different communities. However, this is not

Table 6: Use of inputs, mechanised services, and hired labour on maize farms

Input	Male (%)	Female (%)	Total (%)	Total no. of farmers
Tractor services	100	99	99	369
Chemical fertilisers	79	69	76	281
Purchased seed	19	20	20	73
Herbicides	100	100	100	370
Hired labour	55	84	63	234
Maize shellers	62	66	63	231
Total number of farmers	267	101	370	370
Total no. of farmers	296	204	500	500

Source: Author's own.

Table 7: Use of inputs, mechanised services, and hired labour on rice farms

Input	Male (%)	Female (%)	Total (%)	Total no. of farmers
Tractor services	98	100	99	333
Chemical fertilisers	83	69	76	281
Purchased seeds	5	0	4	13
Herbicides	100	100	100	337
Combine harvesters	26	62	34	115
Hired labour	49	81	57	190
Total no of farmers	247	70	337	337
Total no. of farmers	296	204	500	500

Source: Author's own.

Table 8: Use of inputs, mechanised services, and hired labour on groundnut farms

Input	Male (%)	Female (%)	Total (%)	Total no. of farmers
Tractor services	100	100	100	339
Chemical fertiliser	0	0	0	0
Purchased seeds	5	5	5.0	17
Herbicides	37	55	44	189
Mechanical harvesting	0	0	0	0
Hired labour	58	74	65	218
Total	188	151	339	339

Source: Author's own.

reflected in the uptake of inputs and mechanisation. There is a pronounced pattern within all settlements of a universal uptake of mechanised ploughing services (100 per cent on all farms). Other forms of labour-substituting or labour-saving technologies are also making significant inroads into farm expenditure (see tables 6, 7, and 8). There has been an even more significant uptake of herbicides on rice and maize farms (see tables 6 and 7). Increasing numbers of farmers are hiring combine harvesters on rice farms (see Table 7) and maize shellers (see Table 6).

Combine harvesters and maize shellers are used by both rich and poorer farmers. Richer farmers often

play off mechanised services against hired labour to bring down labour costs. Mechanised service providers sometimes offer to harvest the crops of poorer farmers in exchange for payment in kind, often one bag of maize or rice per acre harvested, which gives them access to cheap crops that they sell for profit. Poorer farmers and women often experience difficulty in recruiting family labour for harvesting and have to rely on hiring labour or if they have insufficient capital for this, exchanging mechanised hiring services for a part of their crop. Hired labour is important for farmers, but it is also being displaced by machinery as labour becomes scarce and more expensive.

There has also been a significant uptake of synthetic fertilisers in maize and rice fields. Seventy-six per cent of both maize and rice farmers use fertilisers.[6] However, there is little demand for new proprietary seeds – the major focus of agricultural development initiatives from the late 1970s. Only 20 per cent of maize farmers, 4 per cent of rice farmers, and no groundnut farmers interviewed purchased seeds on the market. Most farmers preferred to use seeds they saved and selected from their harvest and to use their scarce capital for labour or labour-saving investments.[7] The main emphasis in patterns of expenditure in agricultural production has been on labour-saving technologies.

Diao *et al*. (2014) assume that the recent changes in agriculture and widespread adoption of mechanisation in the Northern Region are the product of successful agricultural liberalisation policies that have created favourable markets for agricultural products, a privatised market in tractor services responding to farmers' needs, and the ability of farmers to expand into new land, resulting in demands on labour, increasing scarcity of labour, and the adoption of tractor ploughing as a cost-effective option. This research challenges these assertions. The main focus in agricultural policy has been on promoting the uptake of new seed varieties. This has met with little success among farmers, suggesting that the priorities in international agricultural research are not fine-tuned with farmers' needs and the main dynamics in their farming systems. In contrast, the technology that has seen the highest uptake among smallholder farmers, tractor ploughing of land, has been, until recently, discredited and given low priority. This suggests that there is no clear convergence between policy directives based on agricultural liberalisation and the empirical patterns of agrarian change.

This research suggests a more complex process of deeper transformations of agricultural production arising over a longer historical period. Previous attempts to introduce agricultural commercialisation have had a much larger influence than conceded by Diao *et al*. (2014). The most significant transformations have been within the farming household and the emergence of youth and women with their own individual farms. Previously, the main constraint in agriculture was the large labour requirements of land clearance and the short window of opportunity in which to carry out land clearance. This had to occur within a month period during the early drizzles and before the onset of the heavy rains. Land preparation that was too early resulted in the soil drying out and becoming hard, and land preparation that was too late missed the heavy rains with the consequence of crop failures. To meet these conditions, households had to have a large labour force. In the past, these labour constraints resulted in family elders controlling the family compound land and the labour of youth, who played a critical role in clearing and ridging the compound farm with hoes. The successful elder had a large number of dependants, and crop production was pooled under his authority. Difficulties in clearing the land in a timely fashion constrained individual farming. As Fuseina Abukari at Nabogu explained:

> Before people started relying on tractors for clearing farmlands, it was difficult for the compound (yiya), even with a lot of young men to clear more than 20 acres a season. Now, a single young man can clear more than 50 acres in a season.[8]

The stumping of land was initially carried out in the 1960s by government agricultural agencies. During the 1970s, aspiring commercial farmers with loans from government began to clear and stump land in the Northern Region with their own tractors. However, the commercial rice sector collapsed in the 1980s, as a result of the world oil and economic crises of the 1970s that made inputs more expensive and placed substantial pressures on governments to be able to continue to subsidise inputs, and from the erratic weather conditions of the Sahelian drought in the 1970s which resulted in widespread crop failures (Shepherd and Onumah 1997).

Many of the large commercial farmers from the south abandoned their stumped farmlands. During the 1990s, farmers in the neighbouring communities began to move onto these lands. During this period, there was also a significant movement of youth into the more distant stumped lands away from the villages. According to farmers, the availability of cheap Chinese bicycles and motorcycles facilitated mobility among youth to move to and cultivate the more distant lands that were not being used. With the disbandment of state farms and the decline of

commercial farmers, many of the private tractor owners and drivers that emerged began to target small farmers within the areas that had previously been stumped. An increasing articulation of gender issues within development programmes and targeting of women's uptake of new technologies has also encouraged women to establish their own farms, which was increasingly made possible by access to tractor-ploughing services.

The emergence of NGOs in the agricultural sector, distributing credits and loan packages of fertilisers and seeds also encouraged many of the youth to expand their farms. Most notable was the Sasakawa Global 2000 (SG 2000) programme, supported by the Jimmy Carter and Sasakawa Foundations, which worked through government extension services to promote the uptake of certified seeds and fertilisers among smallholder farmers. These programmes frequently arranged the provision of tractor services as an incentive to encourage farmers to participate in the uptake of modern technology packages. Although the SG 2000 programme was conceived as a 'soft' loan to farmers, there were elements of hidden subsidies in the costs absorbed by the programme. When the elements of subsidy were removed in the 1990s, loan recovery faltered and the programme collapsed and was closed down in 2003 (Breth and Dowswell 2003; World Bank n.d.).

Several other programmes have moved in to replace the gaps left by the decline of SG 2000. In 2005, the Agricultural Production Support Programme started distributing packages of inputs, fertiliser, and cash to farmers. In the late 2000s, the agribusiness companies Yaara and Wienco created the Masara N'arziki programme, which seeks to establish farmers' associations that are supported with credit packages of inputs (Mangnus and Western 2018). The aim of the Masara N'arziki programme has been to encourage the uptake of hybrid maize varieties and synthetic inputs by smallholder farmers. The provision of tractor ploughing has also been an important component of the programme (*ibid.*).

A similar programme is also run by the ACDI/VOCI, a US NGO with direct support from the DuPont Pioneer Seed Company and USAID (Guyver and MacCarthy 2011). However, the most significant uptake has been of labour-saving technologies rather than of new seeds. The technologies that have been most enthusiastically embraced by farmers have been tractor services and herbicides. Although SG 2000 was instrumental in promoting the use of the Monsanto Roundup herbicide as a minimum tillage technology, the most significant uptake has followed the importation of cheap Chinese herbicides into Ghana. In contrast with the scenario presented by Diao *et al*. (2014) of dynamic free markets encouraging the expansion of agriculture in the 1990s, in reality, donors have supported NGOs and pumped large amounts of credit into the agricultural economy to encourage farmers to take up new crop varieties and inputs (Crawford, Jayne and Kelly 2006).

The changes in the agrarian structure are more dramatic than those envisaged by Diao *et al*. (2014) but have occurred over a much longer time period, and not only in the adoption of technology, but in the social relations of production. The main transformation has been from a compound farm under the administration of the family elder to individual farms, and a greater participation of youth and women in farming in their own right. Mechanisation has played a central role in this process by solving constraints in labour bottlenecks during the period of land preparation. However, the origins of this process need to be traced back to the 1960s and 1970s.

These transformations have led to both the intensification and extensification of agriculture. The extensification is reflected in the expansion of the land areas cultivated by individual farmers and by villages. The intensification is reflected in the emergence of individual farms and the increasing use of fertilisers and labour-saving technologies on these farms. The expansion of areas under cultivation, largely associated with the cultivation of individual farms by young male farmers has resulted in a scramble for land. This has encouraged further individual cultivation as compounds encourage their members to expand their farms and take up individual cultivation to ensure that they are able to keep abreast of the expansion into new land and ensure that they secure land for their families and their progeny. This is now resulting in increasing shortage of land.

However, this shortage of land is not a direct result of population dynamics, since the Northern Region continues to be characterised by low population and large areas of available uncultivated frontier lands. The average population density in the Northern Region lies at 35 per km, the lowest regional population density in Ghana. Although land is readily available in other areas, many farmers are constrained to move from the villages because of the costs involved in opening up new areas, which essentially relate to the lack of available labour, the lack of access to tractors, and the high costs of clearing and stumping the land to make way for tractors. Tractor operators are often unwilling to plough in these areas because stumps and root structures often exert a high toll on their machinery.

In a study of the recent commercialisation of agriculture in the Nunumba area of the Northern Region, in which there was some limited development of mechanisation during the 1960s, Aminu (2016) records that the rising commercial farmers in the Nunumba North District are not indigenes within the villages, but civil servants who had accumulated capital, purchased tractors, and invested in agriculture. The local chiefs, landowners, and elders experience difficulty in getting tractor operators to plough their lands. Therefore, they offer land to commercial farmers in exchange for providing ploughing services. There are no specific terms to contracts determining how much land should be ploughed in exchange for specific plots of land, but if the landlords are not happy with the areas ploughed for them, they can refuse to reoffer the plots to commercial farmers in subsequent seasons. These arrangements have allowed some commercial farmers to gain access to large areas of land, and chiefs and elders to extend the areas they cultivate through tractor ploughing. However, many smallholders are beginning to experience land shortage as medium- and large-scale farmers and elders appropriate large areas of land, which are cleared and alienated with the use of tractors (*ibid.*). New frontier areas in which stumping has not previously occurred are likely to experience difficulties in attracting tractors to plough their lands under private sector mechanisation, unlike the historic areas that were opened up and stumped and cleared in the 1960s and 1970s with state support.

In order to make sense of these developments, mechanisation in northern Ghana needs to be placed within a historical context, in which it is linked to the Ghanaian history of agricultural commercialisation, and the policy frameworks for promoting commercialisation. This requires tracing back the framework of agrarian modernisation to the colonial period and its relation to wider policy debates about the relationship between state, market, and agrarian accumulation, rather than rooting state agricultural policies in notions of neo-patrimonialism and policy distortion by 'elites'. The next section examines the history of state support for ploughing services within the Northern Region, and its impact on contemporary agriculture within the context of the attempts to modernise and commercialise agriculture.

4. MECHANISATION AND THE DEVELOPMENT OF COMMERCIAL AGRICULTURE IN NORTHERN GHANA

Under colonial rule, the Northern Territories of the Gold Coast constituted a labour reserve for the mines and for the cocoa industry. As a consequence, colonial policy deliberately retarded the development of agriculture within the north until the 1940s, when concerns with mounting food imports into the colony resulted in new concerns with addressing food production (Phillips 1989). It was not until the 1950s that an agricultural research structure began to be created with experimental research stations and agricultural experts. The first large-scale agricultural project initiated in the 1950s by the colonial government was the Gonja Agricultural Scheme in northern Ghana, which sought to develop large-scale estate cultivation on 30,000 acres of land. This aimed to integrate mechanised cultivation with peasant agriculture by resettling farmers from the densely populated areas of northeastern Ghana (Grischow 2006).

The farmers were organised into work teams, in an early variant of outgrower schemes. Each farming family was to receive 30 acres of cleared land for arable production and two acres for household consumption. The aim was to resettle 450 families. However, this never materialised. Few farmers were attracted to the project. The project only cleared 4,000 acres by 1953 and by 1955 the cultivated area was reduced to 1,500 acres. In 1957, the project was liquidated. Frequent breakdown of machinery and the unsuitability of much of the terrain to mechanised cultivation thwarted progress (Miracle and Seidman 1968a; Grischow 2006). Early attempts to introduce mechanisation were often frustrated. As Miracle and Seidman (1968a: 11–12) comment:

> Efforts to introduce mechanization encountered difficulties. Anthills, steep slopes, stumps, roots and rocks caused damage to machines. Cleared land tended to erode when exposed to the heavy rains. Improper operations of machinery and frequent breakdowns led to increased costs for spare parts and made it necessary to set up local workshops and servicing centres.

With the attainment of independence, agricultural modernisation continued under the Convention People's Party (CPP). Agricultural initiatives were organised around three sectors: state farms, workers' brigades, and farmer cooperatives. The State Farm Corporation commenced operations in June 1962 following the liquidation of the Agricultural Development Corporation (ADC), with assistance from the Soviet Union and Israel. The objectives of the state farms were to diversify production and reduce the importation of food and raw materials. The state farms focused on rubber and oil palms in the south, cotton in the Volta Region, and rice and maize in the northern sector.

By 1965, 105 state farms had been established including 42 demonstration and experimental stations. Over 250,000 acres of land came under the state farms; however, 23 per cent of this was allocated to cooperatives and 13 per cent to workers' brigades. The workers' brigades were originally established in 1961 as a programme for unemployed workers, which began to focus on agricultural production from 1962. Its aim was to establish a 1,000 acre farm in the south around tree and arable cultivation with minimum mechanisation, and 2,000 acres dedicated to arable crops in the northern sector with mechanised cultivation. In 1964, the state farms operated a total of 714 tractors, of which 64 were not serviceable. The state farms continued to face problems of devising appropriate management for mechanised equipment, which either broke down or badly eroded soils. Machinery was not fully utilised because of the dangers of soil erosion following heavy rain (Miracle and Seidman 1968a).

Although the state farms are often portrayed as a huge failure, this was not the conclusion of Miracle and Seidman (1968a: 44):

> On the one hand, large-scale mechanized farms do not appear to compete effectively with peasant food farmers who have little or no overheads in the initial phase of development. Even this tentative conclusion must be qualified, however, in view of the apparent success of the Soviet-assisted rice farm at Afife. Further research appears to be necessary on the effect of mechanized ploughing in West African laterite soils and the potential dangers of erosion.

The origins of the farmers' cooperative movement lie in the cocoa sector in the colonial period, where they were promoted to gain control over the marketing of cocoa. Following independence, the CPP government sought to mobilise farmers through the cooperative movement, through which it controlled both the internal marketing of export crops and the disbursement of inputs to farmers. The main objective of the Union of Ghana Farmers Cooperative Council (UGFCC) was to promote agricultural mechanisation. However, there were considerable ecological problems of using tractors within the forest zone and the major focus of mechanised cultivation was outside the cocoa area, in food crop sectors within the northern savanna and the transition zone.

Outside the cocoa sector, the UGFCC organised 992 cooperative societies with a total membership of more than 26,000. It took charge of extension work. The UGFCC became the main provider of inputs and services to farmers, but only around 5 per cent of farmers were actively involved with the UGFCC. The UGFCC acquired 486,335 acres of land for farmers but by 1964, only 23,771 acres were cleared and planted (Miracle and Seidman 1968b). The UGFCC organised tractor service centres, which provided ploughing services for farmers. Konings (1986: 169) estimate that between 1961–67, 2,638 tractors were imported into Ghana. Boamah (2001) estimates that the UGFCC, workers' brigades, and state farms used over 3,500 tractors, crawlers, combine harvesters, and rice mills. Most of these were allocated to tractor service stations. By the mid-1960s, the UGFCC planned to expand its acquisitions of tractors for the period 1965–68 by a total of 5,889 and its combine harvesters for the same period by 1,124. It had also entered into negotiations with international tractor manufacturers to establish assembly plants in Ghana (Miracle and Seidman 1968b). These plans were thwarted by the 1966 coup.

The UGFCC charged farmers £15 per acre for the clearing and stumping of land and £2/10s per acre for ploughing already stumped land. This was lower than operating costs because of the high rate of breakages of equipment and high maintenance costs. Only about 50 per cent of the machinery was operational at any one period (Miracle and Seidman 1968b). However, the substantial costs in stumping lands constrained the uptake of tractor ploughing by peasant farmers.

Konings (1986: 168) argues that many of the services allocated by the UGFCC in northern Ghana did not benefit smallholder farmers but were diverted to 'party officials' and to 'urban petty bourgeois' elements (small businessmen, contractors, artisans, and civil servants)', laying the foundations for the emergence of 'capitalist rice farmers in the late sixties and seventies' (Konings 1986: 168).

Following the 1966 coup d'état, the state agricultural sector was reorganised by the National Liberation Council (NLC) and Progress Party (PP) governments, with US and IMF support. The UGFCC was dissolved and agricultural extension reorganised under the Ministry of Agriculture based on the variants of the US Land Grant system that was introduced into Africa. Some of the state farms were sold off to the private sector, as were many tractors. Extension followed a 'progressive farmer' mode (the Focus and Concentrate Programme) based on building a clientele of richer 'progressive' farmers whose adoption of new technologies and methods would act as a source of inspiration to small farmers, leading to technology diffusion. The transition zone and the Northern Zone became the focus of these new initiatives to nurture a class of capitalist farmers. The Ghanaian–German Agricultural Development Project, which was founded in 1970, also provided support to large farmers in the north up to 1974 (Konings 1986; Bennett and Schork 1979).

The failure of the PP to halt the downslide in the economy and popular discontent led to a coup which brought the National Redemption Council (NRC) to power in 1972. Following the 1972 coup, the NRC placed increasing emphasis on building up a capitalist class of rice farmers who would supply the urban market with cheap food. The NRC undertook to supply aspiring commercial farmers with cheap subsidised inputs and tractors, and low-interest loans. However, these plans were thwarted by the world oil crisis and the Sahelian droughts of the mid-1970s, which resulted in outbreaks of fires on rice farms. Some of these fires were attributed to the deliberate actions of smallholders to sabotage the estates of commercial farmers in retaliation for appropriation of their land (Konings 1986; Goody 1980). The policies of promoting commercial farmers often had adverse effects on the peasant communities.

In 1976, an economic crisis spiralled out of control as rice farmers failed to repay their loans to the banks, ultimately leading to a national financial crisis. As a consequence of fiscal constraints, the government was unable to import inputs, machinery, and spare parts, and farmers were unable to meet the urban market demands for rice, leading to increasing food imports, and further exacerbating the financial crisis (Shepherd and Onumah 1997). By the late 1970s,

the focus of NRC agricultural policy shifted from supporting a class of capitalist farmers to integrating smallholders into outgrower schemes, and fostering linkages with international agribusiness (Konings 1986). However, this did not avert the economic crisis and increasing bankruptcy of the state, which was ultimately to lead to political crisis and the adoption of an IMF stabilisation programme and structural adjustment in 1983 (Shepherd and Onumah 1997; Amanor 2017).

Social composition of commercial farming in the 1970s

Konings (1986) provides an insightful analysis of the social relations of production involved in the expansion of commercial agriculture during the 1970s, in his case study of commercial rice cultivation in the settlements of Wiasi and Gemeblisi in the Fumbisi Valley of the Upper East Region. The numbers of commercial rice farmers in this area grew from four in 1974 to 210 in 1977. The bumper harvest of 1976 attracted many newcomers, including many civil servants into rice production. From 1977, drought, incidences of bushfires, and declining government support adversely affected production, and by 1980, the commercial rice farmers had declined to 60. Most of these farmers cultivated the heavy black valley vertisols. Of the 48 farmers interviewed by Konings, 19 per cent cultivated less than 100 acres of land, 35.5 per cent between 101–201 acres, 33 per cent between 201–500 acres, and 12.5 per cent above 500 acres. Only 17 per cent of these farmers did not own a tractor, 48 per cent owned one tractor, and 36 per cent of farmers owned between 2–4 tractors. Sixty-five per cent of farmers provided tractor-ploughing services to other farmers. Thus, the expansion of capitalist rice farming had considerable impact on the introduction of tractor-ploughing services into the north of Ghana. Konings estimates that 2,622 tractors were imported into Ghana between 1971–74.

The largest farmers included top civil servants, military officers, police officers, and ex-politicians. Other groups included traders who had accumulated capital elsewhere and reinvested it in agriculture. Some of these farmers had also accumulated capital within agriculture, which was then invested in purchasing tractors and acquiring large landholdings.

Chiefs also constituted a significant group with investments in commercial agriculture. They secured land for commercial farmers in return for 'gifts' in crops or for ploughing services, which enabled them to enter into commercial agricultural production in their own right. For instance, the paramount chief of Navrongo acquired seven tractors and two combine harvesters with loans from the Ghana Commercial Bank. He cultivated 600 acres of land in 1977. Despite poor yields, he continued to expand his farm, cultivating between 800–1,000 acres into the early 1980s (Konings 1986). Of 210 rice farmers identified by Konings in 1977 as operating in the Wiasi and Gbedebilisi area, 18 per cent were civil servants, 23 per cent businessmen and traders, 23 per cent farmers, 7 per cent transport owners, and 3.5 per cent chiefs.

While some of the largest farmers were from the south of Ghana, the majority were absentee farmers from northern towns. Local farmers from within the villages constituted only a tiny minority of those engaged in commercial rice production. In contrast with the large farmers none of them owned a tractor. Some chiefs discouraged local farmers from farming rice in the *fadama* areas, since they gained considerable rents from the commercial farmers. Most of the commercial farmers drew their permanent workforce from their hometowns and extended families, supplementing this with locally drawn casual labourers.

During the economic crisis of the late 1970s and early 1980s most of the large commercial rice farms collapsed, particularly those associated with the aspiring commercial farmers from the south with political connections. But the commercial farmers from the northern towns continued to farm and possess their large farm holdings and tractors. They formed the hub of the present-day medium-scale farmers, which have been presented as constituting a new phase of commercial development encouraged by liberalised markets (Jayne *et al*. 2016). The large areas of land that had been stumped continued to exist. The lands that were abandoned by large commercial farmers from the south were re-occupied by medium-scale town farmers and smallholders from the surrounding villages.

Since these lands had been stumped and the natural fertility of the topsoils destroyed through ploughing, farmers could not reintroduce bush-fallowing techniques on them. The most cost-effective way of farming them was for farmers to continue using tractor ploughing and synthetic fertilisers. Although the state tractor-ploughing service centres were disbanded, the tractors were sold off to the private sector and continued to operate. This accounts for the continued dominance of second-hand Massey Ferguson tractors within Ghana and dealers trading in their spare parts. Similarly, the input contractors that had procured

subsidised inputs for state distribution reinvented themselves as private companies. For instance, Hari Wientjes, a Dutch national who procured inputs for the state in northern Ghana during the 1970s, registered his activities as the private company, Wienco, which continues to dominate input supplies in Ghana and works closely with the state (Amanor 2017). Thus, state-led agricultural enterprises and networks continued to operate, but now under the label of the private sector. Although state subsidisation of agricultural development ceased, NGOs moved into the gap providing support services, incentives, and soft loan packages for smallholder farmers.

Market liberalisation, agricultural subsidisation, and NGO support

With the adoption of structural adjustment in the early 1980s, the prices of agricultural inputs rose significantly. This depressed commercial agriculture and the use of inputs by smallholders. The price of chemical fertilisers increased 380 per cent between 1990 and 1994. The prices of fertilisers also increased significantly in relation to the price of crops. Hailu (1990) estimates that in 1981 the price of one bag of maize could purchase 5.5 bags of fertilisers as compared to 3.3 bags in 1986. As a result of the increasing price of fertiliser, the demand declined from an average of 38,595 tonnes for the period 1985–89 to 24,568 tonnes for 1990–94 (ISSER 1996).

Donors began to support and encourage NGO interventions to address the falling demand for inputs. NGO programmes stimulated demand by introducing credit programmes in which farmers were provided with packages of inputs and seeds. Private input distributors such as Wienco have also been at the forefront of organising credit facilities for farmers, involving linkages between private sectors and NGOs. By the 2000s, donors began to support state programmes for 'smart subsidies', involving private sector distributors receiving subsidies from the state for cheap inputs. While the major focus of donor assistance programmes has been on providing certified seed and fertilisers, the purchase of certified seed has often been a low priority for farmers, who prefer to plant their own varieties or multiply improved open-pollinated varieties.

The main demands of many farmers in the Northern Region have been for fertiliser and ploughing services. This government has attempted to attract farmers to new technology packages by including access to ploughing services as an incentive to encourage farmer participation. However, the government no longer has access to agricultural mechanisation service centres, so it now depends upon contracting private tractor service providers.

In northern Ghana, the demand for tractors continued to grow through the 1990s and 2000s. However, given the high costs of tractors in relation to prevailing levels of capital accumulation among richer farmers, most tractor buyers depend upon old renovated and second-hand imported tractors. This was greatly facilitated by the liberalisation of vehicle importation and tax exemptions for tractor imports in the 1990s. The majority of imported tractors were second-hand Massey Fergusons, which was the main brand favoured by the state in the 1970s, resulting in an existing network of private sector dealers and a servicing infrastructure.

By the mid-2000s, the Indian government began to offer African governments concessionary bilateral aid for the importation of new tractors, as a way of supporting its infant agricultural mechanisation industries. The Ghanaian government took advantage of Indian bilateral schemes to facilitate the purchase of new tractors. This enabled it to articulate an agricultural mechanisation policy without investing significant resources in its development. This policy has centred on the creation of Agricultural Mechanisation Service Centres (AMSECs). These are private sector initiatives that hire out tractors and other equipment to farmers, which gain support from the state through provision of tractors that come through bilateral aid and credit facilities (Housou *et al*. 2013; Benin 2014; Benin *et al*. 2013). The government policy aims to encourage the establishment of an AMSEC centre in each of the districts (although the demand for mechanisation in Ghana is unevenly distributed). Each AMSEC is envisaged as serving 400–1,000 farmers. Initially the government sold five tractors to each AMSEC on credit. However, the greater proportion of tractors acquired under bilateral aid from India was sold to individual farmers, many of them forming part of the core of medium-scale farmers.

The AMSECs have essentially grown out of medium-scale farmers providing tractor services to farmers. Some of these have further developed provision of ploughing services as a core business. Most of them are modest operations and have not made significant inroads into controlling or dominating the provision of tractor services to farmers. There have been many problems with the AMSEC programme, including high rates of default on the repayment of loans and high rates of breakage of equipment. The tractors are frequently not well adapted to Ghanaian

environmental conditions, and their selection has not been based on research into Ghanaian conditions.

Since the provision of these tractors has been made possible by concessionary bilateral aid, the government of Ghana has little input into the choice of these tractors. The brands of tractors distributed by the Indian government under bilateral aid have varied from year to year (Housou *et al*. 2013; Benin 2014; Benin *et al*. 2013). This has done little to facilitate the emergence of local dealers with spare parts. Spare parts for these tractors are often more expensive than those for Massey Ferguson tractors and not as readily available. The Indian tractors do not have a reputation for being robust. As a consequence, many tractor owners prefer to purchase second-hand Massey Fergusons rather than new Indian tractors. Since 2016, the main imports of tractors under concessionary bilateral aid have originated from Brazil, which has enabled more choice between brands of tractors, including Varta and Massey Ferguson tractors assembled within Brazil, and a wider variety of implements to accompany the tractors.

Some recent studies on mechanisation in Ghana have sought to depict the development of AMSECs as a dangerous return to the statist policies of the past, as a threat to the recent successes in liberalised agriculture in Ghana, and as distorting the emergence of private markets in tractors (Benin *et al*. 2013; Benin 2014; Diao *et al*. 2014; Daum and Birner 2017). This, however, ignores the fact that the AMSEC are private sector dealers rather than private sector–state partnerships and that the elements of subsidisation occur in the relationship between the providers of bilateral aid and the manufacturers rather than the government of Ghana. The tractors are provided at concessionary rates absorbed by the state in the manufacturing government rather than the government of Ghana, unlike in 'smart' subsidies where the government of the recipient country subsidises the price of fertilisers provided by input suppliers. It also overlooks the extent of interventions in the agricultural market by NGOs and transnational corporations working with NGOS, who provide inputs at concessionary prices.

This analysis has shown the continuities in the agrarian economy despite the imposition of market liberalisation in the 1980s. It has shown the continued attempts to encourage uptake of new technologies through policies of providing farmers with loan packages that often contain elements of hidden subsidies, and which have often involved widespread default on payment of loans. Although mechanisation has had a low priority in agricultural development programmes since the 1990s, it has been re-incorporated into state agricultural development as a result of the high demand for ploughing services among farmers in some regions, the rapid development of private markets, and a greater demand among farmers for ploughing services rather than technology packages centred on proprietary seeds. Bilateral aid programmes centred on tractors enables the government to appear to be doing much, while actually investing few resources in agricultural development.

5 CONCLUSION

A historical analysis of the development of commercial agriculture in northern Ghana reveals much continuity into the present, which challenges current assumptions about the role of market liberalisation in initiating a new phase of commercial agriculture. This study shows that the present phase of mechanisation builds upon past initiatives. What has been considered to be the failure of mechanisation, the high toll on tractors and other equipment of converting fallow land into ploughed lands, has actually created the conditions that enable tractor ploughing to be viable in the present. As Mrema *et al*. (2008: 25) has argued, mechanisation needs to be considered within a longer-term time frame rather the short-term profitability of mechanisation:

In general in Asia, policy-makers disregarded the short-term impact of mechanization as less relevant and important. They took a more strategic longer-term perspective of mechanization, viewing it as part of a broad-based economic development strategy aimed at economic growth and agro-industrialisation. To this end, government both stimulated and responded to the trends through favourable tax and subsidy policies and support to nascent input supply industries.

Beyond the continued uptake of mechanised ploughing, there are continuities in the composition of the class of medium- and large-scale farmers, in their origins in civil servants and traders investing in commercial agriculture. They are not a new phenomenon made possible by market liberalisation, but were a central feature of state-led agricultural modernisation policies. The attempt to create a clear dichotomy between statist interventions within agrarian markets and liberalised markets is unwarranted, since agricultural policies continue to intervene within the market to encourage farmer uptake of new technology. This occurs through NGO interventions in seeking to promote technology uptake among smallholders, 'smart subsidies', and various soft loan programmes to farmers, all of which essentially constitute disguised subsidisation of inputs.

The revised theory of induced technology change places emphasis on the dynamics of population, the relationship between land and labour scarcity ratios, and the impact of markets in the uptake of mechanisation. However, it fails to root these changes in more complex patterns of the history and political economy of agrarian accumulation, the politics of agricultural support services, and the livelihood strategies of farmers. This results in a somewhat simplistic model of agrarian change, very much harnessed to affirming dominant theories of market liberalisation, which distorts and caricatures the history of agricultural developments before the introduction of liberal economic market reforms.

6 ENDNOTES

1 This is based on data collected from the *Ghana* Living Standards Survey of 1991/2 and 2005/6.

2 *Bahi,* in Dagbani, also known as in Hausa, refers to heavy valley-bottom vertisol soils, which during the 1970s were the main area in which government focused support for commercial rice production in northern Ghana.

3 Colonel Acheampong was the military head of state from 1972–78.

4 Issahu Abdullai, interviewed 17 July 2017 at Nabogu.

5 The research grew out of a 2016 graduate student training field research programme with Iddrisu Azindow and Aminu Aliu. The questionnaire survey was carried out by Iddrisu Azindow in 2017 while collecting data for his PhD thesis at the Institute of African Studies, University of Ghana (which examines the pressures of commodification on the moral economy of labour relations, family reproduction, and farming practice.

6 There is also a relationship between uptake of ploughing and of fertilisers, since ploughing overturns the topsoil and makes the soil less fertile (Nye and Greenland 1960).

7 See Amanor (2011) on seed policies and uptake of new varieties among farmers in northern Ghana. Fuseina Abukari, interviewed 27 July 2017 at Nabogu.

8 In comparison, the neighbouring highly populated Upper East Region has a population density of 109 people per km^2. The average population density of Ghana is 124 per km^2.

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